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TRANSFORMING THE DISCUSSION

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LANDSCAPE RESEARCH RECORD is published annually and consist of papers focused on landscape architecture subject areas. Each issue is a collection of papers presented at the Council of Educators in Landscape Architecture annual conference of that year. Conference theme is expressed as the subtitle of Landscape Research Record. The views expressed in papers published in Landscape Research Record are those of the authors and do not necessarily reflect the views of the conference planning committee, or the Council of Educators in Landscape Architecture.

PEER REVIEW OF PAPERS: All papers published in Landscape Research Record have been reviewed and accepted for publication through the Council of Educators in Landscape Architecture's peer review process established according to procedures approved by the Board of the Council of Educators in Landscape Architecture. Reviewers are recruited by track chairs from among conference attendees and other outside experts. The track chairs also serve as co-editors in the peer review process. The Council of Educators in Landscape Architecture requires a minimum of two reviews; a decision is based on reviewer comments and resultant author revision. For details about the peer review process and reviewers' names, see REVIEWERS in Table of Contents.

IN THIS ISSUE: In 2018, the conference committee accepted 404 abstracts for presentation and rejected 34 abstracts. Authors of accepted abstracts were invited to submit a full paper. A total of 77 papers were received, 59 papers were selected for peer review. Finally, 30 papers were accepted for publication in this issue. The organization of this issue follows the standard conference tracks listed in the table of contents.
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FOREWARD

Welcome to the seventh issue of *Landscape Research Record*, published by the Council of Educators in Landscape Architecture (CELA). In 2013, the CELA Board approved and adopted a procedure to become fully responsible for publishing peer-reviewed conference papers annually and named the publication *Landscape Research Record* (LRR). LRR is a post-conference publication and published online only.

This seventh issue of LRR is a collection of peer-reviewed papers presented at CELA 2018 hosted by Virginia Polytechnic Institute and State University (Virginia Tech). The 2018 annual conference focused on research, scholarship and creative activity that highlighted the theme of “Transforming the Discussion” which entered into discussions and debates intended to challenge contemporary norms, transform our discussions, and break our landscape architecture chrysalis.

This issue contains 30 quality peer-reviewed papers resulting from the conference. We hope you find them to be a collection of provocative and insightful research that enriches CELA’s dialog of research and creative inquiry on the processes of debate and discussion.

Bo Yang, PhD, PLA, ASLA
The University of Arizona
Editor-in-Chief, *Landscape Research Record* No. 7
CELA Vice President for Research & Creative Scholarship 2016-2018
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COMMUNICATION AND VISUALIZATION

Edited by Bambi L. Yost & Jon D. Hunt
EMERGING TRENDS IN GEOSPATIAL TECHNOLOGIES FOR STUDY OF URBAN LANDSCAPE

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1 ABSTRACT
GIS has been an effective tool to study urban landscape. Recent developments in geospatial technologies offer new possibilities with new toolsets for spatial analysis and data visualization. This paper traces recent major trends in GIS and discusses their implications to the field of urban landscape study. These trends include the following: 1) increase in dimensions with 3D GIS; 2) integration with remote sensing; 3) cloud-based GIS; and 4) integration with virtual reality. This paper discusses a recent project and demonstrates the potential of these new emerging GIS tools applied to the study of urban landscapes. Many GIS applications were incorporated in this urban design project, including 2D mapping, remote sensing, scenario planning, 3D procedural modeling, virtual reality, and cloud-based tools. This paper details technical specifications and workflows used in the project. In spite of several advantages of these tools, their applications are not without drawbacks, such as high costs due to their proprietary nature, limited data availability, and inconsistent data schema and quality. This paper concludes with a brief discussion on their pros and cons for applying these tools in urban landscape study.

1.1 Keywords
Geographic Information System, Urban Form, 3D GIS, Remote Sensing, Virtual Reality
INTRODUCTION
Geographic Information System (GIS) has been a useful tool to study landscape and urban form since its inception in the 1960s. It is particularly effective to measure quantitative variables of built environments, such as density, clustering, proximity, accessibility, etc. (Song and Knaap, 2004; Tsai, 2005). GIS as its own field has continued to evolve in a rapid pace (Goodchild, 2011). Recent developments in the area of geospatial technologies offer new possibilities with new toolsets for spatial analysis and visualization (Kumar, 2015).

This paper traces recent major trends in GIS and discusses their implications to the field of urban landscape study. These include: 1) Increase in dimensions with 3D GIS: conventional 2D maps are being replaced by interactive 3D models generated by procedural rules stored in GIS. Along with locations and associated attributes, vertical elevation and architectural details are also represented. 2) Integration with remote sensing: remote sensing not only enables 3D visualization with imagery processing but also provides other spatial information to create meaningful analysis results. For instance, LiDAR point-cloud data allow extraction of built forms and identification of physical features and land cover. 3) Cloud-based GIS: web-based GIS services allow centralized access to location-based information. Yet through distributed mobile platforms, real-time data collection, sharing, and collaboration are done seamlessly in the cloud. 4) Integration with virtual reality: virtual reality creates immersive experiences with a perception of being physically present in a non-physical world. GIS can greatly enhance the accuracy and realism of virtual scenes with up-to-date terrain models, street networks, and 3D features.

This paper identifies these major developments in geospatial and visualization tools, discusses their key features, and concludes with a discussion on a class project and demonstrates the potentials of these new emerging GIS tools for study of urban landscape. Many GIS applications were incorporated in this urban design project, including 2D mapping, remote sensing, scenario planning, 3D procedural modeling, virtual reality, and cloud-based tools. Technical specifications and project workflows are detailed in the paper.

3 LiDAR
LiDAR (light detection and ranging) is an optical remote sensing technology that uses laser light to densely sample the surface of the earth. It is an active remote sensing technology. LiDAR sends a pulse of near infrared light and waits for the pulse to return. LiDAR can produce highly accurate x-y-z measurements and mass point cloud datasets that can be visualized and analyzed using GIS software programs (Esri, 2016). Spatially organized LiDAR data is known as point cloud data. The initial point clouds are large collections of 3D elevation points along with additional attributes such as GPS time stamps. The specific surface features that the laser encounters, such as the ground, buildings, tree canopy, roadway structures, bridges, etc., are classified after the initial LiDAR point cloud is post-processed (GISGeography, 2017).

Recent developments in LiDAR are increasing the pace of our transition to true 3D GIS. Earlier LiDAR systems emit a pulse of laser energy and measure the time it takes for that energy to travel to a target, bounce off the target, and return to the sensor. These systems are called linear-mode because they generally only have a single aperture, and so can only measure distance along a single vector at any point in time. Newer more recent Geiger-Mode and Photon-Counting LiDAR systems are based on focal plane-based LiDAR design. These systems are able to collect data with sampling rate of more than 200 MHz, versus the maximum 800 KHz of the current linear-mode LiDAR and point cloud density of up to 100 points per square meter. Such LiDAR systems collect data from an altitude up to 30,000 ft. above ground resulting in wider ground coverage. Another important aspect that these newer LiDAR technologies offer, beside the density, is their focal plane design aspect, which results in a raster-style data acquisition and in turn produces an accurate elevation for the intended survey area. Overall, LiDAR has become the inevitable technology to provide accurate 3D data fast and reliably (Abdullah, 2015; Ullrich and Pfennigbauer, 2016).

4 3D PROCEDURAL MODELING
Procedural modeling is a generic term for a class of techniques in computer graphics to create 3D models and textures from sets of rules. Procedural modeling focuses mainly on generating 3D models based on rules, or enhancing models automatically (Andrews, 2017). Procedural modeling is often applied
when it would be too cumbersome to create 3D models using conventional 3D modeling programs, or when more specialized tools are required. This is often the case for vegetation, architecture or landscapes (Muller, et al., 2006; Nishida, et al., 2016).

CityEngine, developed by GIS Company Esri, is a desktop application for the modelling of large-scale urban environments in 3D. With the procedural modeling approach, CityEngine facilitates users to quickly generate 3D city models from existing 2D GIS data. Designers can conduct conceptual design in 3D based on GIS data and procedural rules. CityEngine also allows professionals in the filming and gaming industries to model virtual 3D urban environments for simulation, game development, and entertainment (Ribeiro, et al., 2014).

A single procedural rule can be used to generate many 3D models in CityEngine. With the integration between CityEngine and GIS, a rule set can make use of feature attributes stored in GIS data, such as numbers of floors, floor heights, roof type, or wall textures, to generate different 3D models that represent properties of different features. A 3D model generated in this way is basically a 3D object resulting from a 2D shape extrusion according to the rules defined in a rule set. The origin of these 2D shapes can either be imported from GIS or built manually in CityEngine (Jin, et al., 2015; Ribeiro, et al., 2014).

5 CLOUD-BASED GIS

The rise of cloud computing has been one of the most significant advancements in computer science. It only seems logical that GIS is also heading into the cloud. Some of the broad advantages of cloud-based GIS include: 1) data access can be through any Internet connection, anytime, anywhere; 2) For an organization with a range of remote users, cloud-based GIS makes the distribution of GIS data, analysis and systems simple to implement and manage; 3) cloud-based GIS allows data capture in real or near real time to be displayed directly onto a centralized system (Chappell, 2010).

Esri’s ArcGIS Online is one example of cloud-based web GIS. It provides users with access to many data sources that have already been made available to subscribers, such as Esri’s Living Atlas of the World. Users can also use many templates to create their own maps or apps. ArcGIS Online also includes a suite of basemaps that provide reference maps for the entire earth and context for local jurisdictions (Esri, 2017). These maps are built using available data from a community of authoritative data providers and presented in multiple cartographic styles. ArcGIS Online also includes detailed imagery of the world, which reveals both the present state of the earth and changes over time. It also includes a comprehensive set of demographic and economic data of the United States through its online-based systems: Business Analyst and Community Analyst. With these ready-to-use basemaps and data, users can then add their own GIS data and create mashups that serve their own purposes. Esri’s Story Maps, another web-based platform with a set of templates, allows ArcGIS Online users to combine authoritative 2D maps and 3D scenes with narrative text, images, and multimedia content for sharing and presentation purposes (Esri, 2018).

6 VIRTUAL REALITY

Virtual reality (VR) creates immersive experiences with a perception of being physically present in a non-physical world. To experience VR, users hold a screen mounted to a headset, which is typically powered by a gaming console, a mobile phone, or a computer to their eyes. Then through specialized software and sensors, users are immersed in an artificial world where they interact with various virtual objects (Manly, 2015; Parisi, 2015; Rubin, 2014).

The immersive nature of VR, which allows viewers to encounter a simulated 3D landscape from multiple points of view, can be a very useful tool for urban planners, designers, or researchers in the field of urban morphology. They can use VR to redraw streets and neighborhoods, offer real and imagined views of existing and proposed developments, or study historical events related to urban transformations.

VR has already drawn attention from the GIS industry, considered to be the next frontier to broaden the capabilities of GIS. For example, Esri has created a mobile VR solution for urban planners, architects, and GIS professionals. With their latest release of CityEngine, users of CityEngine have the option to quickly convert their 3D models into VR experiences on mobile devices. Esri’s ArcGIS 360 VR allows users to quickly immerse themselves through a mobile phone with VR headset into 3D city models by teleporting to static viewpoints and comparing different urban design scenarios. These VR experiences can be created in CityEngine and are hosted on ArcGIS Online (CityEngine, 2017).
In addition to this streamlined approach offered by Esri, users can also use commercial third-party 3D game engines (game development software programs, such as Unity or Unreal) to create VR experiences. Esri CityEngine allows users to export their creations in various formats, including .fbx, which can then be imported into 3D game engines. Users then can add VR support to their models in these game engines (Singh, et al., 2014; Smelik, et al., 2014).

7 DEMONSTRATION PROJECT

To explore the potential of these geospatial tools and visualization media, an urban design project was conducted by the author and his students. The Graduate Program in Urban Design in School of Architecture at the University of North Carolina at Charlotte took on the challenge to re-envision the future of Buttermilk Bottom, an old urban renewal site in the City of Atlanta. The main idea for this academic project was to learn from the City of Savannah about how the class might use those lessons to redo what was badly done three decades ago in Buttermilk Bottom. The assignment was to re-design the Buttermilk Bottom neighborhood according to the design principles observed in the plan for Savannah’s Historic District and their quantifiable traits.

To assist in both the site analysis and urban design processes, GIS was used by the class to explore physical structures in both cities, including street networks, block configurations, open spaces, distributions of land uses, demographic data and their related socio-economic characteristics. Many GIS applications were incorporated in this urban design project, including 2D mapping (ArcGIS Desktop, ArcGIS Pro), remote sensing (Esri Local Government 3D Basemaps), 3D procedural modeling (Esri CityEngine), and cloud-based tools (ArcGIS Online).

7.1 Data Acquisitions

The GIS analysis started with collecting data. The class relied on online open-source GIS databases to acquire the needed datasets for their analyses. For the study area in Savannah, SAGIS (Savannah Area Geographic Information System) Open Data site was the primary source, which provides free access to geospatial data in a standardized format to the public. For the site in Atlanta, two sources were used by the class: DPCD (Department of Planning and Community Development) Open Data and ARC (Atlanta Regional Commission) Open Data.

A series of basemaps were created by combining GIS datasets in both ArcMap and ArcGIS Pro to create a digital representation of the existing urban structure for both two cities. The datasets used in these basemaps included the following: streets, parcels with land use information, building footprints, parks, landmarks, points of interests (such as schools, churches), waterbodies, contours, and census tracts. Demographic data were collected from Census Bureau website (American FactFinder) and linked to the census tracts dataset.

7.2 LiDAR Processing

After the basemaps were created, the next step was to create 3D models for both sites in Savannah and Atlanta. These models were intended to display the existing buildings, trees, and accurate terrains to represent the landforms. This was done by extracting 3D features from LiDAR point cloud data (Figure 1).

For the site in Savannah, the LiDAR data was acquired from Department of Architecture in Savannah College of Arts and Design (SCAD). 8 LiDAR tiles were obtained in the .las file format (version 1.1). They were commissioned in 2009, each covering an area of 5,000 ft by 5,000 ft with a point spacing of 1.5 ft. These tiles had been classified into 5 classes: unassigned; ground; building; noise; water.

For the site in Atlanta, the LiDAR tiles were downloaded from the website USGS Earth Explorer. 2 tiles were obtained in the .las file format (version 1.0). The tiles were created in 2006, each covering an area of 5,300 ft by 5,300 ft with a point spacing of 4.6 ft. Since these two LiDAR tiles were not classified, the first step was therefore to reclassify them. ArcGIS Pro was used to process this step. The reclassification was performed by applying the following two methods: classify building and classify by height. After this step, the class used Esri’s Local Government 3D Basemaps tools to process all LiDAR tiles for both two cities to extract buildings and trees in 3D. This step also produced digital terrain models (DTM) in the .tiff file format to represent the bare ground terrain for both two sites.
The class used ArcGIS Pro and Esri’s Local Government 3D Basemaps workflow to reclassify LiDAR point cloud data and extract 3D features from the LiDAR for City of Atlanta (Broyles, et. al., 2017)

7.3 3D Modeling

The 3D models created by extracting features from LiDAR data were considered simple representations of the existing urban structures for both sites. To enhance their visual qualities and model appearances, Esri’s CityEngine was used by the class to add details to the 3D models. These details included architectural structures and textures, landscape features, roadway signs and pavements, transportation features, vehicles and human figures. Lighting effects were also added to enhance the level of realism in the models.

Before using CityEngine, a GIS data package in the .gdb file format (Esri’s File GeoDatabase) had to be prepared in ArcGIS Pro. This package included the following items: 3D buildings extracted from LiDAR by Local Government 3D Basemaps; DTM as .tiff images; tree points (also from LiDAR), street centerlines, building footprints, and aerial photos of the site as .tiff images.

The street-creation tool in CityEngine was used to generate streets. This step was done based on street types that were identified by the class. All the details associated with the streets, such as vegetation, signs, pavements, vehicles and human figures, were added by using Esri’s Complete Street rule package. The class then used Esri’s Urban Design rule package to generate 3D buildings with architectural details and textures.

Overall, the class was able to use the 3D models by CityEngine to examine the physical qualities of the areas, such as: overall land use distributions by color-coding building footprints; potential ways of urban transformations by urban design; and streetscape configurations with fully rendered details (Figure 2).
7.4 Cloud-based GIS
In addition to relying on online open data sources to acquire GIS data, the class also took advantage of Esri's cloud-based platform, ArcGIS Online, for the following activities and purposes:

1) Data and content sharing: An online user group was created to include all the students as well as the instructor of the class to enable sharing of GIS data, processed map layer and scene layer packages, and maps and 3D scenes that were generated by the class.

2) Data processing and analysis: the class also used some of the analysis capabilities offered by the platform to perform some basic analysis, such as walkability analysis and hot-spot analysis.

3) Map and web scene generation: the class used this online platform to generate maps and 3D web scenes, which included detailed streetscapes, buildings, spatial analysis, and to visualize and explore urban structures and design solutions.

4) Project presentations: the class used the template provided by the online platform to create story maps to present project outcomes. Each story map contains multiple forms of media, including static images, text narratives, interactive maps and 3D scenes that reveal urban structures of the two sites. These story maps were made available to the general public online through the Internet (Figure 3).

Figure 3. The class created a story map to organize a series of web scenes for documenting their analyses and design solutions, including land use mix analysis and walkability analysis (Broyles, et. al., 2017)

7.5 VR Development
The class also tested the potential of using virtual reality as a way to study urban form and explore urban design solutions. Their 3D CityEngine models were exported as .fbx files (Autodesk), which were then imported into Unity, a game development platform, or game engine, to be further converted into virtual reality scenes. Unity allows additional lighting effects and environment rendering options to enhance the appearance of the models. It also enables virtual reality settings that allow a user to use a typical game controller, such as Xbox controller, to walk around 3D scenes generated by the CityEngine models. During the class final review meeting, a computer was set up to allow guest critics to experience the virtual reality scenes in person and offer comments for students’ design projects (Figure 4).

8 CONCLUSION
This class project offered an opportunity to explore the possibilities to use new geospatial tools and visualization media to study urban form and its related topics. These tools and media, including 3D procedural modeling with GIS, LiDAR remote sensing, cloud-based GIS platform, and virtual reality, represent four of the many major development trends in the geospatial technology industry and its related fields.

This project reveals potential advantages of these geospatial and visualization tools for the study of urban form, including: 1) quick 3D form extraction from LiDAR; 2) urban structure exploration with 3D procedural modeling; 3) easy access to accurate terrain elevation data and global satellite imagery; 4) easy data sharing and presentation over the Internet through cloud-based platform; and 5) a new way to experience urban spaces through virtual reality.
However, noticeable disadvantages or issues still present and hinder the adaption of these tools, including: 1) proprietary software license; 2) limited data availability and unreliable quality; 3) inconsistent data schema; 4) multiple software programs and platforms with a steep learning curve; and 5) high cost of hardware devices.

Though an in-depth evaluation on the exact effectiveness of these software tools or media for the study of urban form is out of scope for this paper, which can certainly be an important next-step for advancing this particular practice, this project allowed for a quick glimpse of the current development trends in the GIS world. As these digital tools are becoming more and more advanced, we researchers, scholars, or designers interested in understanding the dynamics of city building processes should explore new methods and establish new workflows to utilize these tools to advance our work.

9 REFERENCES


APPLICATIONS OF PHOTOMONTAGE IN CONTEMPORARY LANDSCAPE ARCHITECTURE

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1 ABSTRACT
Landscape architects have employed montage as a representation tool since the 18th century. More recently, a specific type of montage, the photomontage, or composite drawing created by combining photographic elements with other types of representation such as pen or watercolor, have become prevalent in contemporary landscape architecture representation. Digital tools such as Photoshop have contributed to the proliferation of photomontage as a technique for describing designs. Paralleling the use of digital tools to assemble photomontages is a shift from highly abstract, conceptual photomontage compositions to more literal representations (Composite Landscapes Exhibit, 2014). Despite the departure from abstraction in contemporary photomontages, there are examples of photomontages created throughout the design process that go beyond the literal picture (Belanger and Urton, 2014). From an analysis of contemporary literature and works produced by several firms, including James Corner Field Operations, Atelier Girot, and GROSS MAX landscape architects, four categories of photomontage emerge: (1) photomontage as an exploratory sketch, (2) photomontage as a tool to communicate a conceptual idea, (3) photomontage as a tool to combine scientific data and emotional quality and lastly, (4) photomontage as a tool to literally represent a place. Using these four categories, this paper draws upon contemporary examples to analyze the compositional strategies of photomontages in each category. Findings reveal that unique compositional features characterize each category. Photomontages as sketches apply transparency, varying scales and saturation, and are highly conceptual in nature. Photomontages that communicate conceptual ideas have similarly abstract qualities, juxtapose disparate images at different scales, and abandon the traditional rectangular frame. Photomontages that combine three-dimensional modeling tools with emotional qualities include quantitative data with transparent photographic overlays and are incorporated as analytical tools in the design process. Literal representations are contained within rectangular frames, have high, consistent saturation, and show elements and figures at realistic proportions. Analyzing the various types of photomontages and their compositions shows how photomontage can expand beyond a literal representation tool that characterizes many contemporary composite renderings.

1.1 Keywords
Photomontage, Representation, Visual Communication, Contemporary Landscape Architecture

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INTRODUCTION
Landscape architects and designers have employed montage, a technique that combines different pictures to create one image, as a representation tool since the 18th century. Also referred to as composite drawings, montages were used by early landscape designers such as Humphrey Repton to communicate designs to clients by combining maps, text, sketches, and other visual media into single compositions (Daniels from Waldheim and Hansen, 2014). More recently, digitally-produced photomontages, which rely predominantly on combining photographic elements, have become a particularly popular form of representation in contemporary landscape architecture (Daniels from Waldheim and Hansen, 2014). This theme is highlighted in a recent exhibit, Composite Landscapes (2014), which features a selection of contemporary landscape architectural photomontages. An analysis of contemporary photomontages from the Composite Landscapes exhibit, literature, and landscape architecture practice is used to define four categories of photomontages with unique compositional strategies.

2.1 Contemporary Literature on Photomontage
Since the mid- to late-1990s, photomontages have experienced a shift from highly abstract, conceptual composites to literal representations, paralleling the emergence of digital tools such as Photoshop. This has sparked critical discussion, with recent literature advocating for the application of photomontage as an idea-making rather than picturing tool. In her essay Structuring Relations: From Montage to Model in Composite Imaging, author Karen M’Closkey critiques how recent photomontages depict design in this way. She writes, “In this sense it is the procedural and conceptual functions of montage and collage—to re-present, not imitate—that are significant and that have been largely neglected in the shift to digital montage” (M’Closkey from Waldheim and Hansen, 2014). Sanda Iliescu is also critical of contemporary digital, realistic photomontage; in Beyond Cut-and-Paste: The Promise of Collage in Contemporary Design she writes: “Rather than metaphor, what we get from this kind of work is cliché. What we lose is collage’s power to summon feelings that span the fertile territory between art and life” (Iliescu, 2008).

Despite the trend toward literal representation in photomontages, there are examples that exhibit a variety of compositional strategies that expand beyond realism. In their article Situating Eidetic Photomontage in Contemporary Landscape Architecture, Blake Belanger and Ellen Urton write “…many different photomontage techniques that include combining 3D models with photographic elements, image collage, and mixed media compositions. Other offices balance photomontage with more traditional media, such as watercolor painting and colored pencil renderings. Landscape architects commonly employ photomontages to create perspective drawings representing a proposed design scene. In addition, designers also use photomontage in their creative process to investigate conceptual ideas and explore design potential” (Belanger and Urton, 2014).

METHODS
The compositional elements described by Belanger and Urton in Situating Eidetic Photomontage in Contemporary Landscape Architecture serves as the framework for the visual analysis of photomontages in each category. The questions they pose in their analysis are, “what characterizes the image, what are the compositional attributes and which of those characteristics occur with frequency, how was each image constructed, to what degree is the work representational or abstract, and to what degree is the idea conveyed literal or conceptual?” To address these questions, the authors define eight “visual cues” used for analyzing photomontages (Belanger and Urton, 2014). This analysis applies the compositional “visual cues” described by Belanger and Urton including frame ambiguity, scale distortion, and degree of abstraction. Transparency and saturation are additionally used to assess the photomontages, as variation was noted between types of photomontage.

FINDINGS
This paper builds defines four distinct categories of contemporary photomontage: (1) photomontage as an exploratory sketch, (2) photomontage as a tool to communicate a conceptual idea, (3) photomontage as a tool to combine scientific data and emotional quality and lastly, (4) photomontage as a
tool to literally represent a place. Using these four categories, this paper draws upon contemporary examples to analyze the compositional strategies of photomontages in each category.

4.1 Photomontage as an Exploratory Sketch

A contemporary landscape architecture firm, GROSS MAX landscape architects, based in Edinburgh, Scotland, utilizes photomontage as an exploratory sketch by integrating the representation tool into the design process. Belanger and Urton make note of this when they quote Eelco Hooftman, a founding partner of the studio: “While for many architects, the plan and diagram remain the starting point of their designs, for us, the image, or more precisely the mental picture of the image, is the point of departure into further exploration” (Belanger and Urton, 2014).

The photomontages produced by GROSS MAX are characterized by a highly conceptual, unfinished quality, like a sketch, though they are constructed digitally from photographs. The representations present ideas rather than literal pictures, amplified by using high transparency and varying, distorted scales. The composite drawings for Parklandschaft Tempelhof, a 2017 competition entry for a park on an abandoned airport site in Berlin, exhibit this unfinished, abstract quality. One composite drawing for a section of the park titled the Field features a wide runway that disappears into the horizon, bounded by tall grasses and flowers. Transparent overlays, including some bands of abstract color and barely discernable figures, are collaged at different scales, contributing to the abstract, conceptual nature of the composite. In the expansive sky, a very large blimp hovers in the upper right of the image; the exaggerated size of the blimp draws attention to the sky, emphasizing the importance of maintaining the expansive view in the design. While composed of photographs, all representations for the Parklandschaft Tempelhof competition use high transparency, exaggerated, unrealistic scales to emphasize certain qualities of the place, and varying saturation levels (GROSS MAX landscape architects, 2017). These characteristics create an unfinished, abstract photomontage that represent ideas rather than literal pictures, akin to a preliminary sketch in the conceptual design phase.

4.2 Photomontage as Eidetic, or a Way to Communicate Conceptual Ideas

James Corner, a contemporary landscape architect and founder of the practice Field Operations, has explored the topic of photomontage in publications and practice. In his essay *Eidetic Operations and New Landscapes*, Corner advocates for the use of what he terms eidetic images in landscape representation, and similar to Karen M’Closkey, holds a critical viewpoint of composites that literally picture a place rather than illustrate an idea. James Corner defines the term eidetic when he writes, “Eidetic...that which pertains to the visual formation of ideas, or to the reciprocity between image and idea. That drawing is fundamentally about making images suggests that it might actually generate and transform ideas for the percipient rather than simply representing them” (Corner from Waldheim and Hansen, 2014). To create eidetic representations, Corner employs photomontage as one of his primary tools. He describes this when he writes that photomontage is “…essentially an affiliative and productive technique, aimed not toward limitation and control but toward emancipation, heterogeneity, and open-ended relations among parts” (Waldheim and Hansen, 2014). Corner advocates for the use of the photomontage to communicate an idea of a place, rather than to simply portray it literally.

In the book *Taking Measures Across the American Landscape*, Corner collaborates with photographer Alex Maclean to create composites from photographs and cartographic images that encompass the notion of eidetic representation (Corner, 1996). The photomontage titled *Pedagogical Drift*, featured in the *Composite Landscapes* exhibit, is an example of eidetic work (Waldheim and Hansen, 2014). In this photomontage, there is a bird’s eye photograph of agriculture parcels in the bottom right of the composition. Collaged in the background are light contours with a square grid overlaid on a black background. Another layer, abstract forms extracted from a map that perhaps represent a feature of the landscape, such as soil type, is positioned diagonally across the montage, extending beyond the black square in the background. Overall, the composite is very abstract, and suggests a central idea: it emphasizes cultural applications of the American landscape through the use of images that represent how people take measures of land through data such as contours.

James Corner’s eidetic composite *Lake / City / Horizon, Toolonlahti Park*, also featured in *Composite Landscapes*, has parallel compositional qualities to those found in the composites in *Taking Measures Across the American Landscape* (Waldheim and Hansen, 2014). Juxtaposing distinct
photographs, the photomontage abandons a rectangular frame. Images of ground texture, trees, and a human figure are at different scales and saturations. The exaggerated scale of the ground texture highlights a quality that would otherwise be difficult to discern in a literal portrayal from one’s perspective. Like his previous composites and the photomontages composed by GROSS MAX landscape architects, the eidetic representations by James Corner are more abstract than literal and focus on evoking qualities and conceptual ideas about place.

4.3 Photomontage as a Combination of Data and Emotional Qualities

Contemporary landscape architects employ photomontage as a representational technique that combines scientific data with the emotional qualities of a place. Scientific data can include spatial analytical data tools, such as geographic information system (GIS) and three-dimensional modeling software. Karen M’Closkey highlights how data is incorporated into composites when she writes, “...while often used in conventional ways - that is, to make topographic surfaces - three-dimensional models have immense potential to facilitate new forms of composite imaging...” (M’Closkey from Waldheim and Hansen, 2014). One practitioner, Christophe Girot, currently the chair at the Swiss Federal Institute of Technology in Zurich and founder of the practice Atelier Girot Landscape Architecture, explores this concept described by M’Closkey in his representations. He explains his motivation behind combining data with composite images when he writes, “There exists a schism between the way landscape is understood scientifically, either as a functional normative network or an ecological system, and the way the same place exists cognitively, poetically, and emotionally for people” (Girot and Imhof, 2016).

To express the emotional quality of a place with data, or the “way landscape is understood scientifically,” Girot creates composites by combining highly accurate three-dimensional digital models with collaged photographic elements, sometimes annotated with data describing the site. One example, Section through true-color point-cloud exhibited at Composite Landscapes, shows a section perspective created by overlaying semi-transparent photographs of buildings, trees, and vegetation textures on a three-dimensional topographical model. The section cut line is annotated with latitude, longitude, and elevational data (Waldheim and Hansen, 2014). The transparent photographic overlays of elements and materiality provide the viewer with a sense of how it feels to be on the site, while the data provide a quantitative resolution.

Another example produced by Atelier Girot is a composite for a project in Quartu Sant’Elena in Cagliari, Italy. Like Section through true-color point-cloud, the drawing is composed of a three-dimensional model combined with photographic and satellite imagery. The firm’s project description explains how the image was composed, as well as the motivation behind its creation: “Combined with photographs and satellite imagery, the GIS geo-referencing and 3D visualization allow us to identify, at the micro level, landscape, circulation, water runoff, zoning strategies and areas needing resolution” (Atelier Girot, 2017). In this sense, it is interesting to note that the photomontage is not only employed as a tool for communicating the spatial and emotional qualities of the site, but also as a part of the design’s analytical process.

4.4 Photomontage as Literal Representation

Lastly, photomontages are frequently used as tools to literally picture a place; this method has become a popular communication tool for landscape architects, particularly when presenting a design to clients or stakeholders. Though critical of photomontages as realistic portrayals, Karen M’Closkey remarks on the benefits of the accessibility and clarity of this type of photomontage when she writes, “Whereas the photorealistic montage view may not be productive as a design tool, it functions exceedingly well as a means of communication...” (M’Closkey from Waldheim and Hansen, 2014). Recent composites created by James Corner Field Operations serve as an example of the type of realistic photomontage described by M’Closkey. The photomontages created for a design for a park, Presidio Parklands in San Francisco, exhibit realism. The textures, figure, elevated structure, and vegetation are at the same scale. Elements in the composite are opaque, and the overall compositions employ convincing one-point perspectives (Corner, 2017). These qualities, along with rectangular frames, suggest that the photomontage attempts to imitate an actual photographic image to literally represent a place.
5 CONCLUSION
Photomontage is a popular representation tool used by contemporary landscape architects throughout the design process. While recent trends in composite images are literal in nature, their application in contemporary landscape architecture reveals three additional types of photomontage: an exploratory sketch, a way to communicate a conceptual idea, and a way to combine emotional qualities and data. An analysis of examples from the Composite Landscapes exhibit and work by practicing landscape architects reveals unique compositional features in each category. The photomontages as a sketch exhibit high transparency, varying scales and saturations, and are highly conceptual in nature. Representations that emphasize an idea hold similarly abstract qualities, juxtaposing disparate images at different scales and abandoning the constraints of a rectangular frame. Composites constructed with three-dimensional modeling tools include quantitative data and photographs, and are even incorporated as an analytical tool in the design process. Photomontages attempting to literally represent a place adhere to a rectangular frame, and attempt to imitate a photographic image. Understanding the various types of photomontage compositions may allow the representational tool to be used more broadly in contemporary landscape architecture practice; further study or development may involve interviews with artists of the photomontages cited in this paper in order to explore in depth the intentions behind their composites, and how they apply this representational tool in their design process.

6 REFERENCES
DESIGN EDUCATION AND PEDAGOGY

Edited by Matthew Powers & Ashley Steffens
DESIRING WASTE: A PEDAGOGY OF LIFECYCLE APPROACHES TO WASTE AND BROWNFIELD TRANSFORMATION

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1 ABSTRACT
Waste is a term embedded with negative connotations retained by a long lineage of cultural attitudes towards undesired material excess. This perception has resulted in shortsighted reactions that mismanage potentially valuable waste products and landscapes. These wastes must be embraced as desirable opportunities with latent value for producing new economies, ecologies, and cultural landscapes. Landscape architecture is uniquely positioned to reimagine the potentials of waste landscapes like brownfields: the most prevalent and complex landscape condition faced by this profession with up to one million sites in the U.S. Integrating brownfield transformation into design curricula is imperative. The next generation of landscape architects must be critical of and actively engage with complex, contaminated landscapes and waste legacies. Rather than apply conventional approaches to waste reclamation that typically result in passive parks, this paper argues for an alternative approach—landscape lifecycles—that reconceptualizes waste as a resource for site and material transformation. Grounded in concepts of material lifecycles, industrial ecology, and circular economies, landscape lifecycles spatializes these abstract systems and explores the aesthetic, experiential, and performative potentials of waste. The principle result is a design framework towards waste and brownfield transformation—exposing students to a state-of-mind about waste’s design opportunities rather than providing ready-made solutions. Students explore their unique interests within highly structured courses, resulting in a diversity of distinct, speculative responses that engage with waste’s potential. This paper reflects on the integration of this framework in past studios and a current seminar course, uncovering the successes and opportunities for further development.

1.1 Keywords
Waste Reuse, Brownfields, Pedagogy, Design Education, Lifecycles
2 INTRODUCTION

Materials and landscapes associated with waste are perceived as undesirable, a culturally conditioned aesthetic response DiPalma (2017) describes as “disgust”. They are the anthropogenic byproducts of isolated and disconnected approaches to the lifecycles of materials and landscapes. As we continue to produce new single-use material conglomerations that are incapable of being digested or disassembled, they are just as quickly relegated to landfilled mountains of technofossils, where we render useless the limited reserves of Earth’s biosphere.

Material waste produces spatial waste. The United States currently has up to one million known brownfield sites, encompassing the same land area as sixty of our largest cities (U.S. Department of Housing and Urban Development, 2012), and this number will continue to grow under these practices. Brownfield reclamation approaches have broadly continued waste’s legacy as an undesirable condition, driving unconscious aesthetic design decisions to fix and hide waste “under a thin green veneer” (Meyer, 2007) rather than fully engage with it. Our designed built environment must capitalize on waste materials and landscapes as humans continue growing in population and resource use in the Anthropocene. Landscape architecture is uniquely positioned to conceptualize the potentials of waste for adding value in the transformation of waste landscapes: the most prevalent, complex, and ubiquitous landscape condition faced by this profession. Rather than accepting waste conditions as they are and attempt to address them retroactively, landscape architecture can critique and engage with the processes that produce waste conditions. This paper aims to answer: how do we train the next generation of landscape architects to innovatively and actively engage with perceived waste materials and landscapes in order to design meaningful waste places?

In the context of waste’s cultural misperceptions and its effect on design, this paper explores the crucial need for an integrated and critical approach towards waste in design pedagogy. An initial discussion of several waste-to-resource concepts framing waste as a 21st century fuel is followed by critiques of these frameworks for their general lack of spatial and aesthetic design applications. Alternatively, the paper proposes landscape lifecycles as a holistic design-research framework to approach all forms of waste as opportunities for design interventions. This framework argues that sharing waste materials and spaces creates overlaps, resulting in hybrid economic, ecological, and social programs integrated by exchanging waste.

This framework and perspective towards waste has been applied in several past design studio courses and one current seminar course, resulting in a design pedagogy that advocates for the transformation and reconceptualization of waste materials and landscapes. The landscape architecture studios utilizing this pedagogy first began in spring 2014, and findings from this and other more recent studios will be presented. The research seminar is currently in its first semester of implementation and is being critically evaluated in a peer-review of teaching program. Although this course is ongoing, findings from this course, combined with peer and student feedback collected thus far, is presented.

3 WASTE-TO-RESOURCE: CONCEPTUAL FRAMEWORKS

3.1 Material lifecycles and cradle to cradle

Documenting a material’s process of manipulation and transformation through its raw material and energy inputs and waste outputs reveals the material lifecycle. As Calkins (2009) describes: “most material life-cycle flows are relatively linear, where materials move through a cycle and are disposed of; however, some are circular with product reuse, component remanufacturing, and material recycling. The ideal material lifecycle would be a closed-loop circular flow where waste from one process or product is ‘food’ or feedstock for another, and waste released to the environment does not exist” (p. 24).

Cradle to cradle is one response to this call for closed-loop material lifecycles. Cradle to Cradle (2002), a seminal book by William McDonough and Michael Braungart, presents a design philosophy that reconsiders wastes generated by the production, use, and disposal of materials and products. One core principle of cradle to cradle is that materials flow within two cycles: technosphere (non-biodegradable and contained within an industrial cycle) and the biosphere (materials capable of safely decomposing, returning to the biosphere) (McDonough and Braungart, 2002; Webster, 2015). Other
principles include “waste = food,” a shift to renewable energy, and celebrating diversity as a source of resiliency and creativity in systems (McDonough and Braungart, 2002; Webster, 2015).

The book led to the development and implementation of “a framework for quality assessment and innovation: the Cradle to Cradle Certified™ Products Program” (Cradle to Cradle, 2018a). The certification program reviews a product based on “five quality categories—material health, material reutilization, renewable energy and carbon management, water stewardship, and social fairness” (Cradle to Cradle, 2018b). There are currently almost 500 Cradle to Cradle Certified™ Products ranging from building materials to clothing to health and beauty products.

Material lifecycles and cradle-to-cradle highlight waste generated during the production of materials and products. Cradle to cradle shifts the cradle-to-grave (linear) lifecycle approach to a circular approach, reusing byproducts within a material’s lifecycle based on its technical or biological nutrients. Although these concepts have influenced product-based industries to be mindful of reusing generated waste materials, their application and implementation has been limited to individual material industries. Focused on the material scale, they do not fully consider the opportunities of cycling material byproducts between multiple entities and industries. Industrial ecology is one response to this gap.

3.2 Industrial metabolism and ecology

While a material’s lifecycle refers to the materials and energy flows used and lost throughout a material’s or product’s life, industrial metabolism applies this to the scale of an industrial system, (Erkman, 2001) and uses a descriptive approach to inventory and measure the total various types of energy and material flows circulating within the system (Gallaud and Laperche, 2016). Urban metabolism, similarly, applies concepts and approaches of industrial metabolism and lifecycle assessment to the urban environment (Swyngedouw, 2006). According to Erkman (2001), industrial ecology goes beyond analyzing industrial metabolism to understanding how it functions, its regulations, and interactions with the biosphere (Gallaud and Laperche, 2016). Based on this knowledge, coupled with our knowledge of ecosystems, may determine how industrial systems and commercial enterprises can be restructured for greater compatibility with the way natural ecosystems function (Erkman, 2001). Industrial ecology provides a holistic perspective for industrial systems, not only addressing issues of environment and pollution, but also technologies, economies, and the interrelationships between municipal policies, financial institutions, and businesses (Erkman, 2001).

The quintessential model of industrial ecology is in Kalundborg, Denmark, and has evolved over the past four decades. It is recognized as contemporary industrial ecology’s birthplace (Belanger, 2007), and consists of six major partners: Asnaes power station (largest electricity producing coal-fired power plant in Denmark), Statoil (an oil refinery), Novo Nordisk (a biotechnology company), Gyproc (a company producing plaster board), the municipality of Kalundborg (which uses excess heat from Asnaes for its residential district heating system), and Bioteknisk Jordrens (a soil remediation company) (Erkman, 2001). As Belanger (2007) describes, “the driving force that underpins the network is the recycling of bulk chemical wastes as raw material inputs for other industries” (p. 87). Byproducts turned raw material inputs consist of water reuse within a process, excess steam, heat, and gas, calcium sulphate (gypsum), and biomass (used as fertilizer) (Erkman, 2001) all created from one industry and passed on to another.

The sharing of material byproducts as raw material sources between multiple industrial and commercial entities within a region creates an industrial ecology. As Erkman (2001) argues, it is a model that can be replicated in other locations that have industries in close proximity to one another. Concerned specifically with industries and their impacts on the biosphere, in terms of both sourcing raw materials and their disposal, industrial ecology is often cited as related to, or a subset of, circular economies, which provides an even broader perspective (Gallaud and Laperche, 2016).

3.3 Circular economy

According to Gallaud and Laperche (2016), “the concept of circular economy is a fairly recent one, and its definition, which is not yet stabilized, owes much to the work of the MacArthur Foundation” (p. 2). The Ellen MacArthur Foundation, established in 2010, has focused most of its activities on circular economy (Gallaud and Laperche, 2016). Since 2010, the Foundation has published a series of reports and other publications that seek to define and explore the potential of circular economy, with its most recent publication The Circular Economy: A Wealth of Flows (Webster, 2015). Circular economy critiques linear models of resource consumption that promotes a “take-make-dispose” culture, and as Webster (2015) describes, “is
massively wasteful of both raw materials and finished products” (p. 9). In framing the economy as a complex adaptive system, Webster (2015) provides five key principles of a circular economy: 1) as a global economic model, it “decouples economic growth and development from the consumption of finite resources;” 2) separates technical and biological materials (as Cradle to Cradle does); 3) “focuses on effective design and use of materials to optimize their flow and maintain or increase technical and natural resource stocks;” 4) provides opportunities for innovation across fields; and 5) “establishes a framework for a resilient system” (p. 16). Like other concepts, the objective of circular economy is to eliminate waste harmful to the environment. It also advocates for the rental of goods and the purchase of services, rather than the sale of goods, which generates waste (Gallaud and Laperche, 2016).

Several European and Asian countries have begun incorporating circular economy and other concepts in long-term development plans. Gallaud and Laperche (2016) provide several examples of how circular economy is beginning to effect policy. For example, China included circular economy in their 11th and 12th five-year plans (2006-2010; 2011-2015) for economic and social development in order to establish a frugal society with limited resources and energy (p. 6). Based on their review of these multinational plans, they discovered that different countries have not adopted the same definition of circular economy. They each emphasize different aspects, from preventing, reusing, and recycling waste to the promotion of clean technologies and renewable energy (p. 7), many of which are setting ambitious objectives in their long-term development goals.

As Gallaud and Laperche (2016) describe, the meaning and potential circular economy, industrial ecology, and other waste-to-resource concepts carry for technological, social, and organizational innovation remains vague. They provide possibilities for reexamining production and consumption methods at regional scales (Gallaud and Laperche, 2016), but generally lack an understanding of how individual sites effect and are affected by these systems.

3.4 Critiques

The waste-to-resource concepts outlined in Sections 3.1-3.3 above are both broad and hyper-focused, and all advocate for the separation between technologically based and bio-based materials. Cradle to cradle casts a wide net for managing resources and wastes within material and product production systems. Industrial ecology focuses on the industrial system, viewing it as an ecosystem with possibilities for cascading wastes between multiple industrial entities at the regional scale. Circular economy focuses on the flow of economic capital in the form of shared goods and services in order to eliminate harmful waste.

These models have been limited in scope to industries, urban environments, and materials, are narrowly focused on specific topics and contexts, and are commonly applied to the analysis of existing systems. Although these concepts provide essential lenses for effectively managing our material wastes, they do not directly address spatial wastes generated by these processes nor provide methods for effectively confronting these conditions through design. They leave out the landscapes sustaining and fragmented by these processes. With their abstract approaches and systems-based focus, they lack an exploration of the spatial, experiential, and aesthetic considerations of waste reuse, and the environmental and social potentials of hybridizing ecological with anthropogenic systems. Beyond material specification, what is the role of these conceptual frameworks in the design of the built environment, particularly when considering the sites and landscapes that are perceived as waste? Landscape lifecycles is proposed as a design-research framework to support this disparity.

4  LANDSCAPE LIFECYCLES: A DESIGN RESEARCH FRAMEWORK TOWARDS DESIRING WASTE

Western societies generally view systems of economy, ecology, and culture as separate, linear systems. Although the waste-to-resource concepts outlined above call for waste reuse and reduction, they generally follow this tendency. As Engler (2004) states, “Failure to notice waste, misconceptions about waste, and repulsion toward waste prevent us from deciding how to manage it well. They hinder our ability to make waste a meaningful part of our lives and to shape culturally significant waste places” (p. 16).
**Figure 1. Landscape Lifecycles: from separate linear systems toward intertwined, cyclical systems exchanging waste to create hybridity and complexity (2016). Diagram by the author**

*Landscape lifecycles* is a design research framework that views these systems as integrative and cyclical (Figure 1), creating hybridity and complexity. It rejects the notion that there is an end-of-life for materials and landscapes, and recognizes that systems can be intertwined through the exchange of waste materials from each process within each system. As an ecologically grounded landscape-based design approach, landscape lifecycles offers a comprehensive perspective of technological and environmental systems; one that does not see them as mutually exclusive or operating in isolation of one another, but recognizes that such systems are boundless and fluid.

Under this framework, waste landscapes are defined as territories left over from a material or process and typically lack a concrete plan for their futures. These territories include:

1. Contaminated sites, such as brownfields and Superfund sites
2. Landscapes that have a legacy of waste material dumping and collection, for example landfills and confined disposal facilities
3. Sites resulting from materials processing, such as mines and materials processing centers
4. Vacant, underutilized, and inactive properties, including abandoned lots and under-designed, over-engineered spaces that have the potential for human occupancy

Design research in landscape architecture applies research inquiry to a spatial practice, and tests and speculates on the multi-scalar implications of research. It recognizes the overlap and interconnectivity between many disciplines, and helps spatialize research and speculate on the future. As a design research framework, landscape lifecycles aims to push the design disciplines to tackle these waste landscapes with integrative approaches, strategies, and techniques that reactivate waste as a dynamic contributor to local and regional contexts. It is a method for integrating multiple diverse programs rooted in economic, ecological, and social performance to form hybrid assemblages in the transformation of perceived physical and spatial wastes.

Broadening the scope beyond industrial land uses, site-based programmatic relationships are forged through the exchange of internally and externally sourced material byproducts that create new waste economies and ecologies, capitalizing on waste as a generator rather than a detriment. This method aspires to engender new culturally significant landscapes of multiplicity with waste, providing venues for multispecies users negatively affected by waste landscapes to participate in their transformation.

Landscape lifecycles is significant to the field because it disputes conventional modes of reclaiming waste landscapes as passive parks by reframing waste as a resource with material, spatial, experiential, and aesthetic dimensions, which has the capacity to generate highly performative, diverse, and active landscapes as cultural destinations. Combating waste by generating new economic streams built on and propelled by waste resources can drive environmental and economic justice. This proposed framework is applicable to not only design research and a critical lens for evaluating the performance of existing projects that engage with waste reuse, but also as a pedagogy for pushing students to engage with waste through design innovation. Implementing landscape lifecycles as a design pedagogy explores how reacting differently to the creation of waste yields creative acts of reuse.
5 METHODS FOR INTEGRATING LANDSCAPE LIFECYCLES IN DESIGN PEDAGOGY

Landscape lifecycles has been applied as a pedagogy at both undergraduate and graduate design studios and a research seminar. Courses use a scaffolded approach with a phased structure building on skills and the development of a waste-based language. Content and topics explored through readings and discussions build a theoretical foundation in each phase, which parallels and supports assignments, project development, and design inquiry. There is also a period of group-work built into the studios and for the whole semester in the research seminar, allowing students to work together to quickly develop their ideas. Within this pedagogical approach, students are encouraged to explore their own personal interests within the rigorous structure set forth from the beginning of the semester. The sections below outline the integration of landscape lifecycles as a design pedagogy in design studios and a research seminar.

5.1 Studio approach

Landscape lifecycles as a pedagogical studio approach is centered on the theme of waste reuse: repurposing wastes within various regional and urban infrastructural systems, and restructuring these waste streams to guide the redevelopment of a wasted site. Students develop projects that are not only driven by integrating economy, ecology, and culture, but also on establishing new relationships between their proposed programs with the exchange and use of waste materials. It has been applied to a first semester graduate studio and a fourth semester undergraduate studio. Although the general premise for the design approach is the same—requiring students to work at multiple scales and develop economic, ecological, and social programs that exchange waste in the transformation of a waste landscape—the scaffolded approach is varied in order to accommodate students’ skill levels.

Any first semester graduate studio has a steep learning curve in which students are acquiring a new visual and verbal language. To support this curve, the course was integrated and coordinated with their graphics and history/theory courses in which topics and skills students were exposed to in their courses were applied and repeated in the studio. This studio was implemented in five phases. In the fourth semester undergraduate studio, students already have many graphic skills and are able to continue sharpening their existing skills while being introduced to new ones. This studio was implemented in four phases (Table 1).

Table 1. Outline of scaffolded phased structure of the studio approach, illustrating the parallels between content and project assignments.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Time Period</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>Weeks 1-2 (2 weeks)</td>
<td>Reading discussion (Wk 1)- Waste Landscapes&lt;br&gt;Case Study Analysis (topic selection from list)</td>
</tr>
<tr>
<td>Phase 2</td>
<td>Weeks 3-6 (4 weeks)</td>
<td>Reading discussion (Wk 3)- Mapping&lt;br&gt;Reading Discussion (Wk 5)- Contemplating Waste&lt;br&gt;Mapping Analysis (Wk 3-5) (topic selection from list)&lt;br&gt;Mapping Speculation (Wk 5-6)</td>
</tr>
<tr>
<td>Phase 3</td>
<td>Weeks 7-8 (2 weeks)</td>
<td>Reading discussion (Wk 7)- Visiting Site&lt;br&gt;Site Analysis (topic selection from list)</td>
</tr>
<tr>
<td>Phase 4</td>
<td>Weeks 9-16 (7 weeks)</td>
<td>Reading discussion (Wk 9)- Infrastructural Landscape&lt;br&gt;Programmatic Development (Wk 9-10)&lt;br&gt;Site Design (Wk 11-12)&lt;br&gt;Spatial and Material Details (Wk 13-14)&lt;br&gt;Project Refinement (Wk 15-16)</td>
</tr>
</tbody>
</table>
Although there are some differences between the two studios to accommodate skill level, the general premise and approach is the same. For simplification and a focused discussion, the undergraduate studio is used as the exemplar to describe the implementation of landscape lifecycles as a pedagogical approach to design studio. Work from both studios are used to illustrate the outcomes of the approach at both levels.

The studio objectives are to:

1. Expose students to literature and methods for brownfield remediation and reclamation;
2. Apply GIS as a tool for performing regional and site-based analysis; and
3. Challenge typical forms of brownfield reclamation through proposals that integrate social, economic, and ecological programs, exchanging waste materials across three scales: material, space, and system.

Phase 1 of the undergraduate studio is case study research of existing landscape architecture projects focused on brownfield reclamation and land management. Projects are analyzed at three scales: the materials assembly scale, the spatial experiential scale, and the systems scale relative to the project and its context. As an introduction to brownfields, deindustrialized landscapes, and remediation strategies surrounding their redevelopment, this exercise also enables students to develop a preliminary understanding and vocabulary around brownfield reclamation projects.

Phase 2 focuses on learning and applying GIS in the documentation, analysis, and speculation of biophysical and anthropogenic regional systems. After receiving a tutorial and completing a short exercise, students select a regional system to document and analyze across the same three scales, highlighting instances along the process in which material and spatial waste is being generated (Figure 2). The final part of Phase 2 is a group project in which students work in groups of 2 or more to develop quick speculative proposals that synthesize the uncovered wastes of their systems as an intervention for the studio’s site. In doing so, their proposals respond to a scenario the group creates in the context of the site (Figure 3). Students continued working at the same three scales. As a short exercise, this enables students to develop proposals quickly in response to their observations.

![Figure 2. Research outcomes from phases 2 (upper 2) and 3 (lower 2) (2015). Drawings by Marianne Barrett. Permission for reproduction and use provided via email](image-url)
Figure 3. Speculative group project synthesizing waste uncovered during phase 2 (2015). Drawings by Ivy Wong, Mark Hirschbeck, and Ilia Savin. Permission for reproduction and use provided via email
After developing speculative proposals for the site of inquiry in the studio, Phase 3 has students research different topics related to site analysis, from ecology and hydrology to history and transportation (Figure 2). As a collective, students become the expert in his or her topic, sharing information and knowledge they gain in their research. Analysis continues to take place across the same three scales.

The final phase of the studio, phase 4, takes place over the second half of the semester in which students incorporate the knowledge and skills they have acquired and apply them to a larger design project, designing across the same three scales. Working with brownfields and other sites with waste legacies, students are required to not only develop alternative landscape-based strategies to reclaiming these sites,
but they also must develop integrated economic, ecological, and cultural programming that exchange waste. Students are encouraged to explore their own interests within the framework of the studio, enabling them to develop their individual voice in design-research.

This approach has resulted in a wide variety of projects. In the graduate studio, this varies from catfish farming to a work, play, live neighborhood with business incubators to a honey and mead production facility to revive local bee populations (Figure 4). In the undergraduate studio, this ranges from a project that

combines mushroom cultivation, renewable energy production, and wetland creation to an ecologically-based nursery growing native species for climate change adaptation to biomass production, proposing to retrofit the existing coal power plant to run on biomass pellets (Figure 5). Although these topics are complex and require expertise, students undergo a design-research process to fill in these gaps by referencing case studies, in-class reading discussions covering the complexities of remediation, waste reuse, and speculative mapping, and citing relevant literature. Students are evaluated based on accuracy of information presented for both remediation strategies and programmatic requirements, the synthesis of economic, environmental, and social programs through waste reuse, accuracy and quality of graphic presentation, and the development of relationships between site and broader context through research and planning.

5.2 Seminar approach

Landscape lifecycles as a pedagogical approach to a research seminar explores the blurry, ambiguous, culturally constructed attitudes toward waste, its spatial and material implications, and its experiential possibilities. The outcomes of the course are in progress, as it is in its first semester of implementation. The course applies a scaffolded approach over three phases (Table 2), coupling history and theory with a semester long research project done in groups.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Time Period</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Theories + Constructs of Waste Materials + Landscapes</strong></td>
<td>Weeks 1-6 (6 weeks)</td>
<td>Waste Reflection (Wk 1)</td>
</tr>
<tr>
<td>Phase 2</td>
<td></td>
<td></td>
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<tr>
<td>Phase 3</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Waste Reflection (Wk 16)</td>
</tr>
</tbody>
</table>

This project is an expanded version of Phase 2 in the design studio, giving students more time and background content to explore their topics. The course is also currently being evaluated, assessed, and documented under a peer review of teaching program within the University. Final findings from this study will be published to the Digital Commons in summer 2018; however, this paper presents preliminary findings and outcomes of the course.

The course objectives are to:

1. Question and be critical of cultural attitudes toward waste and the impact this has had on design;
2. Use reflection papers to document students’ attitudes toward waste and how it might shift throughout the course; and
3. Speculate on the potentials of material and spatial waste generated by existing material-based systems that affect the built environment and support our city.
These objectives are achieved through weekly reading assignments and discussions, reflection papers, and the semester long research project. This body of work encompasses the outcomes of the course.

The semester’s three phases parallel the three parts of the group research project. Phase 1, *Theories + Constructs of Waste Materials + Landscapes*, investigates the ways in which waste is culturally constructed, how waste materials have come to be managed, and the types of landscapes that have resulted from the production of waste. These topics are investigated each week through assigned and supplemental readings and class discussions. Assigned readings are provided in the syllabus, while supplemental readings are chosen by individual students who find and select a reading to pair with one assigned reading and lead discussion for the week. Parallel to this is Part 1 of the design-research project, in which students investigate the history, spatial trajectory, and processes of a waste material.

The second phase, *Design + Reframing Waste as a Resource—Case Studies*, explores design practices and emerging conceptual frameworks for waste reuse. As with Phase 1, topics are investigated each week through readings and class discussions, including supplemental readings determined by discussion leaders. This phase also includes guest lectures and a field trip to supplement the reading material and discussions. Parallel to this is Part 2 of the design-research project, which entails a case study investigation and analysis of a project that innovatively reuses waste materials and/or landscapes. Students will be exposed to landscape performance as a method of analysis for landscape-based case studies to analyze their own case study.

In Phase 3/Part 3, *Symbiotic Waste Systems*, teams will pair up with one another and develop speculative scenarios and proposals for how their individual waste systems can hybridize, referencing lessons collected from their case studies. The purpose of this exercise is to develop symbiotic exchanges and relationships with one another, grounded in landscape performance criteria of economic, environmental, and social benefits. Proposals will be highly speculative and innovative, challenging and questioning conventional approaches to reusing and reclaiming waste. Although each part of the project has specific requirements for drawing contents and topics, the graphic style, topic selection, and exploration is determined by the student groups.

### 6 FINDINGS

#### 6.1 Cultivating new attitudes towards waste

Within the given framework of the two course types, students gain knowledge in understanding waste’s legacy, its effect on design, and are given the opportunity to speculate on the potential for these circumstances to change. Each student produces a unique project that explores their individual interests and meets the requirements set forth in the course, resulting in an endless variety of project outcomes from applying landscape lifecycles as a pedagogical framework.

Through the research assignment in Phases 2 and 3 of the studio, students are exposed to research topics they had not encountered prior to the studio. For some, the topics they researched heavily influenced their design projects. For example, the Hidden Habitat Nursery project was inspired by earlier work the student completed in the course (as illustrated in Figures 2 and 5). Research was focused on impacts to ecological systems and native flora and fauna from climate change. By documenting the potential northern migration of native species, the student used the information to develop microclimates within the proposal.

Feedback from both students and peers of the studio work has largely been positive. Although some students find the studio to be challenging, many have commented that they enjoy being exposed to a new project type and learning a new process. Peers have commented on the wide range of projects and diversity of work that students produce within the studio framework. Others have commented that the students are achieving the course objectives at a high level because of their ability to build arguments for their proposals by situating their work within a larger context. This has resulted in interesting conversations around balancing the line between too many and not enough constraints. In reflection, the diversity and level of work that has been produced is likely due to the constraints of the studio’s framework coupled with allowing students to pursue topics of personal interest. In most cases, these topics are derived from studio discourse related to readings and discussions that expose students to larger topics that can influence landscape architecture. The integration of waste reuse topics within a landscape architecture design studio also lends itself to exploring the aesthetic, spatial, and formal implications of waste, although some students achieved this more than others did.
As mentioned earlier, the seminar course is ongoing and currently being assessed and documented in the University’s peer review of teaching program. One form of documentation in the course is a student reflection written at the start of the first class, the end of Phase 1, the end of Phase 2, and at the end of the course (Table 2). These reflections have been implemented as a tool to track student learning and collect students’ feedback on course content throughout the course. Although the course is in progress, initial findings based on course discussions and student reflections so far are enlightening.

For the first reflection, students were asked to answer the following questions: How do you define waste? What is your perception of waste? What do you think we should do with waste? What do you hope to get out of the class? Although there were a wide range of responses, students generally defined waste as the leftovers from a process, mostly referring to material byproducts such as “trash,” “garbage,” and “wastewater”. In terms of the outcomes for the course, many students referred to the desire to expand their knowledge on the topic and learn effective strategies of waste management to inform their design work.

The subsequent reflections respond to one repeated question: What is your perception of waste? with new posed questions: What are waste’s opportunities for design? How have your perceptions of waste changed? Students recently completed their reflection papers at the end of Phase 1, and the results vary greatly when compared with previous responses. In order to capture these results, I applied qualitative content analysis using content coding in order to identify words and themes that emerged from the progression of the students’ reflections throughout the course. One reoccurring theme that emerged is that “waste” is a much larger topic than they originally thought, but each student described a different aspect of waste that has caused them to change their perception:

“Waste is not always negative and can be a resource by turning it into fuel and power…Also [better understand] the issue of where waste goes and the lengths major cities go to, to push the waste out of sight. Waste is an industry…”

“…the issue of waste is far more pervasive than I originally thought. It has touched everything from the organization of our homes, neighborhoods, cities, and urban systems as a whole. It is cultural and economic…My perception of waste has been further expanded past the narrowness of thinking it was just the trash in my kitchen.”

“…I am beginning to see waste as a social and cultural definition rather than viewing what is considered waste as inherently useless.”

“Waste, especially in the form of land, such as brownfields…has enormous opportunity in design…I originally related waste to disgust, as we read earlier. I thought it was a problem that had to be solved, rather than an opportunity to take advantage of.”

“I didn’t know space could be a waste product…I didn’t realize that our perception of waste affects those who work with waste.”

Additionally, I frequently moderated class discussions around the topic, during which one student described their experience in the course thus far as “learning a state of mind about waste rather than a specific solution for it.” The reflections are achieving their intended objective—to document students’ changing perception and thoughts of waste throughout the course—with the prospects that these will continue to be documented in the reflections. In both the studio and seminar format, learning outcomes for students demonstrate an expanded knowledge base and design approach in the context of waste materials and landscapes, a topic they will inevitably encounter in practice.

6.2 Opportunities for further development

Pursuing the integration of landscape lifecycles as a design pedagogy has opportunities for further development and documentation that present exciting challenges. Although it is currently difficult to discuss opportunities for further development in the seminar course, there are successful aspects that can be integrated into the studio. For example, the use of reflection writing to document students’ shifting perceptions of waste throughout the studio can help document how this may vary between the courses.

Additionally, in the studios, there has generally been a focus and emphasis on exploring the performative aspects of waste, strengthening the relationships between multiple programs sharing the same space to create hybrid programs by exchanging waste. Although this emphasis can continue, other design
aspects present opportunities for further development. For example, one discussion week in the seminar course revolved around the aesthetics of waste and the role this plays in design. This discussion can help influence the studio by asking students to explore the perceptual aspects of waste in the context of the site and their own biases. For example, Smith, Erdman, & Billing (2017) explore the integration of perceptualist theory in their design studios, and combine analog and digital methods of representation throughout the design process. Introducing this approach into the studio pedagogy may help strengthen the perceptual and experiential aspects of waste, site, and students’ own proposals. Additionally, this may also help influence the formal and site design components of the projects, which can also be further developed. To strengthen the performative aspects of the studio, landscape performance can be integrated into the pedagogical structure in the case study phase, the site analysis phase, and in the final site design phase to document the performative qualities and quantitative benefits of designing with waste.

Waste conditions require more nuanced approaches in all disciplines. Although brownfield sites are one of the most common waste landscape types, these courses aim to develop a methodology, framework, and critical approach to tackling any type of waste landscape by creating a space for questioning and adjusting preconceived notions of waste from harmful and not useful, to opportunistic. This framework seeks to establish waste as the antidote to waste through visibility and registration. The challenge in these courses and in applying landscape lifecycles as a design pedagogy is striking a balance between the aesthetic, experiential, and formal qualities with the performative, systems-based capacity of waste, which have the potential to work in unison. Although ambitious, integrating perceptual analysis with site analysis, and hybridizing function with aesthetics, can ultimately lead to proposals that further explore the multi-dimensional design opportunities of waste.

7 CONCLUSION

Landscape architecture has been constrained by the cultural construction of waste as undesirable. Design studios and seminar courses cultivate critical discussions and creative approaches of tackling waste materials and landscapes, such as brownfields, demonstrating there is no single solution for any particular type of waste site or condition. Integrating this discourse in landscape architecture curricula is imperative in order to train the next generation of landscape architects to challenge conventional models of brownfield reclamation and actively confront the most pervasive landscape conditions they will face as practitioners.

Reframing waste as desirable through landscape lifecycles reveals there are infinite possibilities to reactivate waste sites and materials. This approach advocates for the generation of new, hybrid landscapes that interweave ecology, economy, and culture within the same landscape while engaging with a site’s broader community. These programs benefit one another through the exchange of waste materials, spatializing industrial ecology and integrating traditional and radical landscape architectural methods. In this approach, the end-of-life of materials and landscapes does not exist—these perceived wastes contain latent power to produce value, transforming their legacies by continuing their lifecycles.

8 REFERENCES


CELA MEDIA STATEMENT

Title of Paper or Research:
DESIRING WASTE: A PEDAGOGY OF LIFECYCLE APPROACHES TO WASTE AND BROWNFIELD TRANSFORMATION

Author:
Catherine De Almeida

Institution or Professional Affiliation:
University of Nebraska—Lincoln, cdealmeida2@unl.edu

Media Statement:
Landscape architecture is uniquely positioned to reimagine waste landscapes: the most prevalent and complex landscape condition faced by this profession. Integrating brownfield transformation into design curricula is imperative. The next generation of landscape architects must be equipped to engage with complex, contaminated landscapes. Rather than apply conventional approaches to reclamation that typically result in passive parks, this paper argues for an alternative approach—landscape lifecycles—reconceptualizing waste as a resource for site and material transformation. The principle result is a design framework for waste and brownfields—exposing students to a state-of-mind about exploring waste’s opportunities rather than providing ready-made solutions.
ASSESSING STUDENT LEARNING OF LANDSCAPE PERFORMANCE

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1 ABSTRACT
Utilizing landscape performance as a framework to assess design sustainability continues to be a stronghold in the field. Teaching landscape performance principles is now a requirement for degree programs accredited by the Landscape Architectural Accreditation Board (LAAB, 2016), but there is a gap in the literature on assessment of student learning successes and challenges. The purpose of this study was to develop a pre- and post-survey tool to investigate interest, competency, and applicability of landscape performance in the landscape architecture curriculum. The survey was distributed to 35 students in a site design or technical course that included landscape performance learning objectives at the beginning of the fall 2017 academic term, prior to any instruction in landscape performance and at conclusion of the term. Quantitative and qualitative response coding and analysis was conducted over a month and a half following course completion. Students exhibited improvement in multiple dimensions of understanding landscape performance between the pre- and post-course, and students highly valued the landscape performance approach for making evidence-based design decisions. Students also gained in-depth awareness of the importance of organizational resource support and data quality to ensure success of the approach. Remaining challenges that emerged in student reflections include understanding the relationship of landscape performance with site analysis, as well as quantification methods and design creativity. This initial exploration of landscape performance pedagogy provides critical insights for effectively meeting LAAB requirements as well as informing further research needs for student preparedness and landscape performance teaching materials.

1.1 Keywords
Landscape Performance, Student Assessment, Curriculum, Landscape Architecture Pedagogy

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2 INTRODUCTION

Landscape performance research and practice is a growing necessity for educating clients and stakeholders of the benefits of thoughtful sustainable design. Rating systems such as LEED and SITES have accelerated the need for practical understanding of measuring and communicating economic, social and environmental benefits and tradeoffs. The Landscape Architecture Foundation (LAF) has been key in collecting and dispersing information and resources to direct the profession of landscape architecture toward tools of evidence-based design to empower designers to view the landscape more holistically (ASLA, 2015). Similar to building performance, landscape performance is quickly becoming an expectation among design teams and clients. Twenty-first century landscape architecture is changing, and education programs must keep up.

The 2004 Landscape Architecture Body of Knowledge Study Report (LABOK) assessed the knowledge, time of acquisition, and command expected for various subjects of landscape architecture (ASLA, 2004). This report has directed many landscape architecture programs to better prepare students for successful entrance into the profession. Since the publishing of the LABOK study, Landscape Performance has become a critical skill, knowledge and practice for the profession. The LAF defines landscape performance as “a measure of the effectiveness with which landscape solutions fulfill their intended purpose and contribute to sustainability.” (LAF, 2017b). Recent scholarship has supported the growth and integration of landscape performance into the profession and academia. Literature has focused on the use of landscape performance as a type of post construction/occupancy evaluation for establishing the benefits of the built landscape (see for example, Myers, Carney, & Whitlow, 2015; Ozdil, 2016; Wang et al., 2016; or, Yang, Li, & Binder, 2015, for calculation of ecological, social and economic benefits associated with landscape performance in built projects). Integration into the professional curriculum was completed with the inclusion of landscape performance as a core knowledge, skill and application area in the Landscape Architectural Accreditation Board (LAAB) 2016 Accreditation Standards (LAAB, 2016). Accordingly, the LAF has invested $50,000 over the past four years to support integration of landscape performance into landscape architecture curricula and to openly distribute resources for the benefit of landscape architecture educators (LAF, 2017a).

While programs work to meet the updated accreditation standards for the inclusion of landscape performance into curricula, academia and the profession must also seek to determine how these additional concepts impact student learning. While resources for assessing landscape performance of planned or designed projects already exist, such as Sustainable SITES or LAF Landscape Performance Series, there is a gap in literature and methodologies for evaluating student learning of landscape performance. As part of a continuous process in a student’s education, assessment has been shown to support learning and increase the motivation for learning (Hernandez, 2012). Through assessment of student learning, programs can develop successful curriculum and teaching methods for the professional curriculum of landscape architecture (Brown, 1994).

An initial exploration of the student learning and pedagogical experience is needed to identify the benefits and challenges in this emerging area of landscape architecture curricula. How effective is the new landscape performance curricula at equipping students? Are students gaining the necessary knowledge and skills to critically apply landscape performance processes? To better understand how students are understanding and comprehending landscape performance, student learning should be evaluated for different dimensions of knowledge and cognitive processes (Anderson et al., 2001). An in-depth understanding of landscape performance would include factual, conceptual, procedural, and metacognitive dimensions of knowledge (Anderson et al., 2001). Factual knowledge includes knowing terminology and basic elements of the topic; conceptual knowledge includes principles and classifications; procedural knowledge involves subject-specific techniques and methods; and, metacognitive knowledge is awareness of one’s own cognition and knowledge level (Anderson et al., 2001).

In this study, we evaluate different dimensions of landscape performance knowledge acquired by students over an academic term and explore the learning and teaching experience. A wide range of techniques are available to assess student learning (Suskie, 2009). This study utilizes techniques that provide both direct and indirect evidence of student learning and provides input for future teaching efforts and improved student learning. Direct assessment techniques examine evidence of learning through observable methods such as exams or projects, while indirect assessment gathers evidence through measures, such as self-reported data in surveys or interviews, that determine the perceived value, feelings, or extent of student learning (Suskie, 2009). The use of a pre-instruction and post-instruction survey tool allowed for the examination of the following research questions: “How is teaching landscape
performance effective in developing student knowledge;” and, “How do students reflect on their experience learning landscape performance?” The study contributes to the literature on landscape performance in two key areas. First, the findings contribute to the dialog of assessment of student learning in landscape performance and point to the need for continued studies, not only to drive student success but also continued professional development in teaching. Second, the findings support the need for further research in and development of teaching materials specific to landscape performance to prepare students for 21st century practice.

3 METHODS
This study uses a survey instrument for data collection to explore the research questions. The study’s sample was drawn from one graduate course and two undergraduate courses taught in landscape architecture programs during the 2017 fall term. A total of 35 students (21 female, 14 male) participated in the survey from three universities. Eight graduate student respondents were from a technical course at the University of Arizona that covered landscape performance through the lens of site engineering topics. Nineteen undergraduate respondents were from an upper division studio course at Cal Poly San Luis Obispo that incorporated landscape performance with technical and theoretical approaches to site design. Eight undergraduate respondents were from an upper division, service-learning studio at Montana State University, focused on landscape performance in green infrastructure site design. The three courses varied in format and scope, but shared learning objectives directly related to building knowledge and application of landscape performance principles. These shared learning outcomes included student’s ability to: define landscape performance and explain its importance to the landscape architecture profession; identify the types and concepts of benefits related to landscape performance; and utilize key resources and techniques for calculating performance benefits. The study utilized two surveys, pre-instruction and post-instruction, to better understand changes in student learning and attitudes of landscape performance. The first survey was distributed at the beginning of each course, prior to any instruction in landscape performance. The second survey was distributed at the conclusion of each course. Quantitative and qualitative response analysis was conducted upon course completion. Responses for both surveys were collected anonymously and voluntarily.

3.1 Survey Structure
The survey instrument, which combined direct and indirect measures of student learning, was designed to gauge student familiarity, knowledge and interest in landscape performance as an educational topic. Questions included two multiple choice questions to assess student familiarity with and self-assessed value of landscape performance, four open-ended questions to assess student level and dimensions of knowledge of landscape performance techniques, and two questions (one Likert-scale, one open-ended) to assess student reflection (Table 1). Because there is little existing research on teaching or learning landscape performance, inductive exploration through the open-ended questions was considered appropriate to investigate the research questions. The same instrument was used for both the pre- and post-survey.

Table 1. Survey questions.

<table>
<thead>
<tr>
<th>Familiarity and Value of Landscape Performance</th>
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<tbody>
<tr>
<td>1. How familiar are you with landscape performance?</td>
</tr>
<tr>
<td>o have never heard of it</td>
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<tr>
<td>o have heard of it but don’t remember any specifics</td>
</tr>
<tr>
<td>o have some idea of it but not too clearly</td>
</tr>
<tr>
<td>o I know what it is, and could explain what the basics</td>
</tr>
<tr>
<td>o I know what it is and how to utilize it, and could utilize it within the studio project</td>
</tr>
<tr>
<td>2. The importance of landscape performance to the profession of landscape architecture is:</td>
</tr>
<tr>
<td>o a very important and critical skill</td>
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<tr>
<td>o very Important</td>
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<tr>
<td>o important</td>
</tr>
<tr>
<td>o somewhat Important but no more so than other concerns</td>
</tr>
<tr>
<td>o not important</td>
</tr>
<tr>
<td>o I don’t have enough information</td>
</tr>
</tbody>
</table>
Level of Knowledge of Landscape Performance

3. Imagine you are writing a press release. Define landscape performance in two sentences.

4. What types of impacts may be calculated or measured for a site design? Describe all types you may be aware of.

5. What data would need to be collected in order to measure those impacts? Describe for all impacts discussed in previous question.

6. Describe any potential limitations that should be considered when using landscape performance to evaluate a site design.

Reflection and Self-Assessment of Understanding Landscape Performance

7. Rate how well you understand the process for determining a site design’s performance related to:

<table>
<thead>
<tr>
<th></th>
<th>1 Not at all</th>
<th>2 A Little Bit</th>
<th>3 Somewhat Well</th>
<th>4 Well</th>
<th>5 Very Well</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant species diversity</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
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<tr>
<td>Human physical activity</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
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<tr>
<td>Stormwater rates or volumes</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
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<tr>
<td>Tree benefits</td>
<td>o</td>
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<tr>
<td>Percent impervious cover</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Irrigation Volumes</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
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<tr>
<td>Human restorative experiences</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td>Operating energy</td>
<td>o</td>
<td>o</td>
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</table>

8. My impressions of landscape performance are:

3.2 Analysis

All data was reviewed anonymously without school identification and compiled into a Microsoft Excel spreadsheet for analysis. Analysis took place over one and a half months. For survey questions 1, 2 and 7 descriptive statistics were calculated and compared between pre- and post-survey data to determine change in student familiarity and value of landscape performance. Qualitative content analysis involved a grounded theory approach of iteratively moving between understanding the student responses and emerging insights on learning landscape performance (Glaser & Strauss, 1967). For questions 3 through 6 and 8, pre- and post-survey responses were randomized before content analysis was performed by three researchers. Responses for questions 4 and 5 were combined before randomizing to clarify response intent. In order to analyze level of knowledge, each researcher initially defined answers for questions 3 through 5 that represented high level, medium level, and low level of understanding or knowledge of landscape performance. Then, student responses were compared to the representative answers and assigned ratings on a 5-point scale. Ratings were averaged and categorized into three levels of understanding – high, medium and low. For questions 6 and 8 each student response was coded by three researchers for recurrent and meaningful themes related to the research questions, followed by re-coding to explore thematic patterns and categories (Boyatzis, 1998). Researchers resolved any coding discrepancies through open discussion and responses could be coded with multiple themes. Descriptive statistics were compared for themes between pre- and post-survey data.

4 RESULTS

General familiarity of landscape performance evaluated students’ change in factual knowledge (Table 2). In the pre-survey for question 1, 40% of students had never heard of landscape performance or don’t remember specifics and a mere 3% knew how to utilize it. However, 57% of students, had some idea or knew of it but not very clearly or with specifics. In the post-survey, 69% of students knew what it was and how to utilize it in a project, demonstrating a considerable improvement in multiple dimensions of knowledge. In question 2, nearly 75% of students thought that landscape performance was very important or critical to the profession even at the pre-survey. Even still, data in the post-survey showed an increase to 73% of students who thought it was a critical skill (the highest rating). Also, all students who did not
have enough information to answer the question in the pre-survey (20%) chose an alternative response in the post-survey.

Table 2. Familiarity and value of landscape performance

<table>
<thead>
<tr>
<th>Question</th>
<th>Pre-survey</th>
<th>Post-survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Landscape familiarity</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Have never heard of it</td>
<td>20.0</td>
<td>0</td>
</tr>
<tr>
<td>Have heard of it but don’t remember any specifics</td>
<td>20.0</td>
<td>0</td>
</tr>
<tr>
<td>Have some idea of it but not too clearly</td>
<td>34.3</td>
<td>2.9</td>
</tr>
<tr>
<td>I know what it is, and could explain the basics</td>
<td>22.9</td>
<td>22.9</td>
</tr>
<tr>
<td>I know what it is and how to utilize it within a studio project</td>
<td>2.9</td>
<td>68.6</td>
</tr>
<tr>
<td>2. Landscape performance importance for profession</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I don't have enough information</td>
<td>20.0</td>
<td>0</td>
</tr>
<tr>
<td>Not Important</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Somewhat important but no more so than other concerns</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Important</td>
<td>5.7</td>
<td>9.1</td>
</tr>
<tr>
<td>Very important</td>
<td>45.7</td>
<td>18.2</td>
</tr>
<tr>
<td>A very important and critical skill</td>
<td>28.6</td>
<td>72.7</td>
</tr>
</tbody>
</table>

In question 3, the greatest change from pre- to post-survey was in the percentage responses that demonstrated a high level of understanding, which went from 6.3% to 43.8% (Table 3). A high level of understanding was based on LAF’s definition of landscape performance, which states landscape performance is “a measure of the effectiveness with which landscape solutions fulfill their intended purpose and contribute to sustainability (LAF, 2017b).” Two high understanding, representative student responses were, “Landscape performance is a measure of how well a landscape functions. It deals with site aspects related to social, economic and environmental benefits as well consideration of sustainability,” (3rd year, undergraduate post-survey) and “Landscape performance is the process of calculating quantifiable benefits of a design in context to performance goals and sustainability. The quantified data, provides credibility and reason to support the implementation of a design” (3rd year, undergraduate post-survey). Half (53.1%) of the students exhibited responses representative of low understanding at the pre-survey. A response rated as a low level of understanding did not mention the need for measurement or sustainability benefits, such as, “Landscape performance is how the landscape is used or utilized. This can be from people or how nature can take on the landscape” (4th year, undergraduate pre-survey).

Table 3. Level of Knowledge of Landscape Performance.

<table>
<thead>
<tr>
<th>Question</th>
<th>Pre-survey</th>
<th>Post-survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Landscape performance definition</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Low understanding (avg. rating 1-2.33)</td>
<td>53.1</td>
<td>28.1</td>
</tr>
<tr>
<td>Medium understanding (avg. rating 2.34-3.33)</td>
<td>40.6</td>
<td>28.1</td>
</tr>
<tr>
<td>High understanding (avg. rating 3.34-5)</td>
<td>6.3</td>
<td>43.8</td>
</tr>
<tr>
<td>4. Types of impacts, and 5. Data needs to measure impacts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low understanding</td>
<td>55.9</td>
<td>21.9</td>
</tr>
<tr>
<td>Medium understanding</td>
<td>32.4</td>
<td>53.1</td>
</tr>
<tr>
<td>High understanding</td>
<td>11.8</td>
<td>25.0</td>
</tr>
<tr>
<td>6. Potential limitations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Code: Theme: node data: quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Freq.</td>
<td>Freq.</td>
</tr>
<tr>
<td>Data accuracy reliability, or availability; human error; technical challenges</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Data: benefit measurability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>aspects of landscape architecture where measurement may not be feasible or attainable; underrepresented benefits</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Data: temporal factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>timing-related measurement concerns; unforeseen changing site conditions</td>
<td>8</td>
<td>2</td>
</tr>
</tbody>
</table>
Within questions 4 and 5, just over half (55.9%) of student responses were at a low level of understanding in the pre-survey. In the post-survey, while the high level of understanding responses increased, the majority of responses (53.1%) were only at the medium level of understanding (Table 3). Responses that listed elements of a traditional site inventory were evaluated as characteristic of a low level of understanding. For example, one student responded for types of impacts calculated or measured and data required, “Sun, weather, wind, human traffic, cars, different age and ethnicity groups. Amount of sun a place receives can be measured by observation or online data source (same goes for weather and wind) - look at past records of weather and wind, through observation, one can determine if the area is busy or not and determine peak time for traffic, demographics of an area can be determined through survey” (4th year, undergraduate pre-survey). To receive a high level of understanding rating, responses described specific impacts related to landscape performance metrics and indicate the need for pre-(baseline) and post-data. An exemplar student response was, “Runoff, Energy Use/Embodied, Biodiversity, Habit Quality, Drought Tolerance, Screening of undesirable view sheds, Increase in value of the property. Pre & Post Development Runoff, Total Embodied energy of all materials, # of Species, # of Native habitat species, Water use of Plant Material, % Screening of Parking lots & such, Appraisal before and after” (4th year, undergraduate pre-survey).

Question 6 responses revealed two coded themes: data and project process. The data theme includes four nodes that impact data collection or use in different ways. The process theme includes three nodes that relate to creativity, project goals or programming, and project management (Table 3). Most responses in both pre- (66.7%) and post-surveys (57.9%) represented the data theme. While the frequency of ‘data quality’ and ‘place constraints’ nodes remained steady between pre- and post-surveys, there was an increase in number of responses in the ‘benefit measurability’ node and a decrease in the ‘temporal aspects’ node. Notably, the frequency of responses in the process theme more than doubled between the pre- (20.5%) and post-survey (42.1%). Finally, five responses had no answer or unknown data in the pre-survey, which dropped to zero in the post-survey.

Table 4. Reflection and Self-Assessment of Understanding Landscape Performance.

<table>
<thead>
<tr>
<th>Question</th>
<th>Pre-survey</th>
<th>Post-survey</th>
<th>Weighted Avg. (5-pt scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. <strong>Understanding of process for determining performance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant species diversity</td>
<td>2.97</td>
<td>3.94</td>
<td></td>
</tr>
<tr>
<td>Human physical activity</td>
<td>3.32</td>
<td>4.03</td>
<td></td>
</tr>
<tr>
<td>Stormwater rates or volumes</td>
<td>2.59</td>
<td>4.00</td>
<td></td>
</tr>
<tr>
<td>Tree benefits</td>
<td>3.03</td>
<td>4.09</td>
<td></td>
</tr>
<tr>
<td>Percent Impervious Cover</td>
<td>2.44</td>
<td>4.38</td>
<td></td>
</tr>
<tr>
<td>Irrigation volumes</td>
<td>2.09</td>
<td>2.78</td>
<td></td>
</tr>
<tr>
<td>Human restorative experiences</td>
<td>2.29</td>
<td>3.26</td>
<td></td>
</tr>
<tr>
<td>Operating energy (n=15)</td>
<td>2.07</td>
<td>3.00</td>
<td></td>
</tr>
</tbody>
</table>
8. **Landscape performance impressions**

<table>
<thead>
<tr>
<th>Coded Themes</th>
<th>Description</th>
<th>Freq.</th>
<th>Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Importance: design process</td>
<td>Useful for designer’s work; useful tool to utilize in design process</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Importance: profession</td>
<td>Increases awareness and purpose of LA practice; improves communication of design impact; future of the field</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Importance: evidence</td>
<td>Justifies design decisions and project; generates public or client support; makes impacts tangible to non-experts</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Importance: project sustainability</td>
<td>Improves project sustainability or multifunctionality; improves final outcome or project effectiveness</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>Learning experience</td>
<td>Recognizes value and desire to learn more; overwhelmed; too complex; time constraints on learning extent</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>na</td>
<td>Unknown; no response; too unclear to assign code</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

Student self-assessed level of understanding increased for every topic in question 7 between the pre- and post-surveys (Table 4). At the start of the courses, students felt they had the highest understanding for determining a site’s performance related to ‘human physical activity.’ The stormwater rates or volumes’ and ‘percent impervious cover’ topics had the greatest positive change while ‘human physical activity’ and ‘irrigation volumes’ had the least. At the end of the courses, students felt they only understood the process for determining ‘irrigation volumes’ a little bit to somewhat well.

Impressions of landscape performance in question 8 revealed that both in the pre- and post-survey, students’ reflections were overwhelmingly positive and consistently noted its value for high-quality design processes, products, and the profession. There were only two student responses in the post-survey that represented negative or challenging factors of learning landscape performance. Coded themes primarily represented different aspects of importance, with a small frequency of responses related to the learning experience (Table 4). The ‘design process’ and ‘profession’ nodes had the highest change in frequency from the pre- to post-survey. Finally, when evaluating all responses regardless of code, descriptive phrases were considerably more effusive in the post-survey, such as: “extremely important,” “needs to be widely used,” “necessary and essential,” “critical aspect,” “crucial,” and “it really matters.” Whereas in the pre-survey, descriptive phrases included: “useful tool,” “very important,” and “important concept.”

5 **DISCUSSION**

5.1 **Student Learning**

Data from pre- and post-surveys made evident that a variety of course types and activities can be successful as tools to teach landscape performance and improve student knowledge. Students improved in their understanding of landscape performance on multiple dimensions, even where existing knowledge of a topic was apparent prior to the course. Students’ factual knowledge increase was seen in their definitions of landscape performance and perceived value of the method within the profession. Students’ conceptual knowledge improved in terms of comprehending the types of landscape benefits and general characteristics of measurement. Students exhibited increased understanding of the implications of utilizing landscape performance methods on project management and resources, like time, money, expertise, and technology. They also noted potential impacts on client relationships and that the process could be a waste of resources if clients or partners were not on board. Students also clearly recognized the implications of data quality for a process that fundamentally relies on good data to work effectively. These patterns demonstrate procedural knowledge change, which are essential skills when working in practice and on interdisciplinary teams.
The extent and depth of student understanding of landscape performance also increased over the academic term. For example, while students recognized potential limitations when using landscape performance in the pre-survey, their responses more often related to site inventory methods and site condition constraints. After having utilized landscape performance principles in coursework, responses represented a more nuanced understanding of potential methodological issues. First, a pattern that emerged was students recognized the potential challenges when landscape benefits cannot be quantified effectively. Such as illustrated in this post-survey response, “a possible limitation would be focusing too much on the function of a site and not enough on the aesthetics of it. How the landscape functions is crucial but if a design isn't aesthetically pleasing people won't want to use it” (1st year, graduate post-survey). Second, students recognized the landscape performance method may inhibit aesthetic or cultural goals. One student wrote, “You could forget about people’s needs and concerns, if you are in a mindset to create landscape performance, it may overshadow what people may want” (4th year undergraduate post-survey). These patterns make evident student’s ability to critically analyze when they might question validity or application of a landscape performance approach.

Student’s increased knowledge and positive impressions clearly support the continued training in and application of landscape performance in landscape architecture curriculum. Students noted, “After this class, I feel I have a new purpose for design. Now that I can calculate landscape performance to some degree, my designs will actually prove that it works,” (3rd year undergraduate post-survey) and, “I want to use it in every design I create from here on out” (3rd year undergraduate post-survey). Students also articulated its importance for project sustainability and professional practice. Another student wrote, “I think it’s a critical aspect of landscape design. It can enhance ‘life expectancy’ of designs. It guarantees/shows others not in the profession why we do what we do = communication is key” (3rd year undergraduate pre-survey).

5.2 Student Learning Challenges

While student learning relating to landscape performance clearly reached factual, conceptual, and procedural knowledge levels, the survey results also allude to learning challenges relating to interest, competency, and applicability of the material presented. Interest in the topic of landscape performance proved to be high among the surveyed students, yet questions about the balance of creative freedom and getting “caught up in calculations” emerged as a real concern. Similar to challenges found in landscape implementation courses, there is potential that heavily numbers-driven material may disengage certain student-learner types that may be less technically inclined. Appropriately reinforcing the opportunities of landscape performance in the design process is critical for continued learning success among the broadest population of students (see Future Directions).

The level of competency considering the complexity and depth of information, may also challenge learning in the limited time of an academic term. Post-survey comments describe the “often overwhelming number of functions a landscape has to perform” and that “it’s a lot to comprehend in one semester.” Many methods also rely on long-term observational sessions and complex data collection that reaches well beyond the scope of a single course. Students perceived the difficulty of securing information resources, and commented on the feasibility and accuracy as potential limitations to landscape performance. This may be indicative of the modest increase in understanding the process for determining a site design’s performance related to ‘human restorative experiences.’ However, as one student put it, they became “optimistic and eager to learn more,” and appreciated “learning the vocabulary and the tools,” perhaps despite not having the opportunity for the full time-period needed for observation and data collection. This may also lead to opportunities of learning what to do in the complicated cases of practice, where client goals, budget, and data availability do not necessarily align with designer aspirations for landscape performance.

The difficulty in the delivery and assimilation of all of the applicable topics relating to landscape performance in a single academic term also presents itself as a learning challenge. In regards to covering the depth of landscape performance, it was observed that responses from question 5 lacked in-depth and specific responses to what data would need to be collected in order to measure impacts, which may indicate a need for a deeper view in collecting data and recognizing the reliability of information for specific subject areas. Concerning breadth of landscape performance, based on student self-assessment, understanding of irrigation volumes remained the primary category surveyed that showed only slight improvements in understanding between the pre- and post-surveys. The importance of water resource management is clear in landscape performance work and the SITES rating system, and of particular
importance to the regions in which the surveyed students are studying. Material relating to this area of landscape performance may not have been covered as fully as other topics, and suggests the potential need for prioritization of material covered, along with an appropriate balance of breadth and depth, and follow up in subsequent courses.

5.3 Limitations

The authors noted several limitations to the survey instrument and study. Variations in course content and instruction mechanisms (readings, presentations, assignments) among the authors may be responsible for variations in responses and impressions among students. While the authors relied on LAF educational resources for instruction, however, they may not have delivered the same understanding for key terms, calculation techniques and uses. As a result, some discrepancies were noted among the responses upon the first reading of open-ended questions. Response variation was normed during the reading and qualitative analysis. It should also be noted that landscape performance was utilized within existing courses. While all courses were studio and project based, the focus of the course was directed toward design, site engineering and service-learning at each of the universities respectively. The authors also note that the survey tool was not designed to quantifiably measure levels of student knowledge. Instead, survey methods pull from direct and indirect assessment techniques with a longer term goal of helping guide future teaching strategies, instruction techniques and student learning.

5.4 Future Directions for Teaching and Assessment of Learning

Teaching landscape performance offers tremendous potential for faculty to incorporate new content into existing courses, to develop new courses, to consider new teaching methods, and to help further student understanding of the potential and value of the designed landscape. LAF’s ‘Resources for Educators’ (https://landscapeperformance.org/resources-for-educators) provides teaching materials for past courses funded through LAF’s Landscape Performance Education Grant program and these materials provide a good starting point for educators. Survey results and author’s reflection revealed several opportunities and future directions for teaching landscape performance including:

- A good assessment stems from and revolves around ‘clear and important student learning goals.’ (Suskie, 2009). Faculty teaching landscape performance may benefit from developing shared learning outcomes for future instruction and assessment in order to develop long term, reliable results of student learning.
- Development of assignments and templates that would allow students to collect and analyze data, calculate performance benefits and compare results. These tools would allow for increased understanding of methods associated with data collection and benefit calculation. Applicable assignments and templates would also address challenges associated with the quick pace of the academic term.
- Further clarification and direction on the differences between landscape performance and site analysis. Pre-survey results noted student understanding of landscape performance to be similar to site analysis in purpose, data collection and value. While results showed increased student learning, some post-survey responses still referenced site analysis terms, data types and uses.
- Continued exploration of landscape performance within the context of the design process. As noted in LAF’s Case Study Briefs, landscape performance methods currently support post-occupancy evaluation of constructed projects (LAF, 2017c). Understanding how landscape performance can be taught in the context of project design and development will assist faculty in selecting appropriate courses for the inclusion of the subject. Additional research on how professional offices utilize landscape performance during project development is needed to address this direction.
- Additional efforts in assessing the learning of landscape performance are required. As an added knowledge, skill and application requirement to professional accreditation, program reviews will observe and evaluate if programs have included landscape performance in the curricular offerings. Continued assessment of learning may help facilitate individual student learning, assist programs better prepare for program review, and may offer faculty professional development and scholarship opportunities.
6 CONCLUSION
This study makes clear student interest in and enthusiasm for landscape performance concepts. In addition, the study demonstrates the value of utilizing pre- and post-surveys as a model to systematically assess student learning, teaching impacts, and potential needs for curricular changes, beyond traditional course evaluations. The findings identified specific areas where students struggled with learning landscape performance, which are critical to understand in order to make teaching approaches stronger. Author reflections, informed by student responses, urge for the generation of in-depth teaching materials or site cases to improve student learning and coursework rigor. Instruction can benefit through strategies such as emphasizing distinctions between landscape performance and site analysis, as well as emphasizing integration in the design process to enhance creativity rather than inhibit. The authors acknowledge the tremendous effort put forth by LAF to support the integration of landscape performance into the profession and academia. As continued research looks at best practices for measuring landscape performance benefits as well as case studies that validate landscape performance impacts in practice, future research should simultaneously consider best practices for the teaching and learning landscape performance.

7 REFERENCES
RESEARCH METHODS WITHIN THE MLA: IMPLICATIONS FOR SCHOLARLY INQUIRY IN LANDSCAPE ARCHITECTURE

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1 ABSTRACT
This pilot study analyzes research methods courses offered within North American MLA programs and their potential implications on scholarly inquiry within landscape architecture. Despite more emerging landscape architecture faculty holding doctoral degrees than in previous generations and emergence of some landscape architecture doctoral programs, the MLA is still widely regarded as the discipline’s terminal degree. In published landscape architecture academic position announcements—which typically list doctoral degrees as not required, but preferred credentials—the MLA is assumed to be sufficient training for meeting the research/creative scholarship outputs demanded by many university tenure and promotion processes. This study analyzes research methods courses offered within North American MLA programs and their potential implications on scholarly inquiry within landscape architecture. Direct content analysis of selected research methods course syllabi provided insights on stated course learning outcomes, methods covered, course delivery format, student-generated deliverables, and their relative apportionment toward course grades. Because research questions are necessarily aligned with corresponding research methods, the range of methods that emerging academics are formally taught may impact the range of scholarly inquiries they pursue, the resulting peer-reviewed products they produce, and ultimately their access to a complete range of scholarly dissemination venues. A broad analysis of how MLA programs educate emerging academics in the craft of research illuminates potential implications for the discipline’s ability to effectively pursue its full range of possible scholarly inquiries and presents opportunities for future research.

1.1 Keywords
Research Methods, Scholarly Productivity, Faculty, MLA.
2  INTRODUCTION  

This study analyzes research methods courses offered within North American MLA programs and their potential implications on scholarly inquiry within landscape architecture. Landscape architecture faculty face higher research demands than ever before. Literature describes the range of research and creative scholarship within the discipline (Deming & Swaffield, 2011; Francis, 2001; Zeisel, 2006), projections and discussion of future scholarship (Gobster, Nassauer, & Nadenicek, 2010; van den Brink & Bruns, 2014), multiple analyses of scholarly output levels and their relationship with teaching loads and other factors (Milburn & Brown, 2003; Milburn & Brown, 2016), and research productivity of recently tenured landscape architecture faculty among peer institutions (Christensen & Michael, 2014; Milburn et al., 2003b). Research productivity levels have increased among landscape architecture faculty; however they still lag behind those of other disciplines (Christensen, Michael, & Sleipness, 2017; Christensen et al., 2014). Despite more emerging landscape architecture architecture faculty holding doctoral degrees than in previous generations and emergence of some landscape architecture doctoral programs, the MLA is still widely regarded as the discipline’s terminal degree. In published landscape architecture academic position announcements—which typically list doctoral degrees as not required, but preferred credentials—the MLA is assumed to be sufficient training for meeting the research and creative scholarship outputs demanded by many university tenure and promotion processes. In addition to providing formative research training of future landscape architecture faculty, MLA curricula also provide current MLA students with analytical and technical research skills that they exercise in research assistantships under mentorship of current faculty. For MLA graduates who elect for careers in professional practice, their foundational knowledge in academic research methods can also augment traditional methods of inquiry used in professional practice—particularly case studies—enriched through focused or nuanced lines of inquiry that are directed by a focused research question. Consequently, among a suite of professional skills, an ability to formulate and conduct methodologically sound research offers value for professional offices outside of academia. However, this study is focused on research methods courses as they relate to preparing emerging academic faculty.

When evaluating faculty for promotion and tenure, universities often rely on traditional measures of research productivity, with emphasis on conventional peer-reviewed products (Christensen, Michael, & Sleipness, 2017; Christensen & Michael, 2014; Milburn et al., 2003; Milburn et al., 2001). Due to its diverse breadth of professional work and frequent transdisciplinary affiliations, landscape architecture produces a broad range of scholarly outputs, often transcending boundaries of traditional research. In addition to traditional peer-reviewed products such as journal articles, books, and conference proceedings, exhibition of creative works is also a recognized and respected scholarly output within landscape architecture (Armstrong, 1999; Armstrong, 2000; Nijhuis & Bobbink, 2012; Lavoie, 2005; Lenzholer et al., 2015). Creative scholarship recognition within the discipline is evidenced in manifold ways, from the Council of Educators in Landscape Architecture’s (CELA) thematically organized conference tracks, a broad range of published content in landscape architecture journals (Gobster et al., 2010) and their corresponding calls for submissions, and even the recent change in title from CELA’s Vice President for Research to Vice President for Research and Creative Scholarship. While recognizing creative works as essential scholarly contributions, this paper focuses on how MLA programs train future academicians and advanced professionals in more traditional research methods, in preparation for careers in academia.

Because research questions are necessarily aligned with corresponding research methods, the range of methods that emerging academics are formally taught may impact the range of scholarly inquiries they pursue, the resulting peer-reviewed products they produce, and ultimately their access to a complete range of scholarly dissemination venues. A broad analysis of how MLA programs educate emerging academics in the craft of research reveals which methods universities believe are most essential for their graduates, which methods receive less coverage, and illuminates implications that MLA research methods courses may have on the discipline’s ability to effectively pursue its full range of possible scholarly inquiries.

3  METHODS  

This study describes and evaluates how North American MLA/MSLA programs train emerging academics in the craft of research through direct content analysis of their research methods course syllabi and associated course documents. A search of MLA degree programs located in North America was conducted using websites for CELA (2018), American Society of Landscape Architects (2018) and Canadian Society of Landscape Architects (2018), which revealed 51 MLA programs in 34 US states and 4 MLA
programs in 3 Canadian provinces. Websites for each MLA program were reviewed to determine research methods course offerings. Within programs’ published MLA curricula, courses that focus on research methods were identified and corroborated by program personnel. Copies syllabi, assigned readings, and assignment descriptions were requested via email communication, which included a brief description of the study purpose.

Of the 51 MLA programs, 13 programs provided syllabi for their research methods classes, 2 programs declined to provide syllabi, and requests with the remaining 36 programs are pending. Direct content of the 13 research methods course syllabi was initially performed using systematic intuitive analyses in order to map the thematic areas; these included course activities, research methods covered, instructional delivery method, deliverables produced during the semester, required and optional readings, and evaluation criteria corresponding with course activities. A list of keywords was developed from initial review of the syllabi, reflecting their range of methods-related content, as well as the research typologies described by Deming and Swaffield (2011) and Gobster, Nassauer, & Nadenicek (2010). Following a keyword search, research methods-related themes were mapped and arrayed within a spreadsheet, which provided a format for comparison of each syllabus. While content analysis focused on syllabi, their content was interpreted in the context of their placement within the MLA program curriculum, descriptions of other associated courses, and program descriptions of faculty expertise and credentials. A total of 82 pages of syllabus content were included in the analysis.

4 FINDINGS

4.1 Course Delivery

Following is a summary of course delivery characteristics. All 13 courses included in this pilot study are delivered via face-to-face; none are delivered via dispersed, distance, or online instruction, although one course did require blogging as a means of sharing critique outside of scheduled class sessions. Courses ranged from 2-4 credits, averaging 2.7 credits. Eight of the courses are 3 credits; four courses are 2 credits; one course is variable (2-4) credits. Seven courses met once per week; six met twice per week. Total contact hours spent in class ranged from 1.5 hours to 3 hours, with an average of 2.47 hours per week. Nine of the courses are taught by Ph.D. faculty and four are taught by faculty with masters degrees. None of the 13 courses included in this pilot study were co-taught; however, 5 syllabi reported guest speakers or discussants as a formal component of the course structure.

4.2 Course Structure, Activities, and Content

All courses are structured around discussions of assigned readings, and nearly all courses (12 of 13) culminate in production of a research or project-based thesis proposal. Of the 12 syllabi that describe assignments’ relative value toward final course grade, between 40 and 85 percent of the final course grade is assigned to production and presentation of the thesis research/project proposal; among the 13 courses examined, the final research/project proposal averaged 59 percent of the final course grade. Assigned readings focus on both explanation and application of a range research methods or other associated methods of creative inquiry within landscape architecture. Because nearly all courses are structured around the primary purpose of preparing MLA students for proposal and successful completion of a self-selected thesis topic, the methods covered within the courses reflect a broad range of methods and protocols of both research and design inquiry—reflected in the terrain of landscape architecture scholarship described by Deming and Swaffield (2011). The array of research methods covered in each course is illustrated in a matrix (Figure 1). Review of syllabi revealed a collectively greater coverage of design research, literature review, case study, and historical research. The aforementioned methods do not preclude quantitative analyses; even those geared toward the qualitative end of the spectrum can still contain quantitative analyses embedded within a mixed methodology. However, with the exception of the prevalence of survey methods within the course syllabi, the content analysis revealed substantially less coverage of experimental, correlational, or other discretely statistical research methods.
5 DISCUSSION and FUTURE RESEARCH

This study was initiated under the premise that the research methods described within MLA programs’ research methods course syllabi are a measure of the value that graduate landscape architecture programs assign to knowledge of particular research methods. Analysis revealed the presence of program-specific specializations within research methods training, particularly as these specializations relate to areas of expertise of the course instructor. The syllabi reviewed within this pilot study generally found design research, literature review, case study, survey, and historic research methods received the greatest coverage in research methods syllabi. While quantitative methods are often incorporated within case studies, in the interpretation and reporting of survey data, and embedded and utilized within design research, the research methods found to be most heavily covered in the courses tend toward qualitative research—or methods that can be exercised without necessitating quantitative analyses. In contrast, methods that are necessarily or discretely quantitative were much less prominently featured within the syllabi content. However, their tilt toward qualitative methods does not necessarily mean that MLA programs do not value quantitative research methods or recognize their importance for undertaking evidence-based design or rigorous academic research. Instead, perhaps the syllabi content—focused on readings, discussions, literature review, and case studies, and design applications—may actually indicate that even though their course titles contain the words, “research methods,” many MLA research methods courses are instead geared instead toward providing enough foundational knowledge for students to craft a credible thesis proposal, under the understanding that they will receive more specialized methods training within the context of their thesis committee. Literature review, case studies, and design applications are applicable—even essential—for all MLA students, regardless of thesis topic. However, while sufficient for students embarking on design project-based theses—without augmentation with additional research methods training—they are an insufficient methodological foundation for students who wish to conduct experimental research.

![Figure 1. Research Methods, as reflected in the 13 MLA course syllabi](image)

The study results reflect several limitations. Only 13 syllabi were analyzed—a small share of the 51 MLA programs in North America. Content analysis was limited to syllabi for each course, including learning outcomes, goals, topics, titles of assigned readings, and other text within the syllabus. The content analysis did not extend to the full text of assigned readings or other documents referenced in the syllabus. Analysis was limited to only the words—including titles, descriptions, and explanations of assigned readings—contained in the syllabi. Extending the content analysis to assigned readings would further illuminate research methods covered within each course—methods that may not be apparent within the syllabi. Additionally, a review of course syllabi does not necessarily reflect the entirety of research methods
covered within an MLA program, particularly as graduate students tend to work closely under the guidance of thesis committees comprised of faculty members who possess specialized theoretical or methodological expertise. A survey, questionnaire, or interviews of faculty within MLA programs might illuminate further information that would augment the conclusions derived from the syllabus content.

In hiring prospective faculty for tenure-track positions and evaluating faculty for promotion and tenure, universities often rely on traditional measures of research productivity, with emphasis on conventional peer-reviewed products. Whether conducting research as part of an academic process—or within evidence-based professional practice (Brown & Corry, 2011)—the methods employed are inextricably connected to—and defined—by a line of inquiry. Because research questions must align with corresponding research methods, the range of research methods in which emerging academics receive formal training may impact the breadth of scholarly inquiries they feel confident pursuing, the pace of peer-reviewed products they produce, and ultimately their success within the academic system. Within this pilot study, a broad analysis of how a limited number of MLA programs cover research methods reveals a need to expand the study to a larger sample of North American MLA programs, while considering implications that MLA research methods courses may have on the discipline’s ability to effectively pursue a complete range of possible scholarly inquiries. Future studies will enable a more robust discussion of the issue of research in landscape architecture and potential implications on MLA curriculum development.

This study was initiated under the premise that the MLA is still considered the terminal degree within landscape architecture—and consequently the research methods covered within MLA programs reflect those the discipline deems most critical for future academic career success. However, given the large proportion of MLA graduates who elect to instead enter professional practice, future research on this topic should also include deepened exploration of whether programs view their MLA offerings as preparatory for academia, professional practice, or both. While research methods might seem necessarily geared toward academic inquiry, in our contemporary cultural context characterized by proliferation of data, robust coverage of research methods may instead be viewed as a core competency—essential for landscape architecture practice readiness.

6 REFERENCES


HISTORY
THEORY AND CULTURE

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RESPONDING TO EMOTIONAL ASPECTS OF ENVIRONMENTAL LOSS: IMPLICATIONS FOR LANDSCAPE ARCHITECTURE THEORY AND PRACTICE

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1 ABSTRACT
The physical consequences of biodiversity loss, environmental degradation, and climate change have been well documented, and more is being said about emotions connected to major environmental impacts. This paper explores the role of design theory and practice in addressing environmental losses and changes to places of personal and collective significance. I draw upon the early literature on associated emotions and affect, including work from the ecological humanities, psychology, and biology, and pull this together with the work of artists and curators to explore the implications for landscape architecture theory and practice. Designers generally focus on creating beautiful and pleasant places where one might connect with nature in a positive way. They do not often engage with emotions such as grief, anxiety, guilt, and despair. Yet, as illustrated by the important role played by memorials in most societies, designed spaces can serve as important points for publicly addressing traumatic histories and memories in collective forums. While landscape architects have done the important work of highlighting human intervention in the landscape and making ecological processes evident in designed terrains, I explore how design practice might also respond to the emotional aspects of environmental loss and climate change. Such sites can play a role in transforming public grief into political action, but to do so they must move beyond pastoral forms, lament and nostalgia.

1.1 Keywords
Anthropocene, Climate Change, Design, Extinction, Memorial
2  INTRODUCTION

The physical consequences of biodiversity loss, environmental degradation, and climate change have been well documented, and more is being said about emotions connected to major environmental impacts. This article explores the role of design theory and practice in addressing environmental losses and changes to places of personal and collective significance. I draw upon the early literature on associated emotions and affect, including work from the ecological humanities, psychology, and biology, and pull this together with the work of artists and curators to explore the implications for landscape architecture design theory and practice. Seeing as significant environmental changes today invite, and indeed necessitate, an adequate design response, this article engages in a search for a design approach that might mark their scale and consequences through embodied experiences of mourning, celebration, and interconnectivity. The impact of the human on the environment and climate occurs today at a scale that is impossible to experience in a comprehensive way. Instead, we encounter these changes only as data or as flash events and phenomena that are difficult to apprehend in their entirety. Designed spaces can make abstract information apprehensible and available to the human body in a way that opens up access to understandings of the multiple temporal, historical, and spatial scales involved - from the neighborhood to the bio-region, from our lifetimes to intergenerational thinking. There can be a materiality to these scales.

Designers generally focus on creating beautiful and pleasant places where one might connect with nature in a positive way. They do not often engage with emotions such as grief, anxiety, guilt, and despair. Yet, as illustrated by the important role played by memorials in most societies, designed spaces can serve to address traumatic histories and memories in collective forums (Bakshi, 2017). Concerns about climate change have most certainly affected the design disciplines, leading to an important focus on sustainability, green infrastructure, and ecological restoration (Thayer, 1993; Spirn, 1985; Waldheim, 2006; Reed & Lister, 2014). While landscape architects have done the important work of highlighting human intervention in the landscape and making ecological processes evident in designed terrains, I will explore here how design practice might also respond to the emotional aspects of environmental loss and climate change, and how the work of landscape architectural designers and theorists might be translated to this concern (Ware 2008).

Such sites, I argue, can play a role in transforming public grief into political resistance, but to do so they must move beyond pastoral forms, lament and nostalgia.

3  LANDSCAPE ARCHITECTURE, CULTURE, NATURE

For the most part, the discipline of landscape architecture has responded to environmental disruptions and losses through sustainable design strategies, such as green infrastructure, native plantings, stormwater management strategies, and ecological remediation of brownfield sites and urban environments. Such developments are extremely important, yet I would like to question why landscape architecture has not responded more directly to the cultural and emotional impacts of environmental losses. While responses have been both practical and theoretical (Meyer 2008; Treib 2009), I explore below how to connect relevant theory to the issues explored in this article. To do this I begin with an examination of select aspects of the profession’s development since the eighteenth century. The organic lines and ‘natural’ vistas of the Picturesque garden were part and parcel of the partitioning trend of modernity, whereby a line was drawn between nature and culture. As Bruno Latour has pointed out, this put nature into the domain of science, where it remains off-limits to culture. Landscape architecture must navigate this terrain more than the other design disciplines, such as architecture and urban design, because its palette includes soil, plants, water, and environmental systems.

Landscape architects have done much to improve landscape function in relation to human impacts on the environment, and at times these interventions inform the designed landscape in ways that can be experienced spatially. A few early examples illustrating this approach are Hargreaves Associates’ Guadalupe River Park, DIRT Studio’s Vintondale Reclamation Park, and Peter Latz’s Duisburg-Nord. Unlike land art - which often operates on a purely visual register - and ecological restorations - which are mainly technical and scientific - these projects exhibit a synthesis of these two tendencies. Such projects must be situated among developments in the discipline since the 1980s, outlined by Elizabeth Meyer as attempts to “reconcile the values of earlier ecological design, the operations of landscape as art, the systems aesthetics of environmental art” (2000 p.202). In this way, landscape architects have interwoven design practices over this divide, drawing together nature (now located in science) and cultural expression.

Yet, as Meyer points out, the focus is typically on the ecological aspects of sustainability, and beauty rarely finds room in this discourse. I build here on Meyer’s suggestion that we consider the role of aesthetic
environmental experiences in enabling a shift in the visitor from “an egocentric to a more bio-centric perspective.” (2008 p.6). Such landscapes can play a role in building public support for the environment, and Meyer cites Elaine Scarry’s argument that beauty can cause a “radical decentering.” (Quoted in Meyer, 2008 p.18). Richard Misrach, the American photographer known for documenting changes to the environment by petrochemical manufacturing and nuclear weapons, dispels critiques that accuse him of making “poetry of the Holocaust.” He believes that “beauty can be a very powerful conveyor of difficult ideas. It engages people when they might otherwise look away.” (Quoted in Lippard, 1997 p.180)

In addition to considering beauty, we must also examine the dominant understandings of the relationship between nature and culture, and I discuss here the framework provided by Third Nature as well as subsequent challenges to this paradigm. Third Nature was first described by Jacopo Bonfadio in 1541, when he remarked that at the villas at Lake Garda “…the industry of the local people has been such that nature incorporated with art is made an artificer and naturally equal with art, and from them both together is made a third nature…” This Third Nature was a radical restatement of the relationship between nature and culture. In a much more recent translation of this relationship, several decades ago landscape architects were influenced by land artists to develop different forms of expression, focusing more attention on site-specific phenomena and processes, leading to landscape designs that unfolded over time and at the scale of the body. Most influential of these artists was Robert Smithson, who proposed an alternate model for understanding our relationship with nature.

Smithson was one of the first to take his art outside of the gallery and to work with unconventional materials and sites, incorporating the wastes of construction with ecological thinking. He wrote in 1970: “To organize this mess of corrosion into patterns, grids, and subdivisions is an aesthetic process that has scarcely been touched. Art can become a resource that mediates between the ecologist and the industrialist.” Smithson has described his art as “…entropic situations that hold themselves together. It’s like the Spiral Jetty is physical enough to withstand all these climate changes, yet it’s intimately involved with those climate changes and natural disturbances” (1996 p.298). Several decades after this statement, we are much less likely to imagine any intervention that could actually “withstand” climate change (Skinner, 2010 p.14), yet the notion of intimate involvement is possible. And it is to this element of Smithson’s thinking, the development of a synthesis between industry and nature, that landscape architects might turn to at this moment of climate crisis. Smithson had proposed a different model of nature, one informed by entropic conditions, where the organization of the “mess” of decline or deterioration becomes an “aesthetic process.”

Where Third Nature involved man and nature creating something new together, Smithson proposed a mutually informed entropy - a coordinated dissolution. Could employing such a model of nature today provide a design language capable of expressing environmental losses as well as recognizing and celebrating interconnectivity? Susan Herrington has convincingly argued that “gardens can mean,” and that the duration of time spent experiencing a garden can make “available meaning through memory.” While people may read a book once or twice, “gardens…can be experienced for decades.” (2007 p.314.). How might this power of duration be employed to address a range of environmental losses including contamination, loss of biodiversity, and the impacts of climate change. What elements might compose these landscapes in this period of accelerating environmental change? Landscapes should be designed that consider the changes in the ecological sciences where focus on the fixed endpoint of ecological stability and equilibrium have shifted to understandings of resilience and complexity within dynamic systems. As Meyer argues, “These theories have enormous implications for landscape design, and yet twenty years after their general adoption in the sciences, many landscape architects and their clients operate on outdated, even romantic, conceptions of nature and its beauty.” (2008 p.16). Instead, addressing the questions posed in this article will involve working in tandem with these developments in the ecological sciences. Recent years have seen emerging discussions of what some term “fourth nature” landscapes. Describing ecosystem typologies resulting from invasive species or climate change, Hobbs et.al recognize that “the definitions of ‘natural,’ ‘historic,’ and ‘altered’ are rarely clear and are often determined in relation to cultural, national, religious, or personal experiences or values” (2009 p.601). Moving in the direction of a new understanding of nature, they raise questions about how to manage ecosystems where retention or restoration of the historical reference is no longer possible due to extremely altered conditions such as soil salinity or the dependence of species on certain non-native or even invasive plants. In these environments, they argue, the costs and benefits of restoration to a previous state must be weighed considering that “Such novel systems can be relatively stable and have high cultural value, particularly if they continue to provide
the same, or enhanced, delivery of ecosystem services, such as flood attenuation and habitat provision" (2009 p.603). This fourth nature is an “alternate stable state.”

To take it further and extend beyond discussions of conservation or restoration, we must question how designed landscapes might address the “uncanny” nature of the moment. This is described by Amitav Ghosh in relation to weather events today, which “despite their radically nonhuman nature, are nonetheless animated by cumulative human actions…They are the mysterious work of our own hands returning to haunt us in unthinkable shapes and forms.” Explaining why climate change has been left largely unaddressed in contemporary literature, Ghosh explains that it has proven resistant to the manner in which writers often frame nature. Climate events are “too powerful, too grotesque, too dangerous, and too accusatory to be written about in a lyrical, or elegiac, or romantic vein” (2016 p.43). Translating this argument to landscape architecture, the development of which has been so strongly influenced by the picturesque, the romantic, the lyrical, we can see the roots of why it has been so difficult for landscape architecture to develop forms and spatial experiences that respond to the climate crisis and address attendant emotional impacts.

More is revealed by looking closely at the history of the picturesque form. The Third Nature that found expression in the Renaissance garden - the obvious play of human expression in dialogue with nature - was later masked in the Picturesque garden, in tandem with the Romantic movement and the formation of the Romantic human subject vis-à-vis nature. Romantic painting and literature often represent pristine landscapes, blissful in their simplicity, and allude to the possible overall harmony between the worlds of man and nature. They feature representations of awesome experiences of solitude, adventure, despair, and discovery as the person leaves the moorings of the familiar world. In this tradition, nature became an expression of “a human subject emancipated from the traditional restrictions of religion and society,” allowing for an experience of the “unfathomable depth of the soul.” This human subject is steeped in an infinite longing for “a lost unity and harmony resonantly evoked as ‘nature’” (Schneider, 2007 p.92). The Romantic movement was an aesthetic reaction to the overwhelming onset of the tidal wave of modernity; with this came the birth of an abiding nostalgia for nature. Some landscape historians have argued that this period continues to influence the profession to this day, maintaining connections to this nostalgia (Hunt, 2000 p.136).

Nostalgia takes on new meanings and forms today as we witness growing losses of biodiversity and absences of nature as we have understood it. Considering our impacts on the earth, “emancipation” from the constrictions of human society is no longer possible. Yet, nostalgia still plays a role. The biodiversity that “matters” to early ecologists sets the desired state for ecosystems far back in historical time; in settler societies this is before the arrival of Europeans (Heise, 2016 p.29). And while there are currently shifts from fixed endpoint “restoration ecology” towards the recognition of the need to work with novel ecosystems, romanticized notions of certain species appear in a variety of mechanisms for protection such as biodiversity databases and laws (Heise, 2016). As Hobbs et.al state, “Perhaps…we might, in the future, regard historic and hybrid ecosystems in much the same way as we do human historical sites; large investments will be required to restore and maintain the historical character of such sites” (Hobbs et.al, 2009 p.603). How can a design practice that has been connected to this nostalgic impulse towards nature now respond as growing losses are shifting the very nature of this nostalgia? More importantly, what are the dangers of nostalgia that must be steered clear of? It is instructive to look at how this response has taken shape in other fields, and the rest of this article looks at means for enfolding explorations from other disciplines into spatial design approaches.

4 IMPACTS: ENVIRONMENT, CLIMATE, SOCIETY

Recent books including The End of Nature, The End of the Wild, Storms of My Grandchildren, and The Sixth Extinction describe the enormous scale of the losses we are facing today. Facts and predictions from such texts, often read as snippets in news articles, are overwhelming for many who may then turn away from the enormity of the crisis (Coyle and Van Susteren, 2012). It is not difficult to imagine how reading such statements can bring about despair and despondency:

Nothing—not national or international laws, global bioreserves, local sustainability schemes, nor even “wildlands” fantasies—can change the current course. The path for biological evolution is now set for the next million years. And in this sense “the extinction crisis”…is over, and we have lost.” (Meyer, S., 2006 pp.4-5).
Many scientists and intergovernmental panels are in agreement that the impacts of climate change will be severe, but such impacts are often couched in abstract terms that are difficult to understand. Most people struggle to understand what abbreviations like ppm (parts per million) mean or how they relate to phenomena witnessed in everyday life, such as inconsistent weather or slow changes to their surroundings. These are absorbed into the background and more subtle changes may not draw conscious attention from most. Physical scientists and intergovernmental panels catalogue these losses with databases such as the Red List and ARKive.org. Such assessments are likely to provoke despondency, a sense of helplessness, and inaction. We need other forums for communicating and responding to this information, and a growing body of work has begun to reflect upon associated emotional impacts, as I will describe in this article and urge designers to contribute to such narratives.

Environmental journalist Michael McCarthy outlines the emotions that encounters with the natural world have evoked for him in *The Moth Snowstorm*. Upon seeing his first wild elephant, he felt, “intermingled with wariness, something akin to passion.” As a boy, stumbling upon the great Dee Estuary in the north west of England, there was a “feeling of immensity facing you, of nature untouched on the grand scale.” In the calls of the thousands of birds he found there was a song “pulling everything together, this ethereal mournful fluting, all the beauty of the untouched estuary, and the great skies and the distant mountains…” Upon happening upon a bed of Snowdrop flowers in the woods, he felt the turning of the seasons and the coming of spring: “…here against the dead tones of the winter woodland floor was hope.” Following online the migration of cuckoos that had been tagged by scientists, he felt the excitement of their return to England: “They were coming back… I was watching spring coming from 4,000 miles away.” He also outlines the pain of the losses. At the dead estuary at Saemangeum in South Korea he felt “rage” at the creation of a senseless dead zone that had once teemed with wading birds. Such environmental loss is “astringent,” and it involves hurt. As McCarthy warns, “If loss of nature becomes a sort of essay subject, we miss its immediacy; we may lose sight of its sadness and its nastiness, its sharp and bitter taste, the great wounding it really is” (2016 p.65).

The phenomenal reality of environmental losses involves an impoverishment of our sensual experience of the world: of the colors, sounds, smells and behaviors of vanishing or absent plants and animals (Ryan, 2009). In *The Sixth Extinction: Biodiversity and its Survival*, alongside the ecological and economic arguments, scientists Richard Leakey and Roger Lewin also recognize the aesthetic motives for preserving biodiversity. This aesthetic category, while the least objectively definable, is important. This goes “beyond a merely abstract experience and, instead, taps deep into what it is to be human. An appreciation of, and psychological dependence on, biodiversity is part of the biologically built psyche of *Homo sapiens*, a product of a long evolutionary history.” A depletion of biodiversity has a deep impact on our fundamental composition (1995 p.127). Facing a potential future in which there is “nothing but us” (McKibben, 2006) the incredible scale becomes difficult to comprehend; the enormity of the numbers provoking for many an inability to engage with the facts. Those who pay attention are confronted with figures and projections of possible futures. Thus, emotion is present in the conveyance and reception of alarming data. Yet, “science has no mourning rituals,” (Visvanathan, 1996 p.311) which might assist in making sense of the losses and exploring why they matter.

Due to the focus on objective data, while scientific studies provide knowledge, they can strip away emotional significance. The process of categorization by which we make sense of the natural world conveys knowledge, and then “immediately begins to flatten the meaning” (McCarthy, 2016 p.136). Using numbers, figures, and statistics to describe climate change and environmental losses, this abstract and academic language is sterile; it misses something vital and important in terms of human experience. Instead, as Meyer argues, aesthetic experiences and “challenging forms of beauty can lead to attentiveness, empathy, love, respect, care, concern and action on the part of those who visit and experience designed landscapes.” (2008 p.21). Environmental and digital humanities scholar John C. Ryan proposes that “we need to engage the power of our senses and emotions, and contact the particular life cycles and seasonal patterns of plants…” to fully understand the extinction of a species (2009 p.53). The concept of species itself makes emotional connection and mourning difficult. A species is a “generalisation and an artifice of taxonomy” which has a functional value for science, but is insufficient as an “aesthetic, sensory or emotional medium” (2009 p.73).

An additional complication is carefully outlined by Ursula Heise in her book *Imagining Extinction: The Cultural Meaning of Species*: a “taxonomic bias” is present in science, whereby a fairly narrow set of species is used to represent biodiversity loss; this includes mostly large “charismatic” mammals, almost no
plants, and only a few reptiles and amphibians. Much of the science is shaped by "underlying cultural assumptions" (Heise, 2016 p.13). For example, a recent study on taxonomic and geographic biases in wildfowl species research illustrates a bias towards 'high income' countries, with a focus on a mere 15 species from 7 genera (Roberts et al., 2016). There are nostalgic impulses at work here that share commonalities with the nostalgia often marshaled to support nationalist narratives. For instance, in a number of extinction narratives, “biological crisis typically becomes proxy for cultural concerns: worries about the future of nature, on one hand, and on the other hand, hopes that a part of one’s national identity and culture might be preserved, revived, or changed...” (Heise, 2016 p.48) through species protection, or even through ‘rewilding’ or ‘de-extinction’ projects. Heise argues that biodiversity and extinction are "primarily cultural issues,” (2016 p.5), with an attendant set of emotional influences and concerns. An appeal to rational and logical thinking, to science, to clinical and abstract statistics is not enough. Narratives that make the numbers and losses understandable are required to visualize the enormity and scale of the changes underway. Sustainable development initiatives and complicated strategies for carbon taxes are not going to "stir the soul" or inspire emotional engagement. While such approaches are of vital importance, they remain intangible and abstract in that they do not allow for physical experience or engagement.

The 2012 report The Psychological Effects of Global Warming on the United States points out the major emotional impacts of climate change. For instance, in the aftermath of Hurricane Katrina, affected communities suffered from high rates of depression, post-traumatic stress disorder and domestic violence. Higher suicide and suicide attempt rates were documented as 14.7 and 78.6 times higher than the baseline rates for the area, respectively (2012 p.9). According to forensic psychiatrist Lise Van Susteren, “people suffer more from disasters that are ‘man made’ than they do from natural disasters. The pain caused by intentional or avoidable acts is much harder to get over than those caused by events perceived as accidental or uncontrollable” (2012 p.12). It is not just the victims of preventable disasters who suffer, it’s also the researchers studying these phenomena. Biologist Camille Parmesan outlines the especially difficult emotional toll climate change is having on those who study the issue. She describes an ocean reef she has studied since 2002: “It’s gotten to be so depressing that I’m not sure I’m going to go back to this particular site again, because I just know I’m going to see more and more of it dead, and bleached, and covered with brown algae” (2012 p.19). Kathy Selvage, founder of the Southern Appalachian Mountain Stewards, associates the loss of the mountains with grief. Her childhood memories are of mountainside streams and berry-picking in the woods, but mountain-top removal and surface mining changed this landscape drastically. “To have all that demolished, taken away, geographically eradicated? It is one of the most disturbing things. It was the death of the mountain” (Aldern, 2016).

Research indicates that increased anxiety will likely result from continuous and frequent media reports about climate change, including fear about what the future holds, guilt about personal living and consumption habits, as well as feelings of hopelessness, anger, and sorrow, or what has been termed ecoanxiety (Clayton et al., 2017 p.27). Robert Lifton, who originally coined the term “psychic numbing” to describe the impact of witnessing the disastrous effects of the bombing of Hiroshima, argues that this numbing now extends to a broad swath of humanity in relation to the forces of environmental destruction (1982). As Christian Parenti points out in Tropic of Chaos: Climate Change and the New Geography of Violence, the numbers of those affected by migration and violence connected to climate events will only continue to grow. Militaries across the globe are already preparing as migration on a massive scale is predicted, with Britain’s 2006 Stern Review estimating that climate change will set 200 to 250 million people on the move (2011 p.182). And for those who remain in place, Australian philosopher Glenn Albrecht has coined the term solastalgia to refer to emotions that arise in relation to places that have undergone drastic changes. In contrast with nostalgia, it is “the pain and yearning that stem not from the passing of better times, but from an altered environment” (2005). What happens when people remain in places that have changed drastically; when home environments associated with feelings of belonging and continuity are transformed?

In their writings on trauma, scholars such as Dori Laub and Jill Benet have demonstrated the therapeutic importance of bearing witness (Bennett, 2005 p.31). This is necessary, not only so that others can know the truth of events experienced, but also because it enables those who were there to themselves make sense of and process the experience. Such approaches are grounded in the recognition that traumatic memories do not remain in the past, but rather are firmly situated in the present. As Cathy Caruth has emphasized, “Trauma is not locatable in the simple violent or original event in an individual's past, but rather in the way that its very unassimilated nature – the way it was precisely not known in the first instance –
returns to haunt the survivor later on” (1996). Such understandings have been important for informing commemorative practices, memory work, and memorial design (Bakshi, 2017). A similar impulse can be brought to acknowledging the impacts of disruptions to the relationship between people and their home environments.

5 MARKINGS BY AUTHORS, ARTISTS, ARCHITECTS, AND CURATORS

Explored below are a number of projects created in recent years that address climate change and environmental losses - examining first the two-dimensionality and linearity of text, and moving towards spatial experiences. This accounting is directed towards drawing some conclusions about how design practice might develop along these lines, and then extend beyond elegy and mourning to create sites for reflection, commemoration, and experience of a variety of emotions in relation to changing environments. In particular, landscape architects could translate the narrative studies employed here to designs that take advantage of duration. Many of the projects discussed below are text- or object-based, and most involve deliberate engagement on the part of the visitor, who has made a choice to visit a particular site or gallery space. In contrast, landscape architects can create spaces, employing strategies from the examples listed below, that might bring these narratives into the everyday realm and enable unscripted encounters with landscapes that people will encounter over time. In this section I point to a few strategies from other fields that have the potential to be powerfully translated into landscape designs that engage a politics of place.

Michael McCarthy endeavors such a descriptive task for Saemangeum in South Korea, a former estuary, located on the East Asia / Australasia Flyway. “One of the wonders of the bird world,” it was destroyed by a giant sea wall that turned a landscape of rich mud and wading birds, into an annihilated ecosystem.

Saemangeum is gone. Extinguished. Rubbed out. The whole thing. It haunted me. I kept going back to Google Maps, spellbound by the satellite photo: so simple it seemed, the thin white line in the sea, stretching nearly from one point to another; such destructions it had done…
Yet no one seemed to be bothered about it.
It was over.
It was finished.
It was history.
It was only an estuary.
Who writes elegies for estuaries?
…I resolved I would do it myself, I would go and bear witness to it…(2016 p.78).

Many pages of *The Moth Snowstorm* are dedicated to this task, but McCarthy does not leave the reader at elegy; he also includes descriptions of wonder and awe, and turns to joy as a “defense strategy” in his narrative. He has found that this can be powerful: in speaking to people about their experiences with the natural world, he finds they become animated “once a memory is triggered. It’s as if it were locked away in a corner of their minds, and in recalling it and realizing that it has disappeared, they can recognize what an exceptional phenomenon it was…” (2016 p.102). Rather than stopping at calling out calamities, finding a way to connect with positive, even treasured, memories and emotions can be a more compelling strategy.

John C. Ryan refers to ‘botanical memorials’ in visual arts and literature as “elegies to landscapes lost” (2009 p.66). One such example is *Black Solander* by Gregory Pryor, a memorial to over 10,000 plants in Western Australia, including living as well as endangered and extinct species. In 2005 Pryor created a crypt within the gallery space by rendering these plants as shadowy images on black paper:

The visitor to the exhibition enters into the body of the immediacy, symbolised by the mausoleum within the gallery enclosure. Physical immersion and sensory deprivation, along with an empathic feeling for the threatened and extinct flora, creates an exchange between the viewer and the subject matter…The exclusion of light and colour especially create a sombre visceral reaction: a counter-aesthetic experience (2009 pp.68-69).

This use of sensory control and deprivation could be a powerful design strategy for landscapes and buildings. Marcus Vergetts series of *Time and Tide Bells*, installed in the UK from 2009 to 2014, aims for a different kind of sensory engagement. The bells are positioned at high-tide locations, and the movement of
the waves creates patterns of sound. As sea level rises, the pitch and frequency of the bell strikes will change, giving an auditory accounting of change. Just as the bells seek to bring unexpected sounds into everyday life, other projects have attempted to bring awareness to the hazards of climate change and human impacts on the environment into everyday urban life. The Berlin artists group Realities United have designed a special waste release system for a waste to energy plant designed by the Bjarke Ingels Group in Copenhagen. After a certain amount of CO2 is collected, giant rings of vapor, each 25 meters in diameter and 3 meters high will be released. This will transform emissions from the plant into a symbol of the waste that we release into the atmosphere, seeking to give the abstract debate about emissions a distinct size and visible shape. For the HighWater Line project, started in 2007, Eve Mosher used a sports field marker to inscribe a line in New York City that defined 70 miles of flood zone. This line brought the current reality of urban life into waterfront communities in Brooklyn and lower Manhattan, marking the predicted 10-feet above sea level mark in the case of a major storm event. Moving beyond lament and mourning, such projects speak of an inextricable interconnectivity.

Revival Field: Projection & Procedure, started by sculptor Mel Chin in 1990 during his residency at the Walker Art Center, involved close collaboration with scientists. Chin designed a garden of hyperaccumulator plants, which can draw heavy metals from contaminated soil, at an old landfill near St. Paul, Minnesota. A small square area was enclosed by a chain-link fence within which a circular planting bed crossed by two paths was created. The developing form of the sculpture is informed by a close relationship with scientific knowledge and the specific life cycle of plants. Here, the unseen waste below the ground is brought to the surface and given visual expression. This approach recognizes environmental degradation while at the same time expressing the possibility of remediation and future growth - giving form to two contrasting edges of ecological interrelationally.

Maya Lin has brought her experience with memorial design to species loss with What is Missing?, a project employing a multi-media approach that includes sculpture, video, sound installation, hand-held electronic devices and a website. This has its roots in The Extinction Project; a large bronze-lined “listening cone” that visitors are invited to sit inside of to hear the sounds of animals facing extinction or those already lost. First exhibited at the California Academy of Sciences in 2009, Lin describes the project as about loss, but “not about doom and gloom.” She asks, “how can we protect it if we don't even see it as existing?” The cone creates an immersive soundscape, where people can hear sounds that are no longer available in natural environments. The What is Missing? website is accessible from anywhere, and visitors find an interactive map, a sound gallery, and a number of personal stories, to which they can contribute their own. The website aims to recreate sensory experiences and provide a forum for memories and stories of loss.

At a larger scale construction is currently underway on the Jurassic Coast of England for MEMO, the Mass Extinction Monitoring Observatory. This project, founded by a UK charity in educational partnership with the E.O. Wilson Biodiversity Foundation, is dedicated to “building a global beacon for biodiversity.” Their patrons include the Duke of Edinburgh and David Attenborough. The project proposes to collect images of species that have gone extinct in modern times. Their likenesses will be carved by artists all over the world, and those carvings will become the walls of MEMO. “The ultimate goal of MEMO is to inspire their [species] protection. And perhaps a global symbol which combines all the soul of the arts with the authority of science can provide the kind of cultural lightning rod which the geological drama of the moment surely demands.” Designed by David Adjaye, the building has been inspired by the twisting form of the Portland Screw fossil. Visitors move along a spiral ramp overlooking a central space dedicated to performances and events, and housing a large bell which will ring whenever a species goes extinct. The entire project is conceived of an educational tool, with on-site programs, artists’ residencies in schools all over the world, and training for skills such as carving. As such, it attempts to link art and science, and to connect to living practices and educational initiatives.

A diverse range of projects is presented above. What connects them is a sensibility that attempts to bring to light interconnectivity. As such, they begin to illustrate how interactions with non-human species and the natural world have shaped human lives. Spaces that memorialize changes and mark losses can give shape to connection and contingency. They can allow for mourning, lament, and elegy, but also recognition and celebration of that which remains.

6 CONCLUSION

In many ways, addressing the losses of the Anthropocene challenges generally accepted concepts of mourning - largely drawn from Freud’s 1917 essay on “Mourning and Melancholia,” where grief is viewed
as something to be “worked through” in order to release the lost other. Erica Doss points out that Freud’s later work revised these understandings, and more recent theoretical and critical approaches “emphasize the inseparability of life from death – or the ‘continuing’ bonds between the living and the deceased” (2010 p.80). In relation to environmental losses, the Freudian concept of mourning the lost object falters, in that the project of separation of us from the natural “other” becomes impossible.

Any efforts to commemorate such losses must recognize the ongoing nature and uncertainty of changes that have not reached a clear conclusion point. Such a project differs from memorials that mark the end of wars or conflict, and can be more closely related to memory and heritage projects that support dynamic and flexible engagements with the past (Bakshi, 2017). Many of the dominant assumptions about how memorials work within a framework of “sociotherapeutic assumptions that trauma can be represented and must be cured…” (Doss, 2010 p.146) need to be challenged. Today’s project cannot aim for such closure, but would do better to give form to and allow for the experience of open-ended changes. Such an approach must move past representations of a pastoral environment that never existed and visions of future devastation that are meant to admonish and caution. As Heise questions, “Is it possible to move beyond the story templates of elegy and tragedy and yet to express continuing concern that non-human species not be harmed more than strictly necessary?” (2016 p.13) Paul Wapner suggests a “middle path” for American environmentalism, that operates “across the faultlines of philosophical contestation,” and fashions “the tension itself into insight and practice” (2013 p.27). This same sensibility should be brought to the project of commemoration. An environmentalism that remains mired solely in doom and gloom will be difficult to engage with, and fear has its limitations. Living in a “world of wounds,” as Aldo Leopold wrote, is difficult and foments despair and despondency.

Instead, an appeal that engenders emotional engagement is required: an immersive experience of empathic engagement with loss, interconnectivity, and possibility. Landscape architects might draw on some of the strategies outlined in this article: McCarthy’s “defense through joy;” Pryor’s use of sensory deprivation as a design strategy; the creation of disruptions in everyday life in Mosher’s *High-water Line* or Vergette’s *Time and Tide Bells*; the collective visual and educational project of MEMO; or the interactive, multimedia approach employed by Maya Lin.

Growing developments in the sciences have led to increased understandings of interconnected systems, from George Perkins Marsh’s early work in *Man and Nature* (1864), to Ludwig von Bertalanaffy’s general systems theory (1968), and the Deep Ecology Movement of the 1970s (Macy, 1995 p.14). Yet, such connections are difficult for most people to grasp. Landscape architects can play a crucial role by designing spaces that make such connections visible, experiential, and material, building off of existing landscape architecture theory discussed above. While this article has focused mainly on the creation of spaces that mark absence and acknowledge loss and associated emotions, there are other important scales and registers of intervention. In addition to creating spaces for mourning and interconnectivity, there is also a need to create places that make abstract numbers associated with climate change understandable. We need sites that reveal what these figures mean for living environments today and in the future. There is also the need to create places that people will stumble into in their everyday lives, that will allow for moments to experience joy and wonder and connection, helping to build a sense of interconnectivity into what are increasingly urban daily lives.

Anthropogenic changes are both highly present and strangely difficult to see and to capture. According to Amitav Ghosh, “The climate events of this era...are distillations of all of human history: they express the entirety of our being over time” (2016 p.155). It is impossible to extricate “us” from such events, which only furthers their shadowy opacity. The impacts are so strong - wildfires, the devastation of coastal towns, the disappearance of entire species - yet they are not indelible, and physical expression and points of clarification are missing. The pressing question that designers must address is: How can we experience ourselves in larger scales? We must understand ourselves as situated in overlapping temporal, historical, and spatial scales. Just as memorials can help communities to make sense of historical chronologies and drastically altered territories and borders, we must seek to make sense of the Anthropocene and the materiality of the scales we have brought into being. A phenomenological approach to climate change is possible.

7 REFERENCES


CEL A MEDIA STATEMENT

Title of Paper or Research:
RESPONDING TO EMOTIONAL ASPECTS OF ENVIRONMENTAL LOSS: IMPLICATIONS FOR LANDSCAPE ARCHITECTURE THEORY AND PRACTICE

Author:
Bakshi, Anita

Institution or Professional Affiliation:
Rutgers University, Department of Landscape Architecture, Ab1332@sebs.rutgers.edu

Media Statement:
While landscape architects have done the important work of highlighting human intervention in the landscape and making ecological processes evident in designed terrains, I explore how design practice might also respond to the emotional aspects of environmental loss and climate change. Such sites can play a role in transforming public grief into political resistance, but to do so they must move beyond pastoral forms, lament and nostalgia. As illustrated by the important role played by memorials in most societies, designed spaces can serve as important points for publicly addressing traumatic histories and memories in collective forums.

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i Hargreave’s project integrates a flood-control landscape with a major recreation park and wildlife habitat, through obvious interventions like terraced banks and landforms. At Vintondale, DIRT has created a system of wetland treatment ponds that mitigate the contamination from acid mine drainage (AMD) from years of coal mining in the region. The changes occurring in the ponds, largely invisible and unapproachable due to extreme toxicity, are expressed in the Litmus Garden: trees with different color foliage that express the progressive changes to the water quality as it moves through the six treatment ponds. Duisburg-Nord, the site of a former coal and steel production plant, was transformed into a park. Latz utilized phytoremediation and soil sequestration strategies to address contamination, and transformed industrial elements into a piazza, rock climbing walls, and gardens.


iii As Svetlana Boym has pointed out, nostalgia is not opposed to modernity, but rather “it is coeval with modernity itself.” (Boym, 2001 p.xvi).

iv See https://www.youtube.com/watch?v=1jCGiSDfIAM for more information.

v http://www.memoproject.org/ contains a detailed description of the project.

vi For further discussion of “empathic engagement” see Bennett, 2005 & Bakshi, 2017.
TRANSFORMING THE AMERICAN GARDEN: LOOKING BACK AT “12 NEW LANDSCAPE DESIGNS”

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1 ABSTRACT
In the mid-1980s, an emphasis on lightness, authenticity, and artful presentation defined new movements across a broad range of subjects from gastronomy to physics. In the field of landscape architecture, a similar attention to playfulness, truth (the search for a philosophical base), and representation characterized many works of the era, and was evident in a key exhibition of “new” landscape design held at the time. Through extensive literature review the author examines the historical and critical context of this exhibition to assess what trends influenced landscape architects at that time, and what paradigms evolved in the intervening decades to “transform” American garden design. She finds a renewed valuation by landscape architects of the garden as a source of creative expression and ground for theoretical discourse, and concludes that the exhibition served as a significant marker of an emerging postmodern aesthetic in landscape architecture.

1.1 Keywords
Landscape Exhibitions, American Gardens, Conceptual Design, Landscape Architecture, Postmodernism
INTRODUCTION

Thirty years ago, the landscape architect Michael Van Valkenburgh invited a select group of early-to mid-career American landscape architects with practices and/or research concerned with gardens, to propose hypothetical landscapes for an exhibition intended to illuminate the state of contemporary design practice. Titled Transforming the American Garden: 12 New Landscape Designs, the exhibit was first displayed at the Architectural League in New York in spring of 1986; it traveled thereafter to the Harvard University Graduate School of Design, and other venues nationwide. Funded in part by grants from the National Endowment for the Arts and the Graham Foundation, the exhibition and its accompanying catalog received widespread attention from the design community, both within and beyond landscape architecture. Reviews appeared in the periodicals Landscape Architecture, Artforum, House and Garden, and the Boston Globe, as well as in publications local to each venue. The exhibition catalog was reproduced in the environmental design journal Places, accompanied by commentaries from prominent landscape scholars and critics. Looking back at this exhibition (and the critical debate it prompted) presents an opportunity to assess its influences and situate the work in the context of landscape history.

2.1 The Garden as Source

The most obvious result of the exhibition was the renewed focus on the garden as subject. At a time when landscape architecture was perceived as a stagnant field governed by analysis, a field in need of new models and approaches, the garden re-emerged as an evocative conceptual domain. “In the architectural design circles gardens are ‘back’,” observed landscape architect Laurie Olin (1986, p. 52). Gardens were fertile grounds for a designer’s imagination, free of pastoral associations and the privately-held motives of property owners. Despite its ubiquity, the garden was eschewed as a valid source of investigation in both academia and professional practice in the 1960s and 1970s. In organizing the exhibition, Van Valkenburgh’s premise held that as a viable subject of inquiry, as well an artful resolution to practical concerns, the garden could serve as a valuable prototype for differently-scaled landscape design. Noting how Lawrence Halprin’s design for a private, residential water court inspired a later public plaza project, Van Valkenburgh suggested that “the garden has provided a subject for developing design ideas which formulated later inquiries in other settings” (1986, p. 6).

The idea of the garden as a metaphor for landscape relationships was emblematic of the late 1980s. “Garden” was interpreted broadly in significant texts of the era (Elkins, 1993). In key publications that appeared during this period, the garden was regarded as narrative, as in The Poetics of Gardens (Moore, Mitchell & Turnbull, 1988); understood as “idea, place, action,” as in The Meaning of Gardens (Francis & Hester, 1990); and represented as allegory, as in Green Architecture and the Agrarian Garden (Solomon, 1988). In turn, the designers represented in the exhibition likened the garden to a billboard, an urban carpet, a language, a paradise, and a path to enlightenment. In his preface to Transforming the American Garden, Jory Johnson wrote that symbolism (the expression of intention) is what differentiates garden design from “landscaping” and elevates it to an art form, a creative practice rather than a craft (1986, p. 7). In his subsequent editorial for Places, Donlyn Lyndon distinguished gardening from garden making on similar terms, and discussed the declining emphasis on private gardens in professional practice (1986, p. 2).

As firms focused their efforts on public work, Lyndon hoped the same level of care and detail demanded by a garden would come to characterize the civic landscape. In correspondence regarding the exhibition (also reproduced in Places), Susan Frey, then editor of Landscape Architecture, claimed that “landscape architects have come out the closet to embrace the garden as the essence of their discipline” (1986, p. 42). Clearly, this multitude of meanings and approaches signaled a new conceptual territory for landscape architects, and laid the foundation for this timely exhibition and book.

Historically, a garden embodied a sense of care and management of the land for aesthetic purposes, and was differentiated from “landscape” by its complexity and function. In our collective imaginations, “gardens” have been concise spaces, shaped for intimate experiences; “landscapes” seem unbounded and created by ecological systems. The conflation of terms, and the impulse to clarify them, is long standing. In eighteenth-century England a “landscape” garden described a certain scale and interpretation of place. Today, referring to a landscape as a garden—or worse, a landscape architect as a gardener—is thought to be pejorative or trivializing. Curiously, Jean Feinberg, the former visual arts director at Wave Hill (a public garden and cultural center in The Bronx, New York), criticized one of the 12 New Landscape Designs in her review for Landscape Architecture for the failure of its elements to add up to a “garden landscape” (1986, p. 52). Early modernists contested the prescriptive forms and traditional elitist values that defined previous Beaux-arts styles; they sought “freedom in the garden” and turned instead
toward theory and metaphor to inform their work (Treib, 1993). Comparable impulses characterized the twelve garden proposals.

2.2 The Pursuit of Discourse

As his primary inspiration for the exhibition Van Valkenburgh cited Fletcher Steele's essay for the 1937 exhibition *Contemporary Landscape Architecture and Its Sources*, mounted by the San Francisco Museum of Art (today the San Francisco Museum of Modern Art), that framed issues relevant to contemporary landscape design by presenting state-of-the-art work. At that time, landscape architects had already begun to explore ways to move from a pictorial language of design to one more spatially involved, thus incorporating modernist ideals. Steele and others (including museum director Grace McCann Morley, architectural historian Henry-Russell Hitchcock, and architect Richard Neutra) described the contemporary garden as a functional outdoor living room, in which planting emphasized the architectural lines and volumes of the house. Given a similar framework of inquiry, what motives informed the work of postmodern designers fifty years later?

Jory Johnson, the curatorial assistant for *Transforming the American Garden*, envisioned the descriptive statements that accompanied each speculative design as the basis of a theoretical body of work that might expand the discourse and purview of landscape architecture. This desire for a more rigorous philosophical foundation echoed the preoccupation with literary theory and semiotics by architects in the late 1980s and early 1990s. In their search for new sources of landscape form and aesthetics, scholars at the time cited trends in ecology, semiotics and environmental psychology, and promoted “ecological humanism” as a possible foundation for the development of theory (Howett, 1987; Rosenberg, 1986). Seemingly endless references to the work of Roland Barthes, Michel Foucault, Jacques Lacan, Jean Baudrillard, and Christian Norberg-Schulz could be found in the architectural texts of the period, supporting arguments for a reevaluation of the role of functionalism and representation in design. Asserting parallel beliefs in the necessity for meaning and intention, rather than purpose, to generate form, in their catalog essays the landscape designers also cited influences from Barthes and Lacan, as well as from Elisabeth Kübler-Ross, Paul Shepard, Richard Ellman, Hilton Kramer, Robert Venturi, Italo Calvino, László Moholy-Nagy, Mark Rothko and Robert Hardison.

Three decades ago visual analysis and visual assessment constituted the predominant focus of landscape research—studies that continued to support the traditional valuation of a landscape based on its scenic capacity. Against this backdrop, the twelve hypothetical gardens reflected the more conceptual and phenomenological realms of investigation that inspired many landscape architects of the period who sought to communicate “meaning” in their work. In his essay, “Must Landscapes Mean: Approaches to Significance in Recent Landscape Architecture,” Marc Treib categorized ways in which landscape designers in the 1980s attempted to invest their work with meaning as “the Neo-Archaic, the Genius of the Place, the Zeitgeist, the Vernacular Landscape, and the Didactic” (1995, p. 113). Many of these approaches characterized the gardens in the exhibition. For example, in their proposal *Places for Peace: Garden IV*, Julie Moir Messervy and Peter Friedrich Droege simulated the psychological process of grieving as a call to action against nuclear proliferation. Like environmental and earth artists during the 1960s and 1970s, landscape architects had begun to treat landscape as a medium. These trends suggested a shift to a more experiential rather than visual aesthetic, and defined an era, as Catherine Howett observed, wherein “every formerly plain-Jane axis has been tricked out as a solstitial sight line” (1986, p. 48). In addition to the theoretical references and historical iconography cited in many of the proposed gardens, several designs attempted to “reveal” natural processes or make vernacular patterns “legible” to provoke or edify the virtual visitor. This development of sensitivity to the “agency” of the landscape (and the designer) became a dominant theme in the subsequent decade. For example, in his 1997 essay, “Ecology and Landscape as Agents of Creativity,” James Corner explored commonalities between the human creative process and ecosystem processes as potential sources for more “meaningful” ecological design practice.

3 METHODS

3.1 Literature Review

Primary sources of information for this paper included the original, printed exhibition catalog and the original, print edition of the journal *Places* dedicated to criticism of the exhibition; informal dialog with several contributors of work to the exhibition and to the journal supplemented the literature review. The author conducted an extensive review of other key periodicals from the 1970s through the 1980s including
Landscape Architecture Magazine and Landscape Journal to examine shifting trends in professional practice and academic focus.

4 THE 12 NEW LANDSCAPES

4.1 The Floral Imperative

The competition brief specified that the flower, as a nexus for the relationships between humans and nature, should be the source of inspiration for the proposed gardens. However, the geographical, ecological, and cultural context of each garden was determined by the individual designer(s). The proposed gardens ranged from practical to idealistic, rational to absurd; some were explicitly metaphorical, some were conceived as artworks, others as landscape representations. Only half the entries dealt explicitly with the floral imperative or specified plant species, and specific site conditions informed only six of the twelve works. Details on media, materials, and dimensions were missing from the catalog, so those who did not see the exhibition based their responses solely on print reproductions of the work.

4.2 Garden Design

In addition to the self-conscious imposition of the designers’ intentions, the twelve proposals shared a common spatial structure, using some form of grid or axial relationship to organize the space, and a colorful rendering style, typically executed in pastel tones. The ironic narratives or sarcastic overtones communicated in several of the designers’ essays were echoed in the forms of their gardens. In their compositions a number of designers relied heavily on the tactics of juxtaposition and contrast, or created skewed and offset patterns typical of a postmodern idiom. Despite the provocative manipulation of scale in many of the designs, the resulting gardens did not read as subversive spaces, but instead appeared ordered and even congenial. These ‘new’ garden design vocabularies objectified the landscape as much as did earlier pastoral ones, but the patterning and serial structures evident in many of the works were a refreshing palette-cleanser from the naturalistic motifs that dominated landscape design in the previous decades.

4.3 Stylistic Signatures

Interestingly, the most plausible of the schemes in the exhibition were proposed by designers who have developed impactful practices and international reputations, especially Martha Schwartz, Warren T. Byrd, Jr., and Van Valkenburgh himself. While their respective approaches to environmental design have evolved in the intervening decades, signal tendencies apparent in their exhibited gardens persist in their work today. For instance, Schwartz’s work is easily identified by her emphatic use of color, shape, a repetition of elements, and a Pop aesthetic; Byrd’s abstraction of regional landscape dynamics remains the impetus behind much of his firm’s work. Likewise, the gardens exploring more abstract themes were proposed by those who pursued careers in academia or art, for example, Chip Sullivan, Terence Harkness, and Barbara Stauffacher Solomon, whose methods of representation were more investigatory. The hypothetical designs

Figure 1. Pots of amaryllis envisioned on a Manhattan rooftop would offer commentary during late fall. “The New York City Bulb Garden,” by Martha Schwartz. From Transforming the American Garden: 12 New Landscape Designs, ©Michael R. Van Valkenburgh, 1986. Used with permission.
proposed for “realistic” sites—a rooftop, an urban plaza, a waterfront estate—were easiest to imagine being implemented. Schwartz’s seasonal bulb garden occupied a Manhattan rooftop (see Figure 1); Van Valkenburgh’s linear park traversed a city block between two buildings; and Teresita Falcón and Juan Antonio Bueno situated their residential garden on a lagoon in South Florida. Vincent Healy suggested no specific site for his healing garden, but its geometry and proportions relative to an adjacent building were easy to visualize as typical of an historic Italian villa.

![Image](image1.png)


More difficult to envision as built landscapes, yet most visually compelling, were the gardens proposed within metaphysical contexts (see Figure 2). Sullivan’s paired box constructions contained watercolor illustrations of a mystical rose garden that adapted the form and vocabulary of a Persian garden to a central Florida location; Solomon defined the “site” for her five richly-colored drawings of fields and structures as both the drawing surface itself, and as an estuary in San Francisco’s north bay (1986, p. 44). Her proposition alluded to the ambiguous framework of the exhibition upon which several critics commented. Byrd and Harkness alluded to regional contexts in their garden designs (see Figure 3), and the critics applauded their responses to specific, poetic qualities of place. In his proposed *Tidal Garden*, Byrd referenced the eastern shore of Virginia as a phenomenological edge—at the border between land and sea, where the straight lines of constructed tide pools and geometric garden spaces met the sensuous flows of an estuary, a path “exposed” and “protected” the visitor. Harkness paid homage to the prairies of east central Illinois through drawings and diagrams that captured the visual qualities of the vernacular landscape, particularly its horizontality; he wrote of the natural and man-made processes that “carve,” “slice,” “dust” and “drift” upon it. His edge marked where land met sky, and where divisions between garden and landscape—he thought—were indistinguishable.
4.4 Visual Representation

As broadly as the designers interpreted their gardens’ contexts, their graphic formats and methods of representation were equally diverse. In his three-dimensional model for a garden cemetery Stephen Krog used a single material (which in photographs resembles terracotta) to represent a four-square grove of clipped and shaped horsechestnut trees. Schwartz drafted layout plans with conventional title blocks to illustrate the changing display of potted plants arranged to form the words “ignorance,” “evil,” “money,” and “bliss.” The mode of presentation ranged from straightforward plans, sections, perspectives and scale models to more abstract diagrams, drawings and collages. The “handmade” quality of the work—the diagonal Prismacolor-pencil strokes, the whittled Styrofoam trees, the brown Kraft-paper backgrounds—is conspicuous and contrasts sharply with contemporary, digital processes of production.

5 THE CRITICAL RESPONSE

5.1 Addressing a Need for Innovation

Critical assessments of the exhibition mirrored the spectrum of proposed designs, ranging from appraisals of the gardens as conceptual art to consideration of them as credible built form. Regardless of the criteria used, critics seemed to have agreed that landscape design at the time was in a sorry state. In his contribution to *Places*, Laurie Olin commented on the “aesthetically and sensuously barren” work of previous decades (1986, p. 52). Patricia Philips wrote in *Artforum* that “…these twelve projects cast new hope into this arid design field” (1986, p. 137). With this frame of reference, the *12 New Landscape Designs* provided a necessary infusion of creativity, if not controversy, into professional practice.

5.2 Postmodern Characteristics

In the early 1980s, *Landscape Architecture* ran a series of articles that addressed aspects of postmodernism and their relevance to landscape architecture (See Johnson, 1982; Eastman, 1982; Hester, 1983; Hargreaves, 1983; and Krog, 1985.) Landscape architect George Hargreaves argued that the postmodern aesthetic was derived from external sources of significance—from contemporaneous spatial and cultural systems—rather than from the internal logic of modernism. Several of these same themes resurfaced in the critique of the exhibition, including discussions of historicism, contextualism, formalism, symbolism and humanism. In their reviews for *Places*, Marc Treib and Catherine Howett both noted the
designers’ appropriation of historical archetypes and classical garden features in the twelve proposals, and suggested that it was not a productive way to advance landscape architecture. The designers’ attempts to forge a new identity for the American garden based on traditional design conventions, they thought, lacked authenticity. Robert Riley observed that if a garden is a collection of symbols, to succeed the symbols must be placed in the appropriate context: “it must use symbols that are commonly agreed upon and not just individually selected…” (1986, p. 45). Randy Hester echoed Riley’s criticism of the self-referential gardens in the exhibit, stating that “obscure symbolism poorly translated isolates garden designers from their audience” (1986, p. 51).

5.3 Questioning the Role of Art and Utility
The function and role of art in the practice of landscape architecture was hotly debated in the 1980s, provoked in part by Steven Krog’s essay, “Is It Art?,” published in Landscape Architecture magazine in 1981. The question resurfaced in criticism of the 12 New Landscapes exhibition. The lack of context for each of the gardens was problematic, with no clear parameters for evaluating them as either art or idea. Critics who defined landscape architecture as practical problem solving and who viewed design as a response to established goals, found issue with the hypothetical gardens which were “so self-consciously artful that the design concepts for the garden seem of secondary importance” (Howett, 1986, p. 48). They also questioned the role of art and abstraction in the exhibits, believing that “two-dimensional art theory is wrongheaded for the landscape” (Hester, 1986, p.51). Similar criticism applied to the theoretical motives expressed by the designers. For many of the reviewers the proposals were thought too clever, too personal, too symbolic, and lacking in technical expertise and ecological reality. Riley commented that “these twelve gardens do not give very satisfactory answers” to questions of meaning (1986, p. 45). Some found it difficult to reconcile a garden’s content with its representation, finding merit in the illustration rather than the concept, or conversely, favoring the idea over its means of communication. While several reviewers found visual richness in the catalog reproductions, others, like Olin, thought some of the strongest proposals were represented by “the most vapid, precious, or anemic drawings” (1986, p. 54).

Criticism by practitioners, as published in letters to the editor of Landscape Architecture, was more dismissive of the potential of the 12 New Landscape Designs to affect a transformation of professional practice. One writer questioned if readers were supposed to take “the Van Valkenburgh exercise” seriously, as he believed none of the proposals were valid prototypes for physical design (Baker, 1986, p. 16). Another criticized Byrd’s rendering of vines growing clockwise around a pergola for violating the rules of nature (Whittaker, 1986, p. 9); Byrd responded that this reader missed the point and overlooked the basic intentions of the garden, as did Jean Feinberg when she remarked in her review for the magazine that his garden held “too many popular design elements” (1986, p. 52).

Virtually all the reviewers began their essays by defining the characteristics, or qualifying their understanding, of a garden. They uniformly acknowledged that gardens are functional landscapes, but to the question of whether a garden can (or should) function as art, their responses were mixed. Referring to work in the 1937 exhibition, Fletcher Steele wrote that regardless of style, gardens by their very nature “must ‘work’ and it must be evident, to the uninitiated at least, just how and why they work” (p. 23). Marc Treib applied a similar line of reasoning in his 1988 critique of Parc de la Villette, in Paris, when he argued that “The ultimate success or failure of such landscape designs does not ultimately derive from their intellectual origins, but whether or not they ‘work’ on their own merits as places and landscapes, without recourse to jargon and verbal explanations” (p. 119). These stipulations effectively summarize much of the criticism of the 12 New Landscape Designs.

In 1988 the Museum of Modern Art, New York, organized Landscape and Architecture in the Twentieth Century, a symposium that examined the relationship between nature, culture, and the built environment. In his essay published in the conference proceedings, Stephen Krog discussed the utility of meaning and theory in avant-garde gardens, citing works he respected for their originality, yet thought superficial. (Interestingly, he commended Terry Harkness’s East Central Illinois Garden for its authentic source of meaning.) He claimed, “Landscape architecture desperately needed the jolt of the Bagel and Necco gardens, and Tiffany and Harlequin plazas,” but suggested that deeper meaning can only be built from a strong theoretical foundation, and this was lacking in landscape architecture (p. 100). A comparable observation could be made of the 12 New Landscape Designs. Although the works themselves did not endure as precedents for subsequent projects, and the aesthetic models proved transitory in shaping landscape design practice, the need for substantive inquiry persisted.
6 CONCLUSION

6.1 Impacts of the Exhibition

By presenting the garden proposals in an art gallery, Michael Van Valkenburgh and his co-curators broadened the perceptual framework of landscape architecture, and provoked debate about the role of art in design practice as well. Architects had exhibited their hypothetical designs in similar settings for years (if not centuries) and investigated a wide range of related issues in their “paper architecture.” Contemporary Landscape Architecture, the 1937 exhibition at the San Francisco Museum of Art, was a first for landscape architects; subsequent exhibitions were mounted at the museum in 1948 and 1958. As did these earlier notable shows, Transforming the American Garden provided a valuable record of the ideologies, aesthetics, and methodologies that compelled landscape architects at the time, and served as a model for other public exhibitions of real and imagined works of landscape architecture. In 1998, Brenda Brown along with Terry Harkness and Douglas Johnston mounted an exhibition at the University of Illinois at Urbana-Champaign titled Eco-Revelatory Design: Nature Constructed/Nature Revealed. Inspired in concept by Transforming the American Garden, the catalog was published as a special issue of Landscape Journal and included fifteen exhibits and eight critical essays on the creative expression of ecological phenomena, processes and relationships. The intent of the exhibition and publication was to develop a theoretical and philosophical basis for practice as well as explore issues of representation and aesthetics in environmental design.

Transforming the American Garden: 12 New Landscape Designs centered on the role of conceptual design and theory in generating new landscape forms, and promulgated aesthetics rather than analytics as a more relevant approach to the design of the built environment. Although critics disparaged several of the gardens for being about themselves (Riley, 1986, p. 45), the injection of new ideas into what was generally acknowledged as a stale field was respected by those who found the mode of investigation “refreshing” (Cann, 1986, p. 46). The exhibition was important in framing landscape architecture as an art form at a time when the profession had no obvious aesthetic imperative. Although the postmodern stylings proved to be short-lived impulses, the designers’ artful explorations provided a critical step in the transition to the ecological aesthetic that drives innovation in the field today. Yet, one might question if history is destined to repeat itself—is current work evidence of a return to analysis, wherein the future role of aesthetics is limited to the artful representation of data? Examining the role of art and functionality in landscape architecture remains timely (Szczygiel, 2011).

Lastly, Transforming the American Garden brought attention to landscape architects from within the larger community of artists and design professionals. Citing the “sweeping changes in the field of landscape architecture” the July 1989 special issue of Progressive Architecture, titled “New American Landscape,” featured profiles of Michael Van Valkenburgh, [George] Hargreaves Associates, and the Office of Peter Walker and Martha Schwartz, along with portfolios of other landscape designers. Chip Sullivan, Barbara Stauffacher Solomon, and Pamela Burton (who also contributed work to the exhibition) were quoted in the article. On the cover of the magazine was a photograph of a temporary landscape installation comprised by an alleé of dead shrubs spray-painted lapis blue, a carpet of fallen leaves, and a “temple” built from leaf debris; a white horse stood stage left. This image, like the 12 New Landscape Designs, epitomized the style and trends of American popular culture in the 1980s. Although the exhibition did not serve to transform the garden through the production of new theory, it did introduce new approaches to design that were more diverse, imaginative, and externally-driven than in previous decades. The greatest impact of Transforming the American Garden: 12 New Landscape Designs was perhaps the legacy of creative and intellectual inquiry that continues to stimulate positive change in landscape architecture to this day.

7 REFERENCES


THREE MOMENTS IN AESTHETIC DISCOURSE:
FROM NATURAL LAW TO PHENOMENAL RICHNESS

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1 ABSTRACT
Although aesthetics distinguishes the design disciplines, including landscape architecture, from others such as engineering, aesthetics remains poorly defined. In order to better understand the role of aesthetics in design, this paper explores the definition of aesthetics through three historically-influential texts: Vitruvius’s classical triad of durability, convenience, and beauty; Louis Sullivan’s modernist claim that “form ever follows function”; and James Corner’s presentation of landscape urbanism in “Terra Fluxus”. Each of these authors draws from observations of nature to propose a preferred design aesthetic. For Vitruvius, it is the mathematical proportions found in nature; for Sullivan, the efficiency of natural forms; and for Corner, the dynamics of natural processes. Collectively, these three texts call into question any reference to a “natural law” for design aesthetics, since these natural laws result in very different design styles. However, if we reconsider these texts by setting aside their references to “natural laws”; other elements remain, revealing an alternative definition for aesthetics in design. For all of them, design also involves a subjective, human experience: a pleasurable experience of beauty, according to Vitruvius and a poetic engagement with the physical world, according to Sullivan and Corner. Defining landscape aesthetics as a human experience of “the phenomenal richness of physical life,” (Corner, 2006, p. 32) might challenge landscape architects’ authority as experts in aesthetic judgment. However, we can reconsider landscape architecture’s expertise to be more about understanding the relationships between our physical, sensible environment and subjective experiences rather than about laws for aesthetic taste.

1.1 Keywords
Aesthetics, Design Theory, Vitruvius, Modernism, Landscape Urbanism
2 INTRODUCTION

"Beautiful things are difficult," Socrates concludes in Plato's *Hippias Major* (385-370 B.C./2000, p. 304e). In the dialogue, Socrates challenges Hippias to define absolute beauty. They consider whether the useful, the beneficial, or the powerful can determine what is beautiful. Yet each is found lacking. They then turn to the pleasure of the senses, specifically, sight and hearing, as the source of beauty. But they cannot find a common essence between what is seen and what is heard that contains beauty, so they end their dialogue in unresolved difficulty.

Within landscape architecture theory today, defining beauty – and, more broadly, aesthetics – remains difficult. In *Landscape Architecture Theory*, Michael Murphy (2016) observes, “even with traditional concepts of beauty and aesthetics, description is difficult” (p. 173). This difficulty makes it a challenge to teach or judge aesthetics in design. For example, Kathryn Moore (2015) observes that because it is “Spectacularly ill-defined, design is often seen as a highly personal, mysterious act, almost like alchemy” (p. 49), and “Teaching the real nitty-gritty of the discipline, the designing part of design, is clouded for most by an air of subjectivity, and therefore is seen, somehow, as impossible to teach” (p. 49).

In response to this difficulty, designers and design educators shy away from discussions of aesthetics. One might be tempted to ignore the aesthetic discussion for the more comfortable and straightforward scientific aspects of the design process. As Moore (2015) suggests, “And then there is the dangerous idea that it is possible, indeed preferable, to hide behind the supposed objective neutrality implied by the more scientific, ‘technology-based, problem solving approaches’ (p. 50). Elizabeth Meyer (2008) observed a similar issue in a university design critique, where a juror used the terms “beauty and aesthetics” dismissively, while favoring the more functional term “performative” (p. 9). Perhaps this is why, although Murphy (2016) claims that “design as art, design as science – are no longer understood as mutually exclusive, but mutually reinforcing” (p. 30), there remains a concern, as expressed by Girot and Imhoff (2017) that “aesthetic concerns... have all too often been overshadowed by a positivistic scientific discourse about nature” (p. 7).

Yet, despite its difficulty, aesthetics remains the quality that sets landscape architecture apart from other professions. According to landscape architect Laurie Olin,

> It is the aesthetic endeavor that separates us from social and natural scientists, from engineers and policy planners, from politicians and preservation administrators. We make things in the endeavor to produce environments that are more complex, more stimulating, more useful, and more beautiful that if we had not intervened. (qtd. in Herrington 2017, p. 9)

It is also the aesthetic dimension of landscape architecture that has the potential to engage people in more meaningful ways with the environment. Given the contemporary ecological crises, Girot and Imhoff (2017) argue that “Landscape architecture must be one of the few disciplines capable of merging a deeply symbolic and cultural understanding of nature with the massive environmental transformations to come” (p. 11). Therefore, for landscape architecture to merge aesthetic and scientific thought and realize its potential strength to address our most pressing challenges, we first need to be comfortable engaging in the difficult discussion of aesthetics. We need to find ways to debate, evaluate, and teach aesthetics in design. We need to be able to articulate what makes design more than a means-end functional solution.

To contribute to this discussion, this paper explores definitions of aesthetics through three historically-influential texts: Marcus Vitruvius Pollio (Vitruvius)'s (1st century B.C./1960) classical triad of durability, convenience, and beauty; Louis Sullivan’s (1896/2007) modernist claim that “form ever follows function”; and James Corner’s (2006) presentation of landscape as a dynamic process in “Terra Fluxus”. Each of these three texts is representational of a significant period in architectural design: the classical, the modern, and the contemporary, respectively. At the same time, concepts from these texts, especially Vitruvius’ and Sullivan’s, have repeated to such a degree that many people refer to their ideas without consulting the texts themselves. By limiting the scope to these three texts, one can consider how each of these authors defines aesthetics more closely than a broader survey of aesthetic thought could. Criticisms and concepts from philosopher Arnold Berleant, landscape architecture theorist Ian Thompson, and architectural theorist Douglas Spencer are brought into the discussion to illuminate and support the interpretations. This comparative reading reveals that, despite their differences across time, all three rely on nature as a justification for their aesthetic directives. Yet, if one sets aside these references to a so-
called “natural law,” other aesthetic inspirations are revealed, those of a subjective engagement with the richness of the physical world.

Underlying this paper is the premise that aesthetics cannot be objectively described but is, instead, a concept that is constructed through discourse. In Murphy’s *Landscape Architecture Theory* (2016), he quotes philosopher Jerome Stolnitz’s claim that “aesthetics is a process, not a product, an inquiry, not an almanac” (p. 173). This paper, although limited in scope to three key texts, hopes to contribute to this inquiry. It is not proposing a definitive answer of what aesthetics is in landscape architecture; it cannot do so because many important theorists have been left out of this discussion. Recently, several landscape theorists, such as Catherine Howell (1987), Ann Spiri (1988), Elizabeth Meyer (2008; 2015), and Susan Herrington (2009), have developed sophisticated descriptions of aesthetics as personal interactions with the world, or what Meyer (2015) calls, “a perceptual entanglement between a sensing body and the world” (p. 33). This paper’s aim is to provide some concepts that will hopefully encourage more discussions about how to evaluate or teach aesthetics in landscape architecture. By bringing assumptions that underlie aesthetic judgments to light, we can engage more directly in aesthetic debates, instead of ignoring aesthetic judgments in favor of more easily-proven aspects of design or claiming that aesthetic taste is intuitive and cannot be explained.

3 AESTHETICS AND DESIGN: THREE MOMENTS IN THEORY

3.1 Vitruvius and the Classical Period

Vitruvius wrote *The Ten Books on Architecture* to provide Caesar Augustus with “definite rules” on “the quality of both existing buildings and of those which are yet to be constructed” (p. 4). Widely-considered the first text on architecture, *The Ten Books* (Figure 1) is a blend of practical advice such as how to slake lime for stucco, how to find water sources, and how to string and tune catapults, along with more theoretical reflections on the art and science of architecture. Vitruvius lists six fundamental principles of architecture: order, arrangement, eurythmy, symmetry, propriety, and economy. However, it is his statement that all architecture “must be built with due reference to durability [firmitas], convenience [utilitas], and beauty [venustas],” that has been repeated and revised within architectural theory for centuries (Pollio, p. 17). This triad reappears in the Renaissance in Leon Battista Alberti’s “utility, dignity, and delight”, Sir Henry Wotton’s “firmness, commodity, and delight” (1624), and more recently in Ian Thompson’s “Ecology, Community, and Delight” (2000). Additionally, Immanuel Kant’s division of cognitive faculties into scientific thought (pure reason), moral reasoning (practical reason), and aesthetic judgment also roughly parallel Vitruvius’ triad. Durability - how well a building works structurally and withstands the forces of time - can be likened to Kant’s pure reason, utilizing the scientific laws of materials for specific ends, such as a sound structure. Convenience - how well a building works for the people who occupy it - relates more to Kant’s practical reason, making sure that the building serves human needs.

In his triad of durability, convenience, and beauty, Vitruvius suggests that beauty (and therefore aesthetics) is a separate aim from durability and convenience. Durability and convenience can both be classified as belonging to what philosopher Arnold Berleant describes as practical function: “Practical function involves a context of use in which an object joins with a person in a relation of means to ends” (p. 90). Most design objects have a practical function – their human use. In fact, Berleant cites architecture as the “exemplar of practical function” (p. 93). In defining practical function, Berleant claims, “Things here do not delight in themselves; their attraction lies wholly in the uses to which they can be put” (p. 90), which may be why Vitruvius included beauty as a third goal for architecture, and Kant developed his third critique around aesthetics.

According to Vitruvius, the experience of delight or pleasure does not fit within either of the categories of durability or convenience. What is it, then? Vitruvius defined beauty as, “when the appearance of the work is pleasing and in good taste, and when its members are in due proportion according to the correct principles of symmetry” (p. 17). Beauty in architecture, according to Vitruvius, comes from utilizing the mathematical proportions and symmetries found in nature. The most well-known example of natural proportions that inspired Vitruvius’ architecture are the proportions of the human body. Vitruvius claims, “since nature has designed the human body so that its members are duly proportioned to the frame as a whole, it appears that the ancients had good reason for their rule, that in perfect buildings
the different members must be in exact symmetrical relations to the whole general scheme” (p. 73). These proportions were revived in the Renaissance, most notably in Leonardo da Vinci’s Vitruvian man.

3.2 Louis Sullivan and the Modern Period

At the end of the nineteenth century and beginning of the twentieth century, architects wanted to break from past conventions and to embrace the progress implied in the industrialization of society. One of the most notable expressions of this embrace was the skyscraper (Figure 2). “Form follows function,” the maxim developed then (and still repeated within design schools today), was adapted from Louis Sullivan’s 1896 article “The Tall Office Building Artistically Considered”. In that article, Sullivan observes: “All things in nature have a shape…a form, an outward semblance,” and “these shapes express the inner life, the native quality of the animal” (p. 91). Sullivan argues that, like nature, architecture should have a form that expresses its essence. That essence is not found in mathematical proportions, as Vitruvius suggested, but in how an object functions. Sullivan proposes,
Whether it be the sweeping eagle in his flight or the open apple-blossom, the toiling work-horse, the blithe swan, the branching oak, the winding stream at its base, the drifting clouds, over all the coursing sun, \textit{form ever follows function}, and this is \textit{the law}. (emphasis added, p. 92)

![Image of Wainwright Building](https://www.loc.gov/item/mo0297/)

Figure 2. Louis Sullivan’s Wainwright Building, Saint Louis, Independent City, MO. Source: Historic American Buildings Survey (Library of Congress), https://www.loc.gov/item/mo0297/

Modernist architects Le Corbusier and Walter Gropius took Sullivan’s idea of the functional efficiency of nature one step further and likened designed objects to a machine. Gropius (1926/2007) states,

An object is defined by its nature. In order, then, to design it to function correctly … one must first of all study its nature; for it must serve its purpose perfectly, that is, it must fulfill its function usefully, be \textit{durable, economical and “beautiful”}. (emphasis added, p. 138)

It is interesting to note that Gropius’ triad of durable, economic, and beautiful reflects Vitruvius’ triad, except for two differences. First, Gropius puts beautiful in quotation marks, suggesting an uneasiness with the term as a definitive quality. Second, Gropius substitutes Vitruvius’ convenient with the term economic, indicating a new emphasis on efficiency. Le Corbusier and Ozenfant (1920/2003) are more explicit about the link between nature and efficiency, declaring that natural selection is “a tendency toward certain identical aspects, corresponding to constant functions, functions which are of maximum efficiency, maximum strength, maximum capacity, etc., that is, maximum economy. \textit{ECONOMY} is the law of natural selection” (p. 240). They then link natural selection to what they call “the great law” of mechanical selection (Le Corbusier & Ozenfant, p. 240). The machine-like aesthetic in modern architecture was justified through the natural law of efficiency. “Form follows function” came to mean that good aesthetics occur when all that is not necessary to function is stripped away and the design functions well.

In the term “form follows function,” Vitruvius’ beauty gets merged into his concepts of durability and convenience. Gropius and Le Corbusier's theories exemplify Berleant’s category of mechanical
function, where an “object adapted to a specific task … performs with a maximum economy of movement and minimum of wasted effort” (Berleant, 1996, p. 86). Designed objects are thought of as machines, "a collocation of parts designed to work together to fulfill an external task" (Berleant, 1997, p. 88). Berleant describes mechanical function as lacking aesthetic consideration: "No thought is given to imagination, delight, or any other quality for its own sake, but every attention is devoted to its external end of productive results" (p. 87). Despite this lack of attention to aesthetics for its own sake, machines during this time period achieved the status as aesthetic objects. I argue that this is not due to some natural appropriateness to their form, but because the machine's form became a symbol of people's cultural ideals and hopes for the time. In art movements such as Futurism and Constructivism, one can see how the ideal of the machine, "particularly the industrial machine," as Berleant observes, "has pierced the very heart of human activities to affect the arts themselves" (p. 87). According to Berleant, "Simplicity, regularity, and repetitive patterns of machine products" became aesthetic ideals not because of their efficiency but because they represented the human hopes that made that efficiency into an ideal (p. 88).

Although it appeared that the difficulty of separating aesthetics from function was resolved by subsuming aesthetics to function, culture emerged as a critical link between the two, demonstrating that aesthetic form is not a natural outcome of mechanical function. Instead, aesthetics becomes attached to mechanical function due to its cultural significance. This suggests that aesthetics cannot be reduced to a practical, means-end function because as humans we inevitably attach meaning and emotions to our experiences.

3.3 James Corner and the Contemporary Period

James Corner of Field Operations, designer of the High Line in New York City (Figure 3), is closely associated with the contemporary theoretical movement of landscape urbanism. Like modernism, landscape urbanism is also inspired by how nature works. However, it is not modernism's efficiency of natural forms that inspires landscape urbanism; it is the metabolic processes of ecosystems. As Corner states: "In conceptualizing a more organic, fluid urbanism, ecology itself becomes an extremely useful lens through which to analyze and project alternative urban futures" (p. 29). "Function" in landscape urbanism relates to Berleant's classification of organic function, which "is characterized by an integrity in which all the component elements maintain a harmonious equilibrium by adapting reciprocally to one another" (p. 88-9). Unlike the machine, which can be broken down into parts, the organism interacts with itself in an evolving process, where it generates its own ends. In organic function, Berleant notes: “This sense of function cannot be described analytically by its elements alone but only through reciprocal relationships” (p. 89).

Figure 3. The High Line in Manhattan, New York City at West 20th Street, looking downtown (south). Source: Beyond My Ken - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=10811588
Inspired by Deleuze and Guattari’s call in *A Thousand Plateaus*, to consider objects not through their meaning or forms but through how they function with other objects; landscape urbanists are less concerned about what a city, building, or landscape looks like than about what it does. Unlike modernism, where form is the focus of architectural design; in landscape urbanism, form becomes secondary to process. According to Corner, form-based design is too static; “a particular spatial form” is “merely a provisional state of matter, on its way to becoming something else” (p. 29). It is the relationships, processes, and movements that matter in an organic function. This prioritizing of process over form can be seen in many places in Corner’s “Terra Fluxus.” For example, he criticizes modernism for its “fixed, rigid form” imposed upon “the dynamic multiplicity of urban processes” (p. 28). He praises the “more significant” traditional urban landscapes such as Boston’s Bay Back Fens and Stuttgart’s greenway corridors because they are “[m]ore than aesthetic and representational spaces,” they “possess the capacity to function as important ecological vessels and pathways” (p. 24).

Although this demotion of form in design can be read as a critique of modernism, it can also be read as yet-another prioritization of function over aesthetics. In landscape urbanism, form does not follow function; it is dissolved into function. As critic Ian Thompson (2012) points out,

> [Landscape urbanism] seems to be the heir to those Modernists who thought that predicing design upon function would take care of the aesthetics, or perhaps to those ecologically zealous landscape architects who believed that if you look after the ecology, the aesthetics will take care of themselves. (p.12)

Either way, the role of form and therefore aesthetics becomes secondary to function.

The ecological determinism implied in landscape urbanism and its demotion of form as a primary focus for design raises fundamental questions about the role of designers, as architects and landscape architects have traditionally considered form as their primary medium and creative agency their primary method. Theorist Douglas Spencer (2014) warns that in landscape urbanism, “The thought and practice of design is subsumed by the overriding logic of metabolic and ecological principles” (p. 114). He worries that, “Rather than having the architect as their author, design principles and practices are now authorized and underwritten by the laws of nature themselves” (p. 113). Consequently, the designer has been dislocated “from a position of creative or critical agency” (p.113). What has taken the designer’s place is a reference to a natural or ecological law.

### 4 DEFINING AESTHETICS

#### 4.1 Aesthetics as Natural Law

According to Spencer, landscape urbanists turn to ecological metabolisms as a natural imperative for design decisions. In doing so, like Vitruvius’ rules of natural proportions and Sullivan’s natural law, they justify their aesthetic choices through a reference to a natural law (that of ecology). In all three texts, despite the centuries and decades that passed between them, the author ties aesthetic ideals to some property or characteristic observed in nature. For Vitruvius, it was the mathematical proportions found in plants and animals. For Sullivan, it was the functional efficiency of natural forms. And for Corner, it is the ecological processes that run across our landscapes.

Sullivan admits a ‘natural’ element is difficult to argue against. He says, “we say, simply, it is ‘natural’ it should be so” (p. 91). By claiming a link to nature, their design theories become, as Sullivan and Le Corbusier both explicitly say, law. Spencer is concerned that basing all design decisions on an understanding of nature will mask the human choices that actually go into design:

> It appears that nature – its laws, its organizational processes, and its productive efficiencies – is simply spoken through the medium of designers and their work. It is in fact, though, nature that is the dummy in this ventriloquist act. It is nature that is made to speak of efficiency, productivity, and organization, and in the service of other agents, interests, and agendas. (Spencer, 2014, p. 116)

By viewing these three texts from very different time period side by side, we can see that Spencer has a point. In Vitruvius’ time, nature spoke of Euclidean geometry; in modern times, it spoke of evolutionary efficiency; and currently, in landscape urbanism, it speaks of ecological processes. One could argue that our understanding of nature has just become deeper, but, I think, in these cases, nature becomes a front for decisions and choices – including aesthetic choices - made by humans. In hindsight,
we can see that each of these architectural time periods express a distinct aesthetic style. We can also see that as design styles changes across time and place; these aesthetic choices are not solely contingent on the function of the building or landscape. Thompson (2012) questions whether landscape urbanism’s dismissal of aesthetics is truly a dismissal or if they just are glossing over the aesthetic choices that they make. He says, “As with the Modernists, we might wonder if Landscape Urbanism is truly indifferent to aesthetics, or is simply proposing the replacement of traditional aesthetics with some new ones” (Thompson, 2012, p.12). Aesthetic choices are human choices; they are not simply determined by natural systems. They are choices that involve the material world and its constraints but also allow for some variety within those limits.

4.2 Aesthetics as Experience
This selective review of aesthetic discourses in architecture and landscape architecture demonstrates that we have posited one universal principle after another to justify aesthetic choices, often based on what we claim to be natural. At the same time, within these three foundational texts, there are suggestions of an aesthetic not determined directly by a natural rule or function. If we return to these texts and remove from consideration their references to natural laws, there is a remainder. When each of them discuss design, they hint at a human activity that goes beyond mathematical principles, functional efficiency, and ecological processes. As an inspiration for design, they describe a personal and poetic engagement with the world around them. From these remainders, I propose that we can construct an alternative definition of aesthetics.

Vitruvius defines beauty as three things: “when the appearance of the work is pleasing and in good taste, and when its members are in due proportion according to the correct principles of symmetry” (emphasis added, p. 17). If we put aside “the principles of symmetry” because they appeal to a so-called natural law, and if we put aside “in good taste” because it tries to make subjective taste into a universal social law; we are left with an aesthetics that occurs “when the appearance of the work is pleasing” (p. 17). This pleasing appearance, interpreted as a personal, subjective experience can form the beginning of an aesthetics not based on appeals to universal rules. For example, Figure 4 of the Pantheon in Rome suggests that there is something more to its experience than its classical proportions.

Figure 4. The Pantheon, Rome, Italy. Source: Katherine Melcher
In Sullivan’s essay, even though what is most-widely remembered is the call for efficient forms, personal experiences within the physical world take center stage when he describes his inspiration for design:

Yet to the steadfast eye of one standing upon the shore of things, looking chiefly and most lovingly upon that side on which the sun shines and that we feel joyously to be alive, the heart is ever gladdened by the beauty, the exquisite spontaneity, with which life seeks and takes on its forms in an accord perfectly responsive to its needs. (p. 91)

His poetic invocation for design, might draw inspiration from nature, but it seems to be about something grander than practical and mechanical functions:

Yet the moment we peer beneath this surface of things, the moment we look through the tranquil reflection of ourselves and the clouds above us, down into the clear, fluent, unfathomable depth of nature, how startling is the silence of it, how amazing the flow of life, how absorbing the mystery. (p. 91)

These experiences he describes are not a simple, efficient, means-end relationship with the world around him. It is not just what is in good taste, nor just what works well. As he describes the depth of nature, the amazing flow of life, and the absorbing mystery of it all, he is describing his inspiration for being a designer – what I interpret to be an aesthetic experience of being alive and connected in the world. I think that Sullivan’s aesthetic experience is an intense engagement with, to use Corner’s phrase, “the phenomenal richness of physical life” (p. 32). One can also observe in Sullivan’s architecture (Figure 5) that his invocation of “form follows function” did not mean to him a stripping away details and ornament, but instead is more of a celebration of the complexity of natural forms.

Figure 5. Louis Sullivan’s Wainwright Building, Saint Louis, Independent City, MO. Source: Historic American Buildings Survey (Library of Congress), https://www.loc.gov/item/mo0297/

Like Sullivan, Corner also waxes poetic about one’s physical engagement with the world. To the natural richness in the world as described by Sullivan, he adds and juxtaposes our cultural richness:

The lyrical play between nectar and NutraSweet, between birdsong and Beastie Boys, between the springtime flood surge and the drip of tap water, between mossy heaths and hot asphaltic
surfaces, between controlled spaces and vast wild reserves, between all matters and events that occur in local and highly situated moments, is precisely the ever-diversifying source of human enrichment and creativity. (p. 33)

Obviously, to portray Corner as a pure functionalist or ecological determinist is to misrepresent him. He might dismiss a design aesthetic that relies on static form, but he promotes an aesthetic of engagement with the world. He states: “The collective imagination, informed and stimulated by the experiences of the material world, must continue to be the primary motivation of any creative endeavor” (p. 32), and he concludes his essay with the statement: “I can think of no greater raison d’être for persisting with the advancement of landscape urbanism than this” (p. 33). Although he is not explicit about what this “imaginary” approach may be, his phrases suggest a design that values “material physicality”, “intimacy and difference”, “the tactile and the poetic”, as well as “local and highly-situated moments” (p. 33).

From these remainders – what is left within these theorists’ writings after the fascination for natural forms and functions are removed - we can develop an inspirational, attractive, and, useful definition of aesthetics. Aesthetics can be defined as an experience: a pleasing experience, as Vitruvius suggests. Drawing from Sullivan and Corner, we can conclude that it is an intense experience of engagement with the natural and cultural world in all of its phenomenally rich physicality. Defined this way, aesthetics is not another universal law dictating how a place should be designed or what it should look like; it celebrates the singularity of each person’s experience in the world. The aesthetic experience contains all types of functions (practical, mechanical, and organic), along with personal memories, cultural meanings, and the materiality of the physical world.

5 CONCLUSION
In these selected texts, aesthetic choices are legitimized by reference to so-called natural principles: Vitruvius uses the mathematical proportions found in nature, Sullivan turns to the efficiency of evolution, and landscape urbanists such as Corner claim ecological metabolisms as a natural imperative for design decisions. Especially in modern and contemporary theory, these so-called laws suggest that aesthetic choices should be determined by how nature functions, putting into question the role of human agency and creativity in design. However, each of these architectural periods expresses a distinct aesthetic style that is not contingent on a natural law or function; suggesting that, in design, there remain aesthetic choices that are human choices and not simply effects of natural systems or laws.

A closer reading of these texts reveals that, for their authors, design includes more than mathematical principles, functional efficiency, and ecological processes. For all of them, design also involves a subjective, human experience: a pleasurable experience of beauty, according to Vitruvius and a poetic engagement with the physical world, according to Sullivan and Corner. Aesthetics is described as an experience that combines practical functions, cultural meanings, personal memories, and affective responses with the material world that includes but is not limited to form.

This description of aesthetics is not a radical break from contemporary thought on aesthetics in landscape design. In fact, it complements the general understanding of aesthetics as a personal experience as seen in Spirn, Howett, Meyer, and Herrington’s work, and defined by Meyer (2016) as “a mode of interacting with and knowing the world” that involves “an art and science of sensory perception and cognition” (p. 35). But it does suggest that the idea of aesthetics as experience has been embedded within design from the beginning of its theorization, even when we considered it subordinate to natural law or functions.

What does this understanding of aesthetics as a personal engagement with the physical world mean for how we teach, practice, and evaluate design? On first consideration, at best, aesthetics as a subjective experience has little to give in guidance for how we design. At worst, it might challenge landscape architects’ traditional authority as experts in aesthetic judgment. If we believe that aesthetics are about subjective experiences, any solid grounding for aesthetic judgment (a guide for how we should design or how to evaluate what is designed) is impossible to find because each person has their own experiences, values, and tastes. This threatens landscape architecture’s traditional authority as expert designers – if everyone’s aesthetic judgment is equally valid, then why hire an expert? Perhaps this is the fear that keeps landscape architects from engaging with debates surrounding aesthetics.

I believe that this shaky ground for aesthetic judgment is not a threat but an opportunity for redefining the expertise of landscape architecture. Perhaps, as professionals, landscape architects’
expertise is not as an aesthetic taste-maker, but instead in the understanding of the relationships between our physical, sensible environment and our multiple, varying subjective experiences. Through attention to the detailed, tactile, and particular sensible environments we experience every day and a celebration of “the phenomenal richness of physical life,” designers can facilitate the engagement of people with their shared places on a humanistic and meaningful level. How aesthetics is defined and evaluated must therefore be highly-situated, based on both the people and the place involved. But, just because this aesthetics not grounded in law does not mean that we cannot debate it.

Yes, beauty is difficult, but it is difficult because it cannot be reduced to universal laws or natural functions. Aesthetics is not a science. It is a concept that we have created to explain something about how we experience the world that could not be captured within other concepts we had created. In this way, it escapes a definitive, objective, and measurable statement. This does not mean that we should put aside our aesthetic debates in pursuit of more concrete, achievable endeavors; it means that we can actively and creatively engage with the debate surrounding what aesthetics means, what we want it to mean – and in doing so, also debate what we want design to be. One version of this – based on the limited exploration of these three texts – is shared in this paper.

6 REFERENCES


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Title of Paper or Research: THREE MOMENTS IN AESTHETIC DISCOURSE: FROM NATURAL LAW TO PHENOMENAL RICHNESS

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Media Statement: This paper explores aesthetics through three historically-influential texts: Marcus Vitruvius Pollio (Vitruvius)'s classical triad of durability, convenience, and beauty; Louis Sullivan's modernist claim that "form ever follows function"; and James Corner's presentation of landscape urbanism in "Terra Fluxus". Each of these texts justify their version of aesthetics by referring to nature. However, for these authors, design includes more: design also involves a subjective, human experience: a pleasurable experience of beauty, according to Vitruvius and a poetic engagement with the physical world, according to Sullivan and Corner. Defined this way, design involves our desire to experience, interpret, and express our own interactions with the world.
METAPHORS WE SCAPE BY: THE POSSIBILITIES OF TERRAFORMING AS A NEW DESCRIPTOR OF LANDSCAPE

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1 ABSTRACT

Vocabulary has been a longstanding focus of landscape theorists, who have not only debated the various meanings of landscape and their consequences, but also offered a number of alternatives and specifications of place terminology. Drawing on arguments that language and metaphor have material impacts on the shape of the world around us, this paper explores what kinds of relationships and practices become imaginable through one emergent term—terraforming. Terraforming has its origins in science fiction, but has increasingly come to be used both by theorists in Science and Technology Studies and the Environmental Humanities as a critical descriptor, and by a wide array of other voices in disparate contexts. The paper explores how these terms extend or refine our understanding of environments and their formation, and the agencies they reveal. This is accomplished through a content analysis of dozens of these non-fiction references to earthbound terraforming. These linguistic possibilities are especially relevant in debates regarding the Anthropocene proposal and its underlying assumptions about humanity’s capacity to manipulate the planet’s systems. Critics of this proposal often employ a relational worldview that attempts to situate humans within environments, rather than maintaining a division between nature and culture. This project is shared by a number of landscape theorists, who have been developing alternative linguistic formations around landscape. Accordingly, terraforming can be seen as a term relevant to both conversations that has already demonstrated distinct metaphorical capacities in a variety of contexts.

1.1 Keywords

Terraforming, Relational Ontology, Anthropocene, Nonhuman Agency
2 INTRODUCTION

Noël van Dooren: Sorry … ‘terraform’? Is this science fiction vocabulary?

Fred Keijzer: Mm, I think it is more widely used. It simply means transforming non-Earth environments in ways that make them liveable for organisms from Earth, including humans.


What happens if we take seriously this observation by van Dooren, a Dutch landscape architect, which he made in an interview with Dutch philosopher Fred Keijzer in the Journal of Landscape Architecture, while discussing science fiction and otherworldly environments (Keijzer & van Dooren, 2015)? The idea of terraforming has its origins in science fiction of the mid-twentieth century, referring initially to the transformation of another celestial object for human habitation. But increasingly, the word is being used to describe a broad array of environmental modifications, in ways that touch upon what we typically think of as landscape architecture or environmental design.

Theoreticians in landscape architecture, geography, and other fields have engaged in a long dialogue about a key shared term, landscape, identifying both its strengths and its many weaknesses. They have also explored a range of other terms that qualify or respond to its identified challenges, such as scene; site and situation; and noun-like formations of ecology and the urban. More topological notions of systems, networks, and assemblages have gained increasing traction alongside models that emphasize relationships, emergence, and performativity. Each of these positions regarding (and alternatives to) landscape emerges in a specific context, which is formed by theoretical and practical interests within those disciplines, and the broader philosophical paradigm within which they travel. Moreover, each position within this diversity of conceptions opens up distinct possibilities for imagining and shaping what we commonly call landscapes.

As “the Anthropocene” has gained traction as both a scientific description of our current epoch and an element of the popular imagination, geological and atmospheric language has become increasingly prevalent. Ideas of atmosphere and world have received renewed interest, revealing still more possibilities. Humanity’s status as a geological or environmental “force” and associated calls for geoengineering (Crutzen, 2002)—generally defined as the intentional modification of the Earth’s atmospheric systems—have become a topic of ethical debate (Crist, 2013; D. Haraway et al., 2016; Malm & Hornborg, 2014). In this midst, terraforming has become increasingly used to refer to geoengineering activities proposed or already unfolding here on Earth at various scales and contexts, and especially to describe an array of activities that might otherwise be interpreted through more familiar landscape-derived metaphors and concepts.

This new way of referring to what we might usually describe as landscape has cropped up in a range of places, from theoretical literature in the Environmental Humanities to popular narratives, and even as a metaphor that has been selected as relevant in unrelated scientific papers. In the Anthropocene (whether taken as a fact of geological history or a contested paradigm), how we see relationships that produce environments is clearly changing. Further, we have the opportunity, in choosing between various characterizations of sites and contexts, to materially influence not only discourses but the world around us through our use of certain frames. Feminist Science and Technology (STS) scholar Donna Haraway, one of metaphorical terraforming’s biggest advocates argues that “it matters what thoughts think thoughts” (D. J. Haraway, 2016, p. 35). This paper takes that challenge seriously, and considers what becomes thinkable about the environments usually called landscapes when we think with terraforming instead. This exploration is conducted by drawing together references to terraforming in myriad contexts and comparing their descriptive potentials. Specifically, the paper identifies a number of dimensions—spatial and temporal scale, agency and intention, media, and environmental conditions—which terraforming extends as a description of landscape or environment formation.

These extensions offer an intriguing complement to recent efforts to imagine ever more relational and dynamic conceptions of landscape. The metaphorical potential of our descriptions of the places we encounter and inhabit is implied in these projects which aim to rethink that language. These efforts emerge in a context of ongoing attempts to theorize landscape’s bridging or hybrid character between nature and culture. And they are desperately needed now as a counter-point to the problematic mode of thinking that underlies the Anthropocene proposal, namely that humans have finally overcome nature once and for all.
Because landscapes are where the evidence for the Anthropocene and its proponents’ recommended solutions are situated, such theorizing is of critical importance.

3 THE PRODUCTIVE POWER OF METAPHOR

While theoretical notions of atmosphere and world might draw newfound potency from the material and scalar aspects of the Anthropocene imagination, and notions of situation, assemblage, and nexus highlight the relationality of landscapes, the gerund *terraforming* and its various conjugations—terraformed, terraformer, terraformation, and so on—render landscapes as constructed in a much more explicit way. Terraforming highlights the ongoing production of environments, and insists upon the clarification of subjects and objects. In doing so, it invites a richer articulation of the ways environments come to be, an important question in the so-called Anthropocene. As various authors use the word terraforming, they often draw attention to possibilities beyond human-focused conceptions of landscape as something made by or for humans, or at least framed by their vision. Instead, other agents come on to the stage, and other scales, media, and conditions become thinkable. For critics of the Anthropocene and modern-rationalist thinking in general—who often express a desire to overcome dichotomized thinking regarding nature and culture, and instead employ a relational model—terraforming offers a way of making such possibilities more apparent and explicit as ongoing and historical, rather than speculative processes. In doing so, it opens up the possibility for rethinking, and ultimately materially producing landscapes in this way.

This is possible because metaphors play such a powerful and foundational role in our thinking. Metaphors aren’t simply linguistic references or comparisons, but fundamental to how we understand the world, capable of “highlighting and hiding” certain aspects of it (Lakoff & Johnson, 2008, p. 10). Landscape can be investigated through the metaphors that structure it. Landscape can be understood for instance as a revealing cross-section, as a culturally-produced text, or a way of seeing, each metaphor emphasizing distinct features (Demeritt, 1994). The ways that landscape is represented exist within a field of references that often have political implications, for instance landscape’s association with the feminine within a dichotomized hierarchy (Meyer, 1994). Newer metaphors, such as Haraway’s cyborg and Latour’s networks can also provide opportunities to shift our perspective regarding those problematic nature-culture binaries (Demeritt, 1994).

We can also make material changes to the worlds that metaphors conceptually discursively reveal or mask. These processes are in fact intertwined, or co-produced. As STS theorist Sheila Jasanoff argues, “the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it” (Jasanoff, 2004, p. 2). These socially circulating ideas contribute to broader spatial imaginaries—“socially held stories, ways of representing and talking about places” (Watkins, 2015, p. 509). While earlier theorists of spatial imaginaries have focused on their linguistic or representational aspects, increasingly imaginaries are recognized as co-productive with material practices. We perform imaginaries in the world as we imagine it to be, and the world responds, in ways that in turn reshape our imaginaries and their constituent concepts.

Jasanoff and Kim further articulate this thinking through the concept of "sociotechnical imaginaries," emphasizing the co-productive relationships between groups of people, technologies, ideologies, and the material world, and the political nature of these complexes (Jasanoff & Kim, 2015). A corollary to this line of argument is that there is an ethical dimension to the practices we use in the world: our technologies have the potential to make certain forms of life and the worlds they require more or less possible, creating winners and losers (Winner, 1986). Another STS theorist, Karen Barad, argues for thinking in terms of “ethico-onto-epistemologies,” drawing together our modes of representation and ontological assumptions about what things are with our material practices and their outcomes as fundamentally inseparable (Barad, 2007). This through-line, from foundational assumptions and concepts to ethical outcomes, is precisely the one that Haraway traces when she says “It matters what thoughts think thoughts. It matters what knowledges know knowledges. It matters what relations relate relations. It matters what worlds world worlds.” (D. J. Haraway, 2016)

The Anthropocene proposal is riddled with problematic tropes of geological agency and planetary stewardship that can be unpacked through this kind of critical attention to metaphors (Rickards, 2015). Its critics argue that the Anthropocene in fact bundles together a number of ideas, including descriptions of planetary change and an emphasis on certain technological interventions to address them (Crist, 2013). But if the Anthropocene’s proponents highlight humanity’s technological capabilities, whether for ill or for good, it hides both the differences between various groups of humans and economic systems, with distinct
capacities to exercise geological agency and experience harm (D. Haraway et al., 2016; J. W. Moore, 2017), and the role of nonhumans, both in the past and in the future, in shaping the world (D. J. Haraway, 2016).

For Haraway, it is terraforming, as an earthly, rather than other-worldly practice, that holds the promise of allowing us to act and think more responsibly as we co-productively engage with both our environments and our attitudes about them. The Anthropocene metaphor, with its overemphasis on human agency, is particularly problematic, in that it not only conceptually incapacitates nonhumans, but also limits our ability to imagine a more relational mode of environment-making. As will be shown below, this isn’t simply an optimistic or idealistic hope that Haraway points to. Instead, terraforming, as a metaphor, seems to actually make such possibilities thinkable for many who use it.

4 THINKING SITES RELATIONALLY

Scholars of landscape have long been engaged in efforts to articulate relationships between humans and nature, and employed varying conceptions of landscape to that end (Wylie, 2007). As noted above, a significant goal of the metaphorical work of figures like Latour and Haraway has been to supplant those distinctions entirely (Demeritt, 1994), and facilitate a reimagining of what might be called naturecultures (D. J. Haraway, 2008). This revealing and moving beyond dualist conceptions of nature and culture, toward a more relational mode of thinking and acting, has been of significant interest for many theorists, including not only those in STS, but a broader philosophical lineage. Their tradition includes Deleuze and Guattari’s rhizomatics (Deleuze & Guattari, 1987), Alfred North Whitehead’s earlier process philosophy (Whitehead, 1929/1978) and John Dewey’s Pragmatist notion of emergent publics (Dewey, 1927/2016), and is also reflected in systems thinking-influenced philosophies of assemblage (DeLanda, 2016) and posthumanism (Wolfe, 2010). The kinds of relational thinking these authors represent has been influential in contemporary literature in STS and the environmental humanities, and are reflected in a number of shifts, which highlight key features of this mode of argument, including the Nonhuman / Multispecies Turn (Grusin, 2015; Kirksey & Helmreich, 2010), and the Relational / Ontological Turn (Castree, 2003; Mol, 1999).

Theorists of landscape as both an interpretive and practical tool have pursued a number of agendas that resonate broadly with the concerns of many relational thinkers. For instance, Elizabeth Meyer has explicitly challenged binary thinking about landscape through a feminist lens that references Haraway’s cyborg trope (Meyer, 1994). And Kenneth Olwig’s exploration of the "substantive nature of landscape" through investigation of landscapes as emergent from situated politics in Western and Northern Europe (Olwig, 1996) provides a historiographic grounding for what Latour describes as a thing-politics better suited to addressing the relational assemblages of humans and nonhumans he describes than our conventional framings of environmental politics (Latour, 2005). And John Wylie meanwhile proposes a relational and material phenomenology of landscape, rereading the landscape gaze through the work of Deleuze and Merleau-Ponty, as well as Latourian Actor-Network Theory (Wylie, 2006). More broadly, there has been a turn toward ideas of performativity and emergence in landscape practice, which is especially evident in the work and writing of many landscape urbanists (Barnett, 2013). While that project proceeds broadly from a systems sensibility, there are also arguments for a return to landscape “gardening” as a historical description of, or metaphor for, ecological landscape practice, which has newfound relevance for thinking performatively (Raxworthy, 2003; Weilacher, 2016).

The theorization of other terms for landscape is significant in this context. Sites can be understood in terms of its "upstream" and "downstream" affective registers, moving beyond received notions of bounded space (Burns & Kahn, 2005). Situation can emphasize the possibilities of emergence among an array of actors present (Barnett, 2013). Assemblage, well-worn at this point, emphasizes the contingent relationships among those various actors, near and far. Notions of atmosphere emerge both in an attention to the specific conditions, materiality, and productive technologies of space (Gissen, 2014), and in more philosophical attention to affect (B. Anderson, 2009). Worlds and worldmaking, likewise, have become a common refrain for many in recent multispecies writers, who employ the term to emphasize the emergent and ongoing processes (Ogden, Hall, & Tanita, 2013). This language has also been picked up in a few instances regarding design, with worldmaking offering a way to account for design’s ability to imagine forms of life, which structures facilitate (S. Anderson, 1987). Worlds can be understood, like assemblages, in terms of topological density, more connected to themselves than to other places (Bryant, 2014). And it is from this point that Haraway’s use of the term most directly extends, qualifying the world metaphor by turning to a neologism that makes explicit both the earthly materiality and constructedness of worlds, while implying actors that produce them at the same time.
Moving forward, this paper argues that Haraway's evocative use of terraforming is not merely a clever if ultimately marginal trope, but rather one with greater potential and resonance, used by authors writing both before and after her recent book and the essays it is culled from, many of whom are likely unaware of her work. Terraforming is in fact an emergent term, and one whose metaphorical potentials speak specifically to the concerns that many of these landscape theorists have called attention to in their exploration of expanded vocabularies of place.

5 REDEFINING TERRAFORMING

Terraforming has its origins in science fiction of the mid-twentieth century, referring initially to the transformation of another celestial object to be habitable for Earth-originating organisms. It can be considered a form of planetary engineering, and is typically differentiated from geoengineering by the target of the activities—elsewhere or Earth respectively (Fogg, 1995). It was initially coined in "Collision Orbit," a short story by Jack Williamson (writing as Will Stewart), where he described the transformation of a range of celestial objects, from small asteroids to planets, into breathable worlds with familiar levels of gravity, by spatial engineers, trained in professional college programs and working for interplanetary engineering firms (Stewart, 1942). Since then, the term has proliferated, and its varied usages can be synthesized into three related planetary activities: modify other worlds to support life from Earth, modifying Earth to support alien life, and modifying Earth generally (Prucher, 2006).

Chris Pak, a literary scholar writing on terraforming's use in fiction, highlights ways the term has been used over time to reflect upon and respond to changing attitudes about the environment in policy and the general public, revealing fictional terraforming accounts' political or critical dimensions. But he notes that the third and most recent definition (circa 1997), reflects "a shift in awareness of humankind's ability to alter planets through climate change and other global effects" (Pak, 2016; 2). Pak also links terraforming to "landscaping," which he defines as the conversion on nonhuman environments into ones that support and are imbued with meaning by humans. Terraforming, as an environmental literary trope, thus becomes a venue by which to reflect on these activities, especially and most recently, as this third definition brings these ideas home to Earth. "The ability to alter the landscape and the ethical dilemmas this poses direct attention towards the future," Pak writes. "The fundamental question asked is how we want to live, and it emerges from the concern over whether we can continue living in ways that threaten the integrity of our environments" (Pak, 2016, 17). It is this moment that this paper enters into, expanding on Pak's statement to explore instances of this third definition in nonfiction texts, trying to understand how, in the last twenty years, this term has begun to infiltrate our conceptual terrain, providing opportunities to reframe descriptions of landscape in the Anthropocene.

Terraforming's transition from fiction to speculative science is marked by a small but compelling discourse about precisely what constitutes terraforming, and its relation to other candidate terms, among them planetary engineering, ecopoiesis (Haynes, 1990), and planetary ecosynthesis (Averner, 1976). The transformation of a planet into a lively environment can be conceived of as a transition through ecological succession, from early bacteria and lichens through the introduction progressively more complex forms of life (Graham, 2004). Ecopoiesis has come to be used to refer to the earliest phases of such a succession (Haynes & McKay, 1992). But ecopoiesis is a term that in its initial conception was much more open-ended, suggesting the establishment of an environment or ecosystem in ways that might not be directly oriented toward human benefit (Haynes, 1990). This emergent, rather than directed conception of planet-making is one that Haraway's exploration of terraforming resonates with. She writes, "from the start, the greatest planetary terraformers (and reformers) of all have been and still are bacteria and their kin," but also gives recognition to "the spread of seed-dispersing plants millions of years before human agriculture" as a "planet-changing development" (D. J. Haraway, 2016, p. 99). This provocation situates humans' planetary agency not as something newfound or unique, but in fact an old and well-established aspect of life generally. As will be shown below, this more-than-human sense of the word is one that many of its users intuitively recognize and emphasize in their usage of it.

6 TERRAFORMING AS A RELATIONAL CONCEPT

Haraway's imaginative calls are compelling in their own right—the idea of a world made and remade in messy but fulfilling ways by assemblages of humans and nonhumans provides a powerful counterpoint to the technocratic solutions to contemporary challenges of climate recommended by Anthropocene advocates. The term provides a way to situate arguments that multispecies practices of soil carbon
sequestration through regenerative agriculture and similar practices can make a significant contribution to carbon drawdown (Leu, 2017; Rhodes, 2017). But perhaps even more compelling than the theoretical articulation of terraforming is the thin, if already widely spread use of the term to describe practices of environmental modification by humans and nonhumans alike.

To document this pattern, references to earthbound terraforming were gathered from dozens of non-fiction sources. The examples of terraforming on which this discussion is built do not represent every usage of the term, but in their variedness, provide a representative sampling of how the term is being used. They emerged through a slow gathering process incidental to a broader research effort, and were supplemented by online, content-aware searches of books, journal articles, websites, and periodicals, as well as word of mouth contributions from colleagues. The rigor of the sources ranges from well-known books by established Environmental Humanities scholars and academic papers to journalistic blog posts and student projects. Rather than limiting this analysis to only those instances published in academic contexts, the analysis tends toward breadth, seeking to capture the emerging senses of the term, which might be more exploratory in less-established or edited uses. The success of this broader casting of the net also reinforces the argument that this term is entering into and circulating within the environmental imagination in many different ways, beyond the confines of critical environmental discourse.

Terraforming is a concept with utility across a broad range of disciplines and discourses, as evidenced by the wide range of authors, from various fields, who chose to describe their objects of study in this way. Among these fields are environmental policy, criticism, and design, but surprisingly also medicine, biology, and history. The deployment of terraforming in historical and critical environmental writing in particular is quite often an ironic provocation, a purposeful choice that reveals some deficit in our conventional mode of thinking about relationships between agents and environments. Clearly, these authors all recognize in their own ways that words have significant power to shape what we imagine is possible. The sections that follow discuss at a finer grain the results of a comprehensive content analysis of these varied uses. They are explored across six interrelated dimensions: agency and intention, spatial and temporal scale, and media and condition. In each case, these authors have contributed to a sometimes dramatic and sometimes subtle stretching of our conception of just what environments are and how they come to be, making new metaphorical links and opening possibilities for rethinking how we manipulate landscapes in less anthropocentric terms.

6.1 Agency and Intention

One of the most important challenges these texts raise is the question of agency—who is acknowledged as having the ability to manipulate environments? The agents identified range broadly in size and cognitive capacity, extending well beyond human engineers and planners, to nonhumans and even nonliving entities, as well as technological systems in which those actors are embedded. Despite its futuristic origins, many authors have found terraforming a useful way by which to interpret earlier societies. These include early hunter-gathers (Lovett & Poudyal, 2006), indigenous groups in North and South America (Giordano, 2009; Mann, 2011), and early colonial efforts (Barton, 2004; Wilkinson, 2004). Such descriptions resonate with contemporary notions of cultural landscapes, but highlight the uniquely productive dimensions of these places, and don’t depend heavily on distinctions between designed or vernacular landscapes. Instead, the interrelationship of cultures, production, and ecologies becomes expressed as integral. It also recasts these practices as contemporary, even futuristic, perhaps even surpassing our own understanding of the possibilities of transformative landscape management. Such a move provides a counterpoint to longstanding associations of indigenous groups with nature.

Landscapes are typically thought of as the product of a dialogue with human subjects, whether through their active manipulation, their drawing upon the landscape as resource, or through their gaze. But subjectivity and the acknowledgement of agency that coincides with that status are extended in several of these references to terraforming. Some of these references simply extend agency to charismatic nonhumans, but others more provocatively blur the sense of individuality associated with terraforming entities altogether, muddling affect and intention in ways that resonate with Jane Bennett’s calls for anthropomorphization as a materialist tool, and her notion of distributed agency (Bennett, 2010). One scientific paper with a much less philosophical agenda uses terraforming to describe the activities of Antarctic springtails, small arthropods whose molted skin binds together small mineral particles in ways that create a beneficial sheltered environment (Hawes, 2016). Likewise, cancer cells are described as terraformers in a couple of instances, suggesting that our body’s tissue is an environment that can be
transformed (Perone & Magnani, 2016; Yang et al., 2014). This reference provides a fascinating extension of Haraway's calls for kinship with other earthly terraformers—not only are we related, we and our cancer cells are one flesh, so to speak, battling over the appropriate reconfiguration of our material structure, with distinct takes on what parameters facilitate flourishing.

At the farthest end of this spectrum, glaciers and climate systems are also described as terraforming landscapes, in ways that differentially impact various ecological communities and the hominid species that inhabit them, for instance favoring our own species over our Neanderthal cousins (Lee, 2009), or changing ecosystems and their constituent species composition more broadly (DeWalt et al., 2016). Some authors in the Environmental Humanities pose the possibility of terraforming as an emergent phenomenon, arising not from humans as intending individuals, but as collectives integrated with their technological systems (Luke, 1997; Luke, 2015; Woods, 2014). Even a sociotechnical assemblage such as an airport could be considered a terraformer (Fuller & Harley, 2004). Collectively, these instances suggest that a lack of intention we associate with thinking individuals need not be a disqualification to being a terraformer, nor is biological life as such a requirement. Habitat formation for oneself, while a significant function for many, is also not essential—impacting the habitat of someone else can be terraforming, if one is a glacier, for instance. This point also applies to humans: there are always winners and losers in environmental modification. This expanded sense of agency touches upon the relational ideas of site outlined above, extending the zone of action and affect upstream and downstream from immediate environments.

A final theme that complicates definitions of agency are ideas of emergence and intention as factors within terraforming acts. Does terraforming emerge from the accrued effects of non-coordinated entities or the behaviors of systems that are more than their individual actors, or is it a directed activity, that, guided by an individual organism or coordinated group, results in niche construction or environmental modification? The authors employing these terms take different approaches, even as they describe the activities of similar agents. Those describing geo-engineering schemes imagine directed human activities, whether in rogue experiments or coordinated international policy; some environmental writers, however, anticipate a more complex set of relationships between humans and their systems that doesn't flow from any particular intention, yet still has global effects (Luke, 1997; Morton, 2016). And Haraway takes an emergent view that entangles the active agencies of humans and nonhumans—terraforming simply can't be a one-species show, regardless of the level of intentionality attributed to any particular organism (D. J. Haraway, 2016).

6.2 Spatial and Temporal Scale

The range of sites and scales that these terraformers engage with is equally broad, from the tissues of the human body to regional ecosystems and the global atmosphere. In the middle ground, terraforming refers to more familiar and localized scales of site design and microclimate manipulation (Agency Architecture, 2014; Wei, 2015), land disturbance (Dance, 2016; Jackson & della Dora, 2016; L. J. Moore, 2014) and ecosystem modification (Barton, 2004; Wilkinson, 2004). For many, it is a regional process, playing out at the scale of a continent or biome (Cathcart, 1995; Lovett & Poudyal, 2006; Mann, 2011). This breadth suggests a very elastic definition of the scale of what constitutes a site or an environment. But this elasticity of scale shouldn't be read as a muddying of terraforming's typical planetary conception: after all, the original use of the term referred to the terraformation of an asteroid only two kilometers across (Stewart, 1942). Instead, this original use, which describes the creation of favorable gravitational, thermal, and atmospheric conditions, implies that site emerges in relationship to the environmental conditions desired, and the systems that produce those conditions. Absolute scale, it seems, is secondary to more relative notions of site and system for these authors.

Time provides an additional dimension, ranging from terraforming gestures imagined as a directed act unfolding at familiar construction schedules to the slow emergence of changing conditions over many generations, and even geologic periods. While long-range planning activities may occasionally work with the possibility of multi-generational development in mind, and historical analysis of some cultural landscapes recognizes their development over hundreds or thousands of years, much of typical design action is focused on short-term transformations. Only recently have more process-oriented unfoldings become a part of design inquiry and practice. Conditions produced through undirected and collaborative actions, where designers become one among many in a long relay, significantly challenge that identity. In these instances, design and its notion of bounded, targeted intervention or object production no longer apply. Sites and effects are no longer coterminous in time and space, or nested hierarchically in clear units. Instead “flat ontologies” that can trace these connections wherever and whenever they lead are required.
6.3 Media and Conditions

Related to this sense of scale are questions of medium and conditions—what do terraformers manipulate directly, and how is this connected to desired environmental outcomes? With its reference to previously lifeless worlds like Mars, terraforming implies that no environmental variable, whether atmosphere, temperature, gravity or magnetic field, is taken for granted; each emerges as some action or effect, through some material intermediary, which must be accounted for. There is no longer a passive external container called nature which supplies these conditions.

In many references to terraforming, there is a familiar focus on management of the vegetal components of ecosystems, but also a greater attention to the production of underlying environmental needs, such as soil and irrigation. There is also a greater acknowledgement of their ability to frame certain forms of social life and interdependent plant and animal communities, especially in the case of historical references (Giordano, 2009; Mann, 2011). In more speculative descriptions of earthbound practices, these conditions become variables that are explicitly identified, as in a call to irrigate and plant the Sahara, with increased rainfall implicated as a byproduct of such actions (Bushnell, 2006).

There is also recognition of direct and indirect atmospheric impacts from a variety of organisms' respiration. Cyanobacteria, for instance (D. J. Haraway, 2016), manipulated the global atmospheric composition through increases in waste oxygen, triggering the Great Oxygenation Event, a global extinction, conditions to which life eventually responded, leading to oxygen-breathing species like ours. Bacteria are also proposed as a tool—manipulated through genetic engineering—by which increase carbon sequestration (Solé, Montañez, & Duran-Nebreda, 2015). At the historic end of the technological spectrum, grazing animals and fire are used to maintain a savannah landscape at a regional scale (Lovett & Poudyal, 2006).

These and other terraforming references point to a greater willingness to grant agency to or manipulate animals as part of terraforming schemes, recognizing their niche-constructing and ecosystem engineering capabilities. But biopolitical engagements with the animal kingdom are not often considered in landscape theory and descriptions of practice. More often animals are seen as passive beneficiaries of habitat production schemes by those concerned with landscape—conceptually separate wildlife. Recent interest in oyster restoration and the beneficial filtering side-effect of their respiration-like approach to feeding hints is one of a few compelling exceptions (Orff & SCAPE, 2016), illustrating a thematic extension of design practice terraforming might speak to better than vegetal and pastoral notions of landscape.

If the core of environmental modification by humans has been vegetation management and infrastructural interventions, the attention to more mobile and diffuse nonhumans such as animals and bacteria is a provocative extension, and one that insists upon an extension of agency at the same time, challenging our ideas of media at the same time that it is expanded. While the misbehavior of plants or technology can be written off more easily as a design flaw, animals’ opinions and agendas are much harder to ignore. For instance, an analysis of dairy cows reveals that they are collaborative workers in the milking operation whose lack of cooperation would make the task almost impossible (Porcher, 2017). Whether for the historic maintenance of a savannah or contemporary regenerative grazing schemes for carbon sequestration, animals are our terraforming collaborators, and we are theirs, each embedded in a broader complex, and structuring our respective behaviors in response to our position in a broader complex. In this light, plants should also be seen as lively, rather than simply material (Elkin, 2017).

And so, we should also turn this reflection on media toward ourselves—humans become media not only when our tissues are terraformed by metastasized tissues, but as we modify own practices. Without treading too far toward environmental determinism, it is worth noting again that environmental and social forms of life are co-productively connected, in ways that blur medium and condition.

7 CONCLUSIONS

This paper makes two major claims: first, that terraforming is an emergent description of landscape practice across an array of literatures, and second, that it opens up certain metaphorical possibilities for rethinking landscape formation relevant to contemporary theoretical challenges, namely an increasingly relational mode of operation. This isn’t simply an ambition, but as the references collected to produce the study show, a demonstrated change in thinking, and in a few cases, in practice. The authors who explicitly invoke terraforming as a different or novel form of spatial practice, whether for good or for ill, but one that
regardless invites reflection on our relationships to the world around us, and the understandings that structure those relationships.

The uses of terraforming drawn upon in this analysis include design and activist artworks that stretch our notions of sculpture and architecture, landscape and habitat. From collaborative artworks that engage with other species or narrate possible worlds to structures that leverage plants to recover volcano-devastated ashfields and sea-level impacted beaches, these projects don't just shape or create spaces— they realize processes in ways that blur notions of agent and scale, medium and condition. In these works, and in historic landscape, forestry, and agricultural practices now described as terraforming, we see patterns and forms that are familiar, but also different, and richer. The unsettling character of these projects and descriptions is important to grapple with, not so much because it is new, but because it has always been there, embedded in the practices we call landscape and architecture. But now, with a different metaphor, previously hidden dimensions have been highlighted.

This project began with an attempt to understand how and why a seemingly inapplicable word—terraforming—was being used to describe environmental manipulations at familiar scales and with familiar tools. As Haraway argues, the concepts we use to frame lines of analysis permit certain possibilities and not others. The authors who mobilize the terms highlighted—worlds, atmospheres, terraforming—select these terms over more familiar ones, such as landscape, site, or environment, precisely because of the possibilities that become open to being thought through their usage. Following in the footsteps of the dozens of authors evaluated through this work, perhaps landscape architects should consider what this expanded vocabulary of environmental design offers, in terms of new modes of imagining and practicing. Such an effort will reward those who do so with new ways of describing environments, new media to engage with, and the possibility of imagining new forms of life. This engagement also presents the opportunity to contribute something significant to conversations about the future of the planetary environment—specifically by raising the aesthetic, cultural, and experiential possibilities that are emerging, or might be lost, as we continue to terraform the Earth in the Anthropocene. Terraforming, as a practice that attends to other actors and other outcomes, invites reflection on alternative ethics and principles for practice (Raghavan, 2013). Landscape architecture, reread through this metaphorical lens, can consciously become a world-making enterprise, one that is perhaps better equipped to world for multispecies flourishing, in an ethical and equitable manner.

8 REFERENCES


DIAGNOSTIC POST-OCCUPANCY EVALUATION OF THE LANDSCAPE ENVIRONMENTS IN A PRIMARY CARE CLINIC: ENVIRONMENTAL AND SOCIAL PERFORMANCES

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1 ABSTRACT  
Hospitals and other healthcare facilities are resource intensive. Facing increasing challenges due to global climate change, healthcare facilities have taken the initiatives to design and build their campuses using sustainable strategies. Low impact developments (LIDs) and green infrastructures have been integrated into medical campuses to support landscape performances. Meanwhile, healthcare facilities’ landscapes and gardens have been recognized as contributors to a supportive and therapeutic care environment for patients, visitors, and staff. However, in observance of the emerging studies and trending practices in the realm of healthcare landscape research and design, comprehensive post-occupancy evaluations (POEs) of the built landscape environments regarding their performances and users’ experiences have been insufficiently conducted and reported to date. This paper examined the environmental and social aspects of landscape performances of a primary care clinic following a holistic diagnostic POE approach, including various LID practices and the impacts on stormwater management and carbon emissions. A panel of experts evaluated the human-perceived restorativeness of the clinic’s various green open spaces using an audit toolkit. Users’ behaviors were observed onsite and documented through behavior mapping. A focus group interview was also conducted to explore users’ perceptions and attitudes about the built landscape environments. This study revealed that various LID practices improved stormwater management, reduced carbon dioxide, and conserved landscape irrigation water demand on the clinic site. Nature and restorative elements improved users’ satisfaction about the clinic environment. Barriers to the effective usage of certain areas were identified and discussed including physical access, seating and shading structures, and color plant palette.

1.1 Keywords  

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2 INTRODUCTION

2.1 Research Background

Hospitals and other healthcare facilities are energy-intensive amenities. According to the United States Environmental Protection Agency, healthcare organizations spend more than $6.5 billion on energy each year, and this amount continues to rise to meet patients' increasing needs (United States Environmental Protection Agency, 2007). Large hospitals account for less than 1% of all commercial buildings but usually consume more than 4% of the total delivered energy used by the commercial section (U.S. Energy Information Administration, 2012). Healthcare facilities also consume a large portion of municipally supplied water each year: Water used in hospitals and other healthcare facilities comprises 7% of the total water use in commercial and institutional facilities in the United States (United States Environmental Protection Agency, 2017b). The healthcare profession is committed to doing no harm, yet the construction and daily operation of many healthcare facilities are among the largest producers of greenhouse gases and toxic waste. Facing the increasing challenges of global climate change and the environmental links to many public health issues, healthcare facilities have taken the initiative to design and build their campuses following sustainable and resilient strategies. As stated by Health Care Without Harm (HCWH):

Increasingly it is clear that in order to prevent diseases in the general public, we need to understand the environmental links to those diseases and do whatever we can to reduce environmental exposures. Of all the sectors of society who should understand this growing science, it should be the healthcare sector—they are in the healing business. And they have a responsibility to clean up their own house. (Pionner Team Blog, 2008)

Healthcare institutions are responsible for including and maintaining environmental spaces, especially outdoors. In the recent decade, one of the primary goals of the healthcare industry has been building and operating facilities with the least amount of environmental impact while providing a high-performing healing environment. Organizations and programs have emerged that focus on promoting sustainable design and the operation of and green care giving at healthcare facilities, including the contributions of Health Care Without Harm, Therapeutic Landscapes Network, The Center for Health Design, and Practice Greenhealth Program. In addition, an emerging body of literature has contributed to the advancement of sustainable healthcare design and research. Verderber (2010) identified six patterns in the relationship among the built environment, human health, and sustainability from a historic perspective, where people–nature connections take the leading and constructive position, including natural ventilation, natural daylight and view, water and sanitation, landscape, building configuration and site planning, conservation of historic resources, and local building materials and self-sufficiency (Verderber, 2010). Guenther and Vittori (2013) thoroughly discussed key sustainability indicators organized in six categories for sustainable healthcare architecture, including site planning, form and façade, water, energy, materials and construction practices, and community. These components apply to architecture interiors and the external landscapes when planning and designing healthcare facilities.

In addition to sustainable site development, material application, and construction procedures, a sustainable medical campus should also be defined as a safe and supportive environment that positively contributes to the physical, emotional, social, and even spiritual well-being of occupants (Wittmann, 2010). For healthcare designs specifically, the restorativeness of the built environment is a domain of performance that needs extra highlighting. Restorativeness is a concept derived from Stephen and Rachel Kaplan's (1989) psychological theory of the restorative environment. Nature ideally satisfies the Kaplans' criteria for a restorative environment, which must provide a sense of being away, be perceived extensive yet connected to a larger context, evoke people's fascination, and be compatible with the needs of the individual. Therefore, nature and gardens are increasingly being incorporated into healthcare facilities as core design components. On one hand, accumulating empirical evidence has demonstrated the therapeutic essence and various health benefits nature could provide to facility occupants, such as reducing occupants' stress (Dijkstra, Pieterse, & Pruyn, 2008; Ulrich, 1999), enhancing staff's alertness and reducing medical errors (Pati, Harvey, & Barach, 2008), reducing patients' pain and length of stay (Ulrich, 1984; Vincent, Battisto, Grimes, &
McCubbin, 2010), and enhancing patients’ overall satisfaction with the healthcare facility (Verderber, 1986). Nature and gardens serving as green infrastructure, as another primary component, could significantly improve the site's resilience through stormwater runoff management, air quality purification and the reduction of environmental carbon dioxide, and wildlife habitat restoration. Guenther and Vittori (2013) studied 55 sustainable healthcare facilities; 53 of them integrated biophilia principles that enhanced people–nature connections and 37 projects integrated innovative stormwater management strategies onsite. The 2014 Guidelines for Design and Construction of Health Care Facilities moved “access to nature” from the Appendix to the Environment of Care section as a new key element, further reinforcing the momentous role of nature in the physical environment of healthcare settings (Cooper Marcus & Sachs, 2013).

Regarding the quantification of sustainable parameters of a healthcare landscape environment, Green Guide for Health Care (2007) is an informative source and functional toolkit for examining the design, construction, and operation management of healthcare facilities. The Leadership in Energy and Environmental Design (LEED) is a more widely recognized tool for measuring and certifying the environmental sustainability of building design and constructions. Hospitals are slowly acquiring LEED certification: To date, 37 healthcare facilities achieved LEED Building Design and Construction Certification as documented on the U.S. Green Building Council’s (2017) project directory. Compared to other building categories, healthcare facilities account for a very small portion of the total number of certified buildings, equaling 3% of the total LEED certified schools and 9% of the total LEED certified retail projects in the United States (U.S. Green Building Council, 2017). LEED BD+C primarily measures performances of the building and interiors, and only a few of the criteria, such as sustainable sites and water efficiency, feature exterior environments (U.S. Green Building Council, 2017). The SITES rating system, developed by the Sustainable Sites Initiative (2014) to quantify sustainable features of landscape design and land development, could be a supplementary metric when evaluating the landscape sustainability of a medial campus. However, among the 49 SITES certified projects to date, none are healthcare related (Sustainable SITES Initiative, 2017). Due to the complex nature of sustainability and conflicting parameters the existing metrics are not comprehensive from a holistic standpoint (Peters & Verderber, 2017). For example, LEED and SITES only measure certain criteria and do not include spatial quality of the built environment, the occupants’ satisfaction with the facility, the design’s relationship to history and culture, and many other criteria that designers find essential for analyzing the sustainability and quality of buildings and landscapes (Peters & Verderber, 2017).

Advocacy has grown for healthcare facilities taking steps to evaluate and certify gardens through rigorous post-occupancy evaluations (POEs), a contribution of the field of environmental psychology that is commonly used in the field of architecture to evaluate a built work in terms of the design itself and users’ needs (Bechtel, 1997; Davis, 2011; Zeisel, 1984). In the last 20 years, gardens in healthcare settings and their impact on various users have often been studied through the use of POEs, which has helped summarize effective suggestions for the design of future hospital gardens (Davis, 2011). Diagnostic POE is the most comprehensive POE strategy that evaluates the utilization of the space compared to the goals of the original design and how the design intents were translated into physical forms (Cooper Marcus & Sachs, 2013, 2014). The use of multiple methods to provide reliable findings is critical to a diagnostic POE, such as using behavior traces and activity mapping to record the typical usage pattern of the space, project context and site analysis, interviews with the original design team, interviews with facility staff and essential users, and observation of plant health and site maintenance (Cooper Marcus & Sachs, 2014). Previous scholars have used the diagnostic POE approach (Davis, 2011; Pasha, 2013; Sidenius, Nyed, Lygum, & Stigsdotter, 2017), and the Garden Assessment Tool for Evaluators (GATE), an audit toolkit developed to quantify healthcare gardens’ restorative benefits and social supports, has attracted continuous research interest (Sachs, Cooper Marcus, & Barnes, 2016).
2.2 Research Purposes

This study attempted to develop a holistic approach to evaluate the environmental and social performances of the landscape environments of a healthcare facility that claims sustainability. A diagnostic POE of the landscape environments of a community outpatient clinic was conducted following the holistic approach. The purposes of this study were to (1) explore the extent to which the design and utilization of various outdoor green spaces in a healthcare facility fulfill the original design goals; (2) understand the successes and weaknesses of these green spaces regarding the functionality in maintaining the site sustainability and providing health benefits; (3) evaluate the human-perceived levels of restorativeness of various green spaces in the clinic environment, and (3) summarize design suggestions that could promote psychological, emotional, and social support for facility users as indications for future practices.

3 RESEARCH METHODS

Quantitative methods were most helpful when answering questions of “what” the relationship was between specific variables whereas qualitative methods addressed process-oriented questions to determine the “why” and “how” of a phenomenon (Adler, 1996; Leech & Onwuegbuzie, 2007). Mixed methods can increase research credibility, facilitate data validation, and overcome the weaknesses or intrinsic biases that come from a single method (Bogdan & Biklen, 2006); therefore, the mixed methods approach has become prevalent in healthcare design research (Nejati, Shepley, Rodiek, Lee, & Varni, 2016; Shepley, 2011). This study adopted mixed methods following a holistic diagnostic POE model (Figure 1).

3.1 Environmental Performance Measures

As Figure 1 indicates, for environmental performances, the reduced stormwater runoff onsite was estimated using the National Stormwater Calculator developed by the United States Environmental Protection Agency. The calculator is a software application developed based on the EPA’s Storm Water Management Model (SWMM) for computing small-site hydrology for any location within the United States, based on local soil conditions, land cover, and historic rainfall records. It can also be used to simulate the amount of stormwater runoff generated from a site under different development and control scenarios over a long period of historical rainfall (Li, Tung, & Chen, 2017; Rossman & Berner, 2017). In addition, the i-Tree Design (v 6.01) software from the USDA Forest Service (2017) was used to estimate the stormwater control by individual trees on the facility site as well as the carbon dioxide reduction. The i-Tree Design is an adaption of the Street Tree Resource Analysis Tool for Urban Forest Managers (STRATUM) that conducts urban and community forestry analyses and evaluates tree benefits (USDA Forest Service, 2017).

3.2 Social Performance Measures

For social performances and benefits, a mixture of quantitative and qualitative methods was employed to evaluate the landscape’s social benefits housed within the framework of diagnostic POE. Data were collected via various methods as well as from different sources and perspectives. Social performances and benefits were evaluated by the GATE audit tool—a scored checklist of elements and qualities that should be considered into the design of an ideal restorative garden (Sachs, 2017). The latest version of GATE consists of 96 items evaluating the human perceived level of restorativeness of garden spaces in general acute care hospital environment. The tool requires two or more evaluators to evaluate a garden individually, and their rating scores are averaged for each item. The GATE tool has established high validity.
(e.g., Pearson correlation score $r = 0.79$, $p < .001$ for the accumulative item score, indicating strong correlation strength) and strong reliability (e.g., Kappa and intra-class correlation coefficient ranging from 'good' to 'excellent' for inerrater reliability) (Sachs, 2017, pp. 79—101).

In this study, the following tools/methods were used to evaluate social aspects of the site: (1) analysis of the archival drawing and documents to evaluate the project’s context and site condition, (2) behavior observation and mapping that visualized people’s usage patterns, (3) the GATE audit tool to quantify the level of restorativeness of three green open spaces at the clinic property through which five domains of design features indicating a restorative and supportive environment were measured using a scoring system (Sachs et al., 2016), and (4) semi-structured focus group discussions with user representatives onsite.

4 DATA COLLECTION AND ANALYSIS

4.1 Site Analysis and Behavior Mapping

The study site, Hennepin County Medical Center Whittier Clinic, is located in the Whittier neighborhood in an urban center of Minneapolis that provides community medical services while connecting local residential neighborhoods to surrounding commercial districts. The property fully occupies one city block (3.5 acres), and the site was formerly a brownfield that required intensive site remediation. Three green outdoor spaces are integrated into the site design, including the Pocket Park located at the northwest corner of the site, the Community Park that connects the south and the east side of the site, and the Native Prairie, a rain garden located at the south boundary of the site that utilizes a low-maintenance, native plant palette. An underground parking garage is located to the west of the clinic building. Four entrances to the clinic building separate the flow of staff and patients/visitors. The main entrance (A) is the most frequently used for dropping off/picking up patient and visitors who arrive in a vehicle. The two secondary entrances (B and C) along Nicollet Avenue South and West 28th Street are primarily for staff and patients/visitors taking public transportation. Entrance (D) is a coded entrance used only for authorized staff. Various LID practices have been integrated into the site design, including the rain garden, multiple infiltration islands on the parking lot, and vertical greenery panels for screening noise and unpleasant views. A site location map and the site plan (Figure 2) indicate the spatial layout and the relationship between the site and the local context.

Figure 2. Site location map and site plan
Following similar procedures in previous diagnostic POE studies by Davis (2011) and Sidenius et al. (2017), the project context and the design solutions addressing the original challenges and goals were evaluated using a thorough examination of the archival documents and original drawings, site analyses, an informal interview with the lead designer, and a walk-through indicative of an onsite evaluation. The investigators also conducted 3 hour-long onsite observations on June 14 (3:30–4:40 PM) and June 15 (9:00–10:00 AM and noon–1:00 PM). Users’ typical behaviors and the site utilization patterns were documented through behavior mapping and field notes and then further visualized through a heat map (Figure 3). Archival studies identified three main principles/goals that guided the project, including (1) sustainable and “green” design (i.e., achieving LEED certification); (2) community connections (i.e., creating an integrated and welcoming amenity for the neighborhood); and (3) landscape legacy (i.e., the owner needed to be able to easily maintain the design aesthetic in the future). Design challenges and solutions for each goal were further identified, and the success and failure of the design solutions are preliminarily summarized in Table 1.

4.2 Environmental Performance Computing and Estimation

Stormwater Runoff Reduction

Using the EPA’s National Stormwater Calculator (1.2.0.0 Beta MSI version), two site development scenarios were estimated. The current scenario was based on the current site design with various LID practices, including a rain garden (Native Prairie), street planters and infiltration islands in the parking lot, and permeable paving in the community park area. The conventional scenario was a site design with impervious materials with no LID practices, which was very similar to the pre-development site condition. As interpreted from the original construction documents, the land cover proportion for the current scenario was 38% pervious and planting materials and 62% impervious ground. Roughly 65% of the site’s impervious areas were treated by the rain garden, 30% of the site’s impervious areas were treated by infiltration islands, and 5% of the site’s impervious areas were directed to permeable pavement. For the conventional scenario, 100% of the areas were estimated as impervious areas, and all runoff was directed to the civil sewage. This scenario was very similar to the site condition before development. Table 2 compares stormwater runoff onsite between the current and conventional scenarios; the current design scenario with various LIDs integrated could reduce approximately 2,309,540 gallons of stormwater runoff.

Tree Benefits

An analysis of the archival planting plan provided by the original designer as well as walk-through site survey, identified more than 80 trees representing 10 species, around 500 shrubs representing 15 species, 4 vine species, and more than 800 perennials formulating the plant palette. These plants included Autumn Blaze Maple, Renaissance Reflection Birch, Swamp White Oak, Northern Pin Oak, Ironwood, Serviceberry species, Dogwoods, Dwarf Bush Honeysuckle, Grow-low Fragrant Sumac, and various Yew species. The i-Tree Design (v6.01) program estimated that approximately 14,636 pounds of carbon dioxide (CO₂) are reduced each year through the newly planted tree and shrub canopies—equal to the CO₂ emitted by one passenger vehicle travelling 16,153 miles (United States Environmental Protection Agency, 2017a).²
Table 1. Project context analysis and evaluation of the design as compared to original goals/ challenges.

<table>
<thead>
<tr>
<th>Principles/ Goals</th>
<th>Sub-goals/Challenges</th>
<th>Design Solutions</th>
<th>Level of Success</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable and Green design</td>
<td>Urban 'brownfield' cleanup and remediation</td>
<td>Nearly 20,000 cubic yards of contaminated soil was removed and professionally processed by pollution control agency. Four wells discovered during the construction on the site was sampled and properly abandoned.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Landscape solutions to manage stormwater runoff</td>
<td>Infiltration islands and a rain garden infiltrates runoff directly from the parking lot and the building, resulting in a reduction of site runoff by 31.5% for a 2-year, 24 hour design storm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water and energy efficiency</td>
<td>Xeriscaping strategy employed in the planting design and reduced landscaping water by 50% as compared to a conventional design.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Access to public transit routes and bike routes</td>
<td>Installation of a bus shelter, 4 bike racks, and a Nice Ride station, the bike-share system in Minneapolis, to encourage green transportation.</td>
<td></td>
<td>The bus shelter was not used as a transportation hub properly.</td>
</tr>
<tr>
<td></td>
<td>Sustainable materials for landscape elements</td>
<td>Locally sourced materials such as limestone seat walls, woodchip and crushed granite path paving, and stones in infiltration islands.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Screening mechanical equipment from neighboring residences along the northwest edge of the site</td>
<td>A combination of vine species and structured planting panels (green screens) blocked unpleasant views and noise.</td>
<td></td>
<td>The green panels are lush and very well established.</td>
</tr>
<tr>
<td></td>
<td>Wildlife habitat reestablishment</td>
<td>The Native Prairie was designed to attract bird species.</td>
<td></td>
<td>Multiple wildlife species were detected on the site.</td>
</tr>
<tr>
<td></td>
<td>Pursuing LEED Certificate</td>
<td>LEED Silver achieved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Connections</td>
<td>Connections to public sidewalks and surrounding commercial districts</td>
<td>A network of garden paths with natural paving materials provide multiple passage opportunities.</td>
<td></td>
<td>The paths in the Native Prairie are not wide enough for smooth transportation. The parking lot prevents direct transition between the Native Prairie and the clinic building.</td>
</tr>
<tr>
<td></td>
<td>Encouraging passive leisure or recreation at the Community Park</td>
<td>Open turf areas, bench seating and shade trees are featured in the design.</td>
<td></td>
<td>A lack of shading structures/canopy trees. Seats are not protected by adverse climates such as wind and strong sunlight. A lack of seating that are easy accessible by wheelchair users.</td>
</tr>
<tr>
<td>Landscape Legacy</td>
<td>Durable and easy to maintain landscape features</td>
<td>Stone, chosen for durability, was a dominant material. Stress-tolerant plant species and easily maintained arrangements.</td>
<td></td>
<td>Native Prairie has minor invasive species, and there are minor debris and obstacles on the path.</td>
</tr>
</tbody>
</table>

Notes: ● Goals fully achieved or challenges fully addressed ○ Goals partially achieved or challenges partially addressed

**Landscape Irrigation Water Conservation**

The landscape planting design for Whittier clinic included xeriscaping strategies and native, drought-tolerant materials for the ground cover palette, which aimed to save irrigation water, reduce maintenance, minimize fertilizers or pesticides, and provide wildlife habitat (Sovocool, Morgan, & Bennett, 2006). Weather-based sensor controllers for the irrigation system were installed onsite and further contributed to the conservation of landscape irrigation water. As indicated by the archival documents and estimations conducted by the original design team, the reduced landscape irrigation water was estimated using Hunter Water Saving Calculator. The Hunter calculator quantified the annual water savings potential for a project based on historical weather data as well as user-defined assumptions on irrigation practices, plant types, landscaped area, and irrigation methods (Hunter, n.d.). The total irrigated area equaled 54,938 square feet in this project. Compared with the conventional water requirement (baseline scenario with conventional controller that assumes no rain shut-off device), the current scenario (with ET sensor installed and xeriscaping strategy) could save a total of 554,566 gallons water, resulting in a 69% savings in landscape irrigation water (Table 3).
Table 2. Comparison of stormwater runoff onsite between current scenario and conventional scenario.

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Current Scenario</th>
<th>Baseline Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Annual Rainfall (inches)</td>
<td>34.46</td>
<td>34.46</td>
</tr>
<tr>
<td>Average Annual Runoff (inches)</td>
<td>4.20</td>
<td>28.60</td>
</tr>
<tr>
<td>Days per Year With Rainfall</td>
<td>68.56</td>
<td>68.56</td>
</tr>
<tr>
<td>Days per Year with Runoff</td>
<td>10.89</td>
<td>50.77</td>
</tr>
<tr>
<td>Percent of Wet Days Retained</td>
<td>84.11</td>
<td>25.95</td>
</tr>
<tr>
<td>Smallest Rainfall w/ Runoff (inches)</td>
<td>0.43</td>
<td>0.10</td>
</tr>
<tr>
<td>Largest Rainfall w/o Runoff (inches)</td>
<td>0.81</td>
<td>0.20</td>
</tr>
<tr>
<td>Max. Rainfall Retained (inches)</td>
<td>4.15</td>
<td>0.59</td>
</tr>
</tbody>
</table>

Table 3. Comparison of irrigation water conservation.

4.3 GATE Scores

Three expert evaluators conducted GATE evaluations onsite on June 15, 2017, between 8:30 AM and 2:30 PM. The weather was sunny and windy on the day of evaluation, and the temperature ranged between 71°F and 82°F. The Community Park, Native Prairie, and Pocket Park were systematically evaluated following the metrics for five domains of restorative features: (1) access and visibility, (2) sense of “being away,” (3) nature engagement, (4) walking and activities, and (5) places to rest (Sachs et al., 2016). Mean scores of all evaluators’ ratings were calculated and converted to a 1–10 scale for easier interpretation. Table 4 summarizes the GATE scores of each domain for all three green spaces.

Visual and physical access scores for Community Park were moderately high while the Native Prairie and Pocket Park received lower scores, suggesting that the green spaces were not closely attached to the clinic building, and the direct, convenient connection between facility occupants and these spaces was inadequate. The focus group discussion, which will be discussed later, supported this finding. According to the original goals, the site was intended to be designed as a community public space open to local residents and tied into a larger green space system. During the site observation, local residents and non-patients were seen frequently bypassing the property and using the three garden areas for short-term relaxing and leisure activities.
Landscape designs for the clinic site provided certain levels of sense of “being away,” scoring 6 for all three green spaces. As the site is located in an urbanized area along Nicollet Avenue, a main street connecting to restaurants and business districts, noise and traffic are inevitable for a majority of the site. However, Pocket Park, located along a traffic heavy spot, scored highest for sense of “being away.” Lush green panels and a pergola provided a strong sense of enclosure that contributed to this result.

All three gardens gained high scores for nature engagement in the plantings subdomain. The majority of the ground surfaces were planted and maintained well. The three areas all had a rich variety of plants that stimulate the senses. Multiple bird species, beneficial insects, and rabbits were identified in the Native Prairie area. As reflected by the original designer, as well as site observations, the growth of trees in infiltration islands varied; those in infiltration islands with curbs grew taller and flourish more than those in infiltration islands without curbs. Seasonal icy road conditions result in salty roads to minimize slippery roads in Minneapolis, and the salty water is directed to uncurbed infiltration islands, thereby affecting the growth of plants.

The site design integrated a network of pedestrian pathways. However, some paths were not wide or smooth enough for easy utilization by handicapped people. For example, during the site observation, a wheelchair user accompanied by his/her family could only sit on the lawn near the Native Prairie because the path was too narrow and plant debris was on the pathway. The parking lot also became a barrier to accessing the clinic from the south edge of the property because of the narrow paths at Native Prairie and a lack of direct connections. The path at the Community Park was highly used by various users. During the site observation, local residents took shortcuts through that path to nearby commercial districts or to the bike share station.

Multiple types of seating were available at the site, including a limestone seating wall near the entrances of the building and garden benches at various green spaces. Site observations determined that the most utilized seats were the entrance’s front seating walls. After discharge, patients usually stayed near the main entrance and waited to be picked up. Local residents and passengers utilized the seating walls near the entrance along Nicollet Avenue. A lack of picnic tables and insufficient shading resulted in clinic staff’s inadequate use of seats in all green spaces. This will be further discussed with the findings from focus group discussions.

4.4 Focus Group

One focus group interview was conducted onsite to explore individuals’ use of the three green open spaces as well as their perceptions and attitudes. Thirteen user representatives attended the study on June 15, 2017, from noon to 1:00 PM. Table 5 summarizes participants’ demographic information. The focus group discussion was structured according to a list of predetermined questions: (1) Which part of the outdoor green spaces on campus and what specific gardens/courtyards do you use the most during your stay in the facility, and how do you use them? (2) What are the feelings or emotional states during and after your use of the green spaces, using adjectives to describe the feelings? (3) Regarding visibility and accessibility aspects, how do you perceive the green spaces compared to major indoor areas such as major corridors, waiting areas, dining areas, and exam rooms? (4) How do you usually interact with design features in the green spaces, including plantings and seats, and have you found any facilitators/barriers to the use of these spaces? (5) For clinic employees: How do you think that having various green spaces on campus could impact your work performance and satisfaction about the physical environments of your workplace? (6) Are there any design features that you feel are missing on the site? Any additional desired features?
Table 4. GATE scores for the three evaluated landscape spaces at Whittier Clinic.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Score Detail</th>
<th>Final GATE Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Domain</strong></td>
<td><strong>Score Detail</strong></td>
<td><strong>Final GATE Score</strong></td>
</tr>
<tr>
<td><strong>1) Community Park at HCMC Whittier Clinic, Minneapolis MN</strong></td>
<td></td>
<td></td>
</tr>
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<td>Access &amp; Visibility</td>
<td>Visual Access to the Garden</td>
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<td>Physical Access to the Garden</td>
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<tr>
<td>Sense of “Being Away”</td>
<td>Sense of “Being Away”</td>
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<td>Aesthetics &amp; Maintenance</td>
<td>6</td>
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<tr>
<td>Nature Engagement</td>
<td>Plantings</td>
<td>8</td>
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<tr>
<td></td>
<td>Other Natural Features (e.g., water features)</td>
<td>2</td>
</tr>
<tr>
<td>Walking &amp; Activities</td>
<td>Primary Walkway (Path or Paved Thoroughfare)</td>
<td>7</td>
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<tr>
<td></td>
<td>All Paved Areas</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Lighting, Wayfinding, &amp; Amenities</td>
<td>4</td>
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<tr>
<td></td>
<td>Variety &amp; Activities</td>
<td>7</td>
</tr>
<tr>
<td>Places to Rest</td>
<td>Seating Availability &amp; Type</td>
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<td></td>
<td>Private or Social</td>
<td>8</td>
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<td></td>
<td>Aesthetics &amp; Sun</td>
<td>8</td>
</tr>
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<td></td>
<td>Tables</td>
<td>1</td>
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<tr>
<td><strong>Actual GATE score (1-10 scale): 6</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>2) Native Prairie at HCMC Whittier Clinic, Minneapolis MN</strong></td>
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<tr>
<td>Access &amp; Visibility</td>
<td>Visual Access to the Garden</td>
<td>6</td>
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<tr>
<td></td>
<td>Physical Access to the Garden</td>
<td>3</td>
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<tr>
<td>Sense of “Being Away”</td>
<td>Sense of “Being Away”</td>
<td>6</td>
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<tr>
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<td>Aesthetics &amp; Maintenance</td>
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<td>Nature Engagement</td>
<td>Plantings</td>
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<td>Other Natural Features (e.g., water features)</td>
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<td>Walking &amp; Activities</td>
<td>Primary Walkway (Path or Paved Thoroughfare)</td>
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<td>Lighting, Wayfinding, &amp; Amenities</td>
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<td>Variety &amp; Activities</td>
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<tr>
<td>Places to Rest</td>
<td>Seating Availability &amp; Type</td>
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<td>Private or Social</td>
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<td></td>
<td>Aesthetics &amp; Sun</td>
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<td>1</td>
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<tr>
<td><strong>Actual GATE score (1-10 scale): 6</strong></td>
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<td></td>
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<tr>
<td><strong>3) Pocket Park at HCMC Whittier Clinic, Minneapolis MN</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access &amp; Visibility</td>
<td>Visual Access to the Garden</td>
<td>4</td>
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<tr>
<td></td>
<td>Physical Access to the Garden</td>
<td>4</td>
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<tr>
<td>Sense of “Being Away”</td>
<td>Sense of “Being Away”</td>
<td>7</td>
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<tr>
<td></td>
<td>Aesthetics &amp; Maintenance</td>
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<tr>
<td>Nature Engagement</td>
<td>Plantings</td>
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<tr>
<td></td>
<td>Other Natural Features (e.g., water features)</td>
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<tr>
<td>Walking &amp; Activities</td>
<td>Primary Walkway (Path or Paved Thoroughfare)</td>
<td>8</td>
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<td>Lighting, Wayfinding, &amp; Amenities</td>
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<tr>
<td></td>
<td>Variety &amp; Activities</td>
<td>5</td>
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<tr>
<td>Places to Rest</td>
<td>Seating Availability &amp; Type</td>
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<td>Tables</td>
<td>1</td>
</tr>
<tr>
<td><strong>Actual GATE score (1-10 scale): 6</strong></td>
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</tbody>
</table>
Participants were also invited to review the design of each of the three green spaces and express their opinions. A content analysis was conducted of the focus group discussion’s narrative, assisted by MAXQDA, a software program designed for computer-aided qualitative data analysis. Two investigators coded the transcript. Four types of topics were identified: (1) general description of the site (e.g., locations of the green spaces and typical users); (2) overall usage preference and attitude toward the green spaces; (3) typical user behaviors and activities at the green spaces as well as desired activities/programs; and (4) domains of garden restorativeness and design features, following the theoretical framework described in the GATE audit tool. Codes describing the topics and frequency of mention in the discussion were calculated and visualized through a simple frequency analysis (see Figure 4).

Table 5: Demographic information of focus group participants

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-29 years old</td>
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</tr>
<tr>
<td>30-49 years old</td>
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</tr>
<tr>
<td>50-64 years old</td>
<td>3</td>
</tr>
<tr>
<td>65 years old and above</td>
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</table>

<table>
<thead>
<tr>
<th>Gender Distribution</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>12</td>
</tr>
<tr>
<td>Male</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Profession</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrator</td>
<td>1</td>
</tr>
<tr>
<td>Clerk</td>
<td>1</td>
</tr>
<tr>
<td>Doctor</td>
<td>1</td>
</tr>
<tr>
<td>Education</td>
<td>1</td>
</tr>
<tr>
<td>Medical Assistant</td>
<td>5</td>
</tr>
<tr>
<td>Nurse</td>
<td>3</td>
</tr>
<tr>
<td>Social Worker</td>
<td>1</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Years of Experience in Current Career</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 years</td>
<td>4</td>
</tr>
<tr>
<td>6-10 years</td>
<td>1</td>
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<tr>
<td>11-15 years</td>
<td>3</td>
</tr>
<tr>
<td>16-20 years</td>
<td>4</td>
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<tr>
<td>Above 20 years</td>
<td>1</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Years Working at Current Facility/Health System</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used to work with HCMC System before Whittier Clinic opened (7 years or longer)</td>
<td>4</td>
</tr>
<tr>
<td>Joined HCMC Whittier Clinic after its open (less than 7 years)</td>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hours per Week Working at Current Facility</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-19 hours</td>
<td>1</td>
</tr>
<tr>
<td>20-39 hours</td>
<td>5</td>
</tr>
<tr>
<td>40 hours and above</td>
<td>7</td>
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</table>

Generally, primary users of most of the green spaces were clinic staff. Typical activities include walking along the property perimeter for daily exercises and looking at nature from within the building. Local community residents usually bypass the site, walk through the site to take a shortcut to surrounding restaurants, or sit on benches for a short time, relaxing and looking at the greenery. Patients typically wait inside the clinic building and look out the window. For outdoor areas, patients only use the building’s front areas while they wait for their appointments or to be picked up. Group events and public use were not common at the site, and interviewees mentioned that patients rarely use the Native Prairie because of limited accessibility and walkability. As described by the focus group participants, “staff use most of the space,” and “there are always some patients outside the entrance.” As the clinic parking lot was open to the public, there was a shortage of parking spaces for clinic staff as well as some inevitable usage conflict between local residents and clinic staff/visitors.
Access and visibility were the most discussed subtopic related to the restorativeness of green outdoor spaces and the design features, accounting for 12.9% of the total discussion. People enjoyed the views and natural light from multiple spaces within the clinic building, but the accessibility and walkability to the Native Prairie was low. The parking lot was a barrier, and a lack of continuous, obvious walking paths further contributed to the isolation of Native Prairie from the clinic users. As stated by user representatives:

Patients not being able to walk from the building to the Native Prairie area because there is no natural walkway. Like kids, and strollers want to hang out, they wouldn’t go across the parking lot to get there. [Participant Narration 1]

There is no natural walkway, meandering...you have to walk in the street, walk along the driveway to get there, or walk around the edge. [Participant Narration 2]

Overall, clinic staff as represented by focus group participants appreciated the opportunities to engage with nature in the clinic environment. They held positive attitudes of the design of various green open spaces on the site. Having abundant daylight and views of nature enhanced staff’s mood and improved the perceived quality of their work environment. Selective participants’ responses are quoted as follows:

I just goanna to say that I love looking at the community garden area, I just feel good. I like all of it very much, but there are something very special about the grasses and about the native plants...there are so much nature integrated in that space that I really appreciate. [Participant Narration 3]

When we build this building, it’s a new building...it has a rain garden to filter the stormwater, it was something that everyone is very proud of. So I actually really like it. I know it’s not that flashy, but it makes people feel good. [Participant Narration 4]

Compared to our previous clinic, we didn’t have any garden, no green. Compared to that, this is much better. [Participant Narration 5]

I used to work with XXX (facility), it was so dark, and we had hardly any natural light. So that’s one of the things we asked for: abundant natural light, and a sense of connection with nature. We have so much more of that and I feel we are really rich in that way. [Participant Narration 6]

Negative perceptions of the green spaces on the clinic site or desired landscape features focused on four aspects: (1) a lack of “inviting” features to make the green space a destination, (2) a lack of picnic tables and shading near the seats, (3) a lack of bright colors and flowering species that bloom in different seasons in the planting design, and (4) low walkability from the clinic building to the Native Prairie area. Participants’ original responses are quoted here:

And it will be interesting to think about what would draw us to the outside in there. I think that’s retreatinng ourselves, because it’s part of mentality and stress management to take a few minutes, two minutes, to look outside. But we are often...sitting all day. So I think a piece of it is the retreatinng ourselves, because it’s hard to take a few minutes from ourselves. I don’t know how the landscapes could help us in that way. But people said there could be something more attractive to overpower that. [Participant Narration 7]

So if there were something like a waterfall, something like them, I would find a reason to go out there and just sit, look at the water, whatever. This is almost like if we are walking around the building, around the block, I would probably sit down somewhere but probably not since it’s so sunny there and there is nowhere to sit and avoid the sun. [Participant Narration 8]

The investigator also interviewed the staff about their attitudes to various LIDs on the site in order to explore the public’s comprehension of sustainable design. Most participants expressed a sense of pride about having a rain garden in their clinic. One participant questioned the use of infiltration islands filled with
stone materials, and other participants were not aware of the benefits of utilizing drought-tolerant species in the Native Prairie. After some explanations about sustainable design, all participants agreed that signage or interactive devices on the site to explain the design concepts would help educate the public and spread knowledge about sustainability.

5 DISCUSSIONS AND CONCLUSIONS

Following the holistic diagnostic POE approach, a systematic evaluation of the landscape environment at HCMC Whitter Clinic was conducted in this study. A series of environmental benefits of landscape performances were identified, including stormwater runoff reduction, tree benefits, and landscape irrigation to conserve water. These results indicated that integrating LIDs in a healthcare design can promote site sustainability and resilience. In general, toolkits and metrics adopted in this study demonstrated the efficiency of quantifying environmental performances, especially the application of the EPA’s National Stormwater Calculator in the estimation of stormwater management performance for a built project. However, certain limitations in using these tools were identified. Given that the required design parameters were derived from archival drawings and documents provided by the designer, measurement inaccuracies of land cover ratios and plant dimensions can occur in the EPA’s calculator and the i-Tree application. Even when considering the measurement of these parameters through site survey, human errors are inevitable. Various databases of climate conditions and soil characteristics used as the basis of these tools could not provide the most current and accurate data, which may have resulted in system errors.

The identified social benefits of landscape performances at Whittier Clinic can be summarized as follows:

1. The landscape environments in the clinic property provided restorative natural views and daylight as well as sufficient nature engagement for clinic patients and staff, as indicated by GATE ratings and site observational studies.
2. A network of pathways in the outdoor environments enhanced walking as daily exercises in outdoor green spaces for clinic staff.
3. The rich source of green spaces improved the staff’s overall satisfaction with their work environment.
4. Designed as a community open space providing relaxing spaces and easy access to surrounding neighborhoods and the commercial distracts for local residents.

Research findings from this study, as well as design principles reflected from the GATE audit tool (Sachs et al., 2016) led to the following suggestions for restorative landscape designs in an urban clinic environment:

1. Strategically locate green spaces at various spots onsite to facilitate utilization by staff and patients: some close to the clinic building entrance for easy access by facility occupants, while some close to the property boundary to invite public use. Direct, noticeable pathways connecting the clinic to the green spaces promote the overall usage of those spaces.
2. Provide a unique design landmark at certain green spaces, such as a water feature or an interactive sculpture, to attract users and increase the livability of that area.
3. Design sufficient shadings near seats at certain green spaces as well as picnic tables to attract and retain users and increase the livability of that area.
4. Design primary walkways to follow Universal Design principals that support users with limited mobility/functionality.
5. Use colorful plant palettes and floral species to increase the visual pleasure provided by natural environments.

Facing increasing challenges of global climate change and an imperative course of ecosystem reestablishment, healthcare facilities should take initiatives to design and build their campuses using sustainable strategies that reduce energy and water consumption as well as carbon emissions in addition to contributing to urban resiliency. As a healthcare landscape project that integrated systematic considerations of sustainable designs and thrived for seven years since its completion in 2011, HCMC
Whittier Clinic experimented with the cutting-edge design concepts of that time and produced positive environmental and social outcomes. During the same seven years, landscape architects have further embraced the spirit of sustainable design; however, the general publics and the local communities are still catching up on at a slower speed. The continuous sharing of knowledge related to sustainability through exemplary practices, as well as improved user experiences and health outcomes, in those sustainable environments will accelerate the recognition of sustainability among clients and end users.

ENDNOTES
1: The following formula was used to make an estimation: average reduced annual runoff gallons = average reduced annual runoff inches $\times 0.083$ feet/inch $\times$ area of the site acres $\times 43560$ square feet/acre $\times 7.48$ gallon/cubic feet. Therefore, the average reduced annual runoff (gallons) = $(28.6 \text{ inches} - 4.2 \text{ inches}) \times 0.083 \text{ feet/inch} \times 3.5 \text{ acres} \times 43,560 \text{ square feet/acre} \times 7.48 \text{ gallon/cubic feet} = 2,309,539.7 \text{ gallons}$.
2: It was estimated by i-Tree Design (v6.01) that approximately 14,636 pounds of carbon dioxide ($\text{CO}_2$) are eliminated each year through the newly planted tree and shrub canopies. According to the EPA, the average passenger vehicle emits about 411 grams of $\text{CO}_2$ per mile. $14,636 \text{ pounds} \times 453.6 \text{ gram/pound} \div 411 \text{ grams/mile} = 16,153 \text{ miles}$. Therefore, the reduced amount of $\text{CO}_2$ equals the $\text{CO}_2$ emitted by one passenger vehicle that travels 16,153 miles (United States Environmental Protection Agency, 2017a).
3: All scores were converted to a 1–10 scale for easier interpretation and comparisons.
4: The term “restorativeness” was developed based on Stephen and Rachel Kaplan’s (1989) psychological theory of the restorative environment. Nature ideally satisfies the Kaplans’ criteria for a restorative environment, which must provide a sense of being away, be perceived extensive yet connected to a larger but comprehensible context, evoke people’s fascination, and be compatible with the needs of the individual. Following this track of theory, prior scholars have crafted the term “restorativeness” to describe the restorative qualities of environments. Examples of the usage of this term can be found in numerous studies, such as Bagot, Allen, & Toukhsati (2015), Collado, Staats, & Sorrel (2016), Hartig, Korpela, Evans, & Gärling (1997), Pasini, Berto, Brondino, Hall, & Ortner (2014), and so on.

ACKNOWLEDGMENT
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IMAGE/DIAGRAM/TABLE CREDITS
Figures 1, 3, and 4: Developed by the first author
Figure 2: Courtesy of HGA Architects and Engineers
Tables 1, 4, and 5: Developed by the first author
Table 2: Generated by EPA National Stormwater Calculator
Table 3: Generated by Hunter Water Saving Calculator, courtesy of HGA Architects and Engineers

REFERENCES


PARKS AS A HEALTH TREATMENT: MEASURING THE DOSAGE

LAYTON, ROBBY
North Carolina State University/Design Concepts CLA, Inc./GP RED

1 ABSTRACT
Recent research confirms that parks are correlated with healthy lifestyles, and doctors are now prescribing them as treatment for a variety of ailments. The purpose of this study was to explore using validated metrics linking parks to public health goals in an index to assess the relative potential for a given site or collection of sites to produce positive public health outcomes. Health benefits are associated with exposure to and behavior within parks and greenspace. For this study the GRASP® Active Index was developed to indicate the relative potential of a given site to encourage greater use and/or physical activity. The index could be considered a measure of the relative “strength” of the park as a form of health treatment. The index combines an evaluation of park components (features that visitors go to a park to use, such as courts, fields, playgrounds, and picnic facilities) and other characteristics such as the availability of shade, seating, and drinking water, collected using the GRASP®-IT direct-observation audit tool with evidence from the literature incorporating Active Energy Expenditure (AEE) ratings system to generate an overall score for each park. The scores for individual parks can be aggregated to produce performance measurements for a collection of sites or locations, such as a park agency, planning district, or other jurisdiction. The resulting index was used to demonstrate its practicality as a way to compare the relative potential for physical activity generation between parks and to measure relative access to physical activity opportunities across a geographic area.

1.1 Keywords
Parks, Greenspace, Public Health, Landscape Performance
2 INTRODUCTION

Public parks, (including trails, greenways, and other greenspace locations generically referred to as parks), are a special kind of landscape that is a relatively new phenomenon in human history. They emerged as part of a larger reform movement during the 19th century to improve the lives of urban dwellers during the Industrial Revolution, becoming policy elements by which governments promote the well-being of citizens. Parks have taken on renewed importance recently in response to public health threats brought about by modern lifestyles. Doctors have even begun to prescribe visits to parks as a form of treatment for a variety of ills (Root, 2017).

Advances in medicine have mitigated many infectious and congenital diseases, but depleted physical activity brought about by technology has resulted in an increase in chronic diseases related to behavior, including obesity, Type 2 diabetes, and others (e.g., Bedimo-Rung, Mowen & Cohen, 2005; Kaplan, 1995; Sallis, Floyd, Rodriguez & Saelens, 2012). A social ecological model posits that modifying the environment with parks and other forms of greenspace can influence behaviors, including physical activity (Sallis et al., 2012). In fact, recent studies place parks among environmental variables with the most convincing relationship to physical activity (Bauman, et al., 2012), linking the availability of greenspace to potentially lower risk of obesity and other diseases.

The focus on parks as a way to encourage and facilitate physical activity has brought with it research on other dimensions of health that might be associated with both active and passive use of parks and greenspace, including psychological, social, ecological, and economic well-being (Sallis & Spoon, 2015). A large body of evidence now confirms the relationship between the availability of parks and individual behaviors that promote better health. This makes the provision of parks a matter of public welfare and environmental justice. Because all parks are not the same, it is necessary to be able to measure the differences between them to assure that they are administered effectively and equitably. This paper presents a metric that measures the relative potential for individual park features to encourage and facilitate increased use and physical activity—behaviors that are associated with better health. The measures for individual features can be aggregated to produce a measure for an entire park or system of parks, and to identify gaps or inequities in the availability of parks across geographies and/or populations.

2.1 Park Measurements

The study of correlations between the physical environment and health outcomes requires effective measurements of the environment (Giles-Corti et al., 2005; Saelens et al., 2006). Common metrics for parks include total park land, number of park locations, distance to a park, and measurements of the features within a park (quantity, type, size, location, quality, etc.). Among these, features seem to be emerging as particularly important (McCormack et al., 2010). Typical attributes recorded for park features in the past have been mainly limited to type and quantity of each. New evidence suggests that more information on the quality and functionality of park features should be included in park evaluations. Kaczynski et al. (2016) found an average park quality index for parks within one mile of an individual’s residence to be significantly associated with park use. They also found a significant correlation with park use for the number of parks within one mile. An earlier summary of existing research published by Active Living Research (ALR) in 2010 concluded similarly that having more parks within a community is associated with higher physical activity. However, while ALR cited evidence that park proximity and having more park acreage is associated with higher levels of park use and physical activity—particularly among youth—Kaczynski et al. found that distance to the nearest park and the amount of park space within one mile were not significantly correlated with park use.

While quantitative metrics such as these have long been used in research and policy for parks services, the role of qualitative measurements of such attributes as aesthetics, condition and safety is an emerging aspect of greenspace research. ALR’s (Active Living Research, 2010) conclusion that park aesthetics, condition and safety may be associated with park visitation and physical activity levels within parks is supported by Kaczynski et al.’s (2016) finding that park quality is an important aspect of park use. More specifically, enhanced park quality was preferred over the provision of new facilities in a study of minority populations in Houston, Texas (Smiley et al., 2015).

Thus, evidence from the literature points to park features and park quality as significant attributes of individual parks that are associated with visits to greenspace and physical activity, suggesting that a metric which incorporates both the number of features within a park and overall site quality could be useful in assessing the park’s contribution towards public health. The incorporation of park acreage into the metric
may also be useful, though less definitive. While total park acreage within a community has been identified as having a potential effect on physical activity (Cohen et al., 2010), the fact that more parks and larger ones imply a greater number of features may play a role in that effect (Giles-Corti et al., 2005).

2.2 Park Features and Physical Activity

The contribution of individual features (also referred to as components) towards park visits and physical activity varies. Cohen et al. (2010) found that gymnasiums and baseball fields were the busiest areas, while areas most frequently used were dog parks, walking paths, water features, and multipurpose fields. The ALR study (Active Living Research, 2010) indicated that within parks, people tend to be more physically active on trails, at playgrounds and at sports facilities. Recognizing this variation Floyd et al. (2015) developed a set of energy expenditure ratings associated with typical components found in parks. The ratings reflect the energy expended above and beyond the sedentary rate for each component, coded into categories of low, medium, and high. This results in a relative value for each feature in terms of its effectiveness at generating physical activity within the population.

2.3 Auditing Park Characteristics

Given the need to measure the variables described above from one place to the next, a number of audit tools have been developed to assess outdoor environments such as parks, trails, and streets. These tools rely primarily on direct observation. Direct observation is considered to be a reliable and valid method for collecting such data, but it is not the only one available. Remote sensing, crowd-sourcing, and use of secondary data are other methods that are growing in popularity among researchers. Most of the observational tools are intended to be used by trained observers, although new tools, such as eCPAT are being developed for use by citizens, youth, and other constituencies (BEACH Lab, 2016). Combined with research findings, such tools can be used to identify metrics and indicators correlated with health outcomes.

No single audit tool is perfect for all applications. Each has its strengths and weaknesses. Some are shorter and take less time to complete, while others are longer and provide greater detail. Some capture general data on a wide range of features, and others capture more data on fewer features. Testing has found some tools to be more reliable on certain features than others, although direct observation tools have been found reliable on most items (Bird et al., 2015; Joseph & Maddock, 2016). In general, reliability is highest for objective items that rate presence and number of features. Reliability tends to be lower for subjective items and those that may change over a relatively short timeframe.

3 METHODS

The intent of this study was to develop and evaluate a prototype—referred to as GRASP®Active—for an empirically derived index that could be used to evaluate the potential for a specific site (park, trail, location, etc.) to encourage use and stimulate physical activity. This would allow researchers and planners to compare one park to another or evaluate alternative proposals for a single park in terms of the most advantageous public health outcomes. It could also be used to measure variations in the availability of public health resources across populations and geographic areas to address environmental justice considerations.

A review of the literature was conducted to identify variables with strong evidence of correlation with public health goals, and which could be measured with available audit tools. Park features and park quality were identified as significant correlates of park use and physical activity, so the metric was organized around individual park components, and overall park quality was used as a weighting factor to modify the value of components. A functionality rating for each component and an energy expenditure rating associated with that component type were also used to modify each component’s overall value.

3.1 Sources of Data

Secondary data obtained from an inventory of parks in Cary, North Carolina conducted by the Principal Investigator (P.I.) in 2011 as part of a citywide parks and recreation master plan were used as measurements of park characteristics for this study. The inventory was conducted with the GRASP®-IT audit tool developed by the P.I. and others for use in the parks and recreation management field. The GRASP®-IT tool has been used on more than a hundred parks and recreation plans across the United States over a period of seventeen years, and has been applied in studies related to social equity, environmental justice, and public health (GP RED, 2013; Arlington Heights Park District, 2018). The
The instrument is designed to be used by trained observers and has been tested and found to have moderate overall reliability (exact agreement = 65% on all items, kappa = 0.42).

The tool rates 86 items, which are grouped into two categories: **components** and **modifiers**. Components are defined as those things that individuals visit a park to use—such as fields, courts, picnic facilities, and playgrounds, as well as paths, natural areas, open lawns, and other items related to passive use. A total of 71 unique components that may be present within a park have been defined in the tool. In addition to labeling and counting the components within a given park, each individual component is scored on its functionality—defined as the capacity to fulfill expectations for its intended purpose at its specific location. Scores of 1 (below expectations), 2 (meets expectations), or 3 (exceeds expectations) are assigned by the auditor to each component present in a specific location.

Modifiers are comfort and convenience amenities that support or enhance the overall experience of visiting the park, including such things as the availability of restrooms, drinking water, shade, seating and overall comfort, convenience, and scenic quality. A total of 15 items are assessed as modifiers in the tool. Each type of modifier present at the park is evaluated on its overall capacity to meet expectations for that park using the same rating scale as described above for components. For example, if the amount of shade present at the park meets expectations for shade at that park (based on local norms for similar parks), the modifier *shade* is given a value of 2 for the park. If not, it is given a value of 1. If shade exceeds expectations, a value of 3 is assigned for the shade modifier. Scores for 14 of the modifiers are summed to derive a total value for the park, which is then recoded into a modifier factor for the park site of low (1.1), moderate (1.2), or high (1.3). The 15th modifier is a rating of the overall "feel" of the park based on its design and ambience, including the sense of comfort and safety as well as the scenic value of the site itself and its surrounding context, scored as low (1), moderate (2), or high (3). This is referred to as the park’s D&A factor.

A rating for the potential of each type of component to promote physical activity was derived from a study published by NCSU Cooperative Extension (Floyd, et al., 2015). The NCSU study provides a listing of the total energy expenditure over and above the sedentary rate (referred to as AEE), and a recoding of this into three categories of high (coded 1), moderate (coded 2), and low (coded 3) for all individuals present within an activity zone associated with each of 40 facility types. The AEE ratings were reverse coded for the purposes of this study into Low = 1, Moderate = 2, and High = 3. The facility types were matched with the components in the GRASP®-IT tool and the reverse-coded AEE rating was assigned to each GRASP®-IT component. For components that could not be matched with a facility type from the NCSU study, additional research of the literature was conducted to estimate the AEE value based on published studies of energy expenditures associated with various activities and the expert opinion of the investigators.

### 3.2 Calculating the Index

Data from the 2011 inventory were used to populate the variables of an algorithm and generate a numerical score for each of Cary’s 32 parks. Components present within the park were the basic unit of analysis. For each component that was present in a park, its functional score was multiplied by the reverse-coded AEE rating for that component type and by the recoded modifier value for the park, then by the design and ambience factor (D&A). The results for all components were then summed to provide a total component park score (CPS) for the park, as shown in Figure 1.

![Diagram](https://via.placeholder.com/150)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Functionality (F)</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>AEE (E)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Park Modifier Factor</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Park D&amp;A Factor</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Component Totals</td>
<td>21.6</td>
<td>9.6</td>
<td>9.6</td>
<td>4.8</td>
<td>9.6</td>
<td>4.8</td>
</tr>
</tbody>
</table>

**Figure 1.** Illustrated formula for computing the total component score for a hypothetical park with six components (2018). Functionality and Active Energy Expenditure (AEE) ratings vary by component. Site has a park modifier factor of 1.2, and a Design and Ambience (D&A) factor of 2. Diagram by the author.
Given the inconclusive evidence in the literature for a relationship between the acreage of parks land available and park use or physical activity, further analysis was performed to determine whether to include park acreage in the index. Evidence in the literature suggests that the influence of park size on park visitation and usage may be related to the tendency for larger parks to have more features and that it is the features rather than the park size that affect park use (Giles-Corti et al., 2005). Thus, including park size in the metric could unintentionally be double-counting the influence of park features. To investigate this, the statistical relationship between park size and the total number of components was analyzed in SPSS 23. Results showed that the number of components in a park was positively correlated with the number of acres with a correlation of \( r = .600 \) (\( R^2 = .360; \ P < .01 \)). While this is evidence of correlation, it does not account for all of the variation in the number of components. It also does not take into account the fact that larger parks might tend to have higher modifier values, so a separate correlation analysis was performed for park size and modifier values, yielding a non-significant correlation of \( r = .264 \) (\( R^2 = .070; \ P = .072 \)). Finally, a correlation analysis was run on park size and the total component value for all parks, resulting in \( r = .548 \) (\( R^2 = .300; \ P = .001 \)).

While the statistical analyses showed some correlation between park size and park features, there was enough variation left unexplained in the values for Cary’s parks to warrant including park size in the metric. Therefore, the total component park score (CPS) for each park was multiplied by the size of the park in acres to arrive at a final index value for each park. The resulting scores cover an immense range of values. Transforming numbers that extend from very small to very large into logarithmic values is a useful way to make them easier to comprehend. The values were converted to base 10 (Log 10) logarithmic values in SPSS. Descriptive statistics for the results are shown in Table 1.

### Table 1. Descriptive statistics for parks in Cary, NC.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of components</td>
<td>32</td>
<td>41</td>
<td>1</td>
<td>42</td>
<td>11.06</td>
<td>9.94</td>
</tr>
<tr>
<td>AEE total for all components</td>
<td>32</td>
<td>42.00</td>
<td>1.00</td>
<td>43.00</td>
<td>15.25</td>
<td>10.63</td>
</tr>
<tr>
<td>Modifier factor</td>
<td>32</td>
<td>5.60</td>
<td>2.20</td>
<td>7.80</td>
<td>5.59</td>
<td>1.75</td>
</tr>
<tr>
<td>Size in acres</td>
<td>32</td>
<td>274.26</td>
<td>0.63</td>
<td>274.89</td>
<td>50.99</td>
<td>74.66</td>
</tr>
<tr>
<td>Component park score</td>
<td>32</td>
<td>1,625.80</td>
<td>4.40</td>
<td>1,630.20</td>
<td>279.36</td>
<td>347.12</td>
</tr>
<tr>
<td>Total park score</td>
<td>32</td>
<td>289,455.69</td>
<td>3.48</td>
<td>289,549.17</td>
<td>24,763.24</td>
<td>57,767.92</td>
</tr>
<tr>
<td>Log 10 of total park score</td>
<td>32</td>
<td>4.92</td>
<td>0.54</td>
<td>5.46</td>
<td>3.29</td>
<td>1.30</td>
</tr>
</tbody>
</table>

#### 3.3 Analyzing the Index

A multiple linear regression analysis was run in SPSS to determine the relative effects of the main variables (total AEE, modifier factors, and park acreage) in predicting the Log10 Score of a park (Table 2).

### Table 2. Linear regression results for variables in the GRASP®Active Index

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>Std. Error</th>
<th>Beta</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEE Total</td>
<td>0.077</td>
<td>0.015</td>
<td>0.629</td>
<td>0.000</td>
</tr>
<tr>
<td>Modifier Value</td>
<td>0.195</td>
<td>0.066</td>
<td>0.263</td>
<td>0.006</td>
</tr>
<tr>
<td>Size in Acres</td>
<td>0.003</td>
<td>0.002</td>
<td>0.172</td>
<td>0.149</td>
</tr>
</tbody>
</table>

Results show that the three variables together account for about 80% of the variation in Log10 scores for parks in Cary (\( R^2 = .822; \) Adjusted \( R^2 = .80; \) \( P = .000 \)). Total AEE accounts for the largest portion of the variance in the Log10 Score (\( R^2 = .395; \) \( P = .000 \)) with the park’s modifier value next (\( R^2 = .069; \) \( P = .006 \)).
and park size as the least important and non-significant contributor of the three ($R^2 = .030; P = .149$). Given the empirical nature of the AEE variable and evidence from other sources supporting the contributions to physical activity from park features, it seems appropriate for AEE to be weighted more heavily in the equation than park quality and park size.

While the algorithm for the index is rooted in evidence from the literature, there is no clear basis for what the ideal value should be for any given park. One way to approach this is to look at the distribution of values among Cary’s parks. The histogram in Figure 2 shows clustering around the Log10 values of 1.5 and 3.75. A look at the specific parks around these two clusters shows that the lower value tends to be made up of small parks that the Town of Cary classifies as “Mini Parks” and one classified as “Neighborhood Park”, but which was rated low in the original inventory and considered by Cary parks staff at that time to be an under-performing park. The higher cluster is made up of locations classified as “Neighborhood Parks”, which contain more features and are intended to serve a larger area. At the highest end of the scale are large parks that Cary classifies as “Community” and “Metro” parks and venue-type locations classified by Cary as “Special Use Facilities” that have concentrations of sports fields and active-use features.

![Figure 2. Histogram for Log10 Total Park Scores for parks in Cary, NC (2018).](image)

4 APPLICATIONS

The index provides a way to measure and assign a value to an individual park which indicates its relative potential to encourage and support public health goals. Further research is recommended to determine what the ideal score for any given park should be, but the metric does allow for comparisons to be made between different parks and an ordered ranking of them to be produced. For example, a group of parks can be distributed into categories of low, medium, and high (i.e., top third, middle third, lowest third). Such rankings can be used to set policies and priorities for which parks to improve and which ones to maintain in their current state, and to set performance standards for proposed new parks.

The two cluster points identified in Figure 2 could be used as benchmarks against which parks could be measured, with small parks benchmarked against the 1.5 Log10 value and larger ones against the 3.75 value. Policies might be adopted which target those as values to be used in prioritizing.
4.1 Performance at the System Scale: Aggregated Measures for a Specific Geographical Area

To test the index for use in planning at the park system level, the values for Cary’s parks were used to measure Level of Service (LOS) values across the city using ArcMap 10.1. The first step in the process was to enter the values for each park parcel into the attribute table of the park locations layer. The parcels were then buffered with a ½ mile Euclidian buffer, and a recoded Log10 score of 1 (low), 2 (moderate) or 3 (high) was assigned to the corresponding buffer. The recoded Log10 values were used in order to simplify the results, but the full Log10 values, or the total park scores could be used to create a more intricate map with greater subtlety between values.

The buffers were combined to create a map displaying the composite values that result when the buffers are overlain on one another (Figure 3). The yellow background on the map indicates the geographic

![Figure 3. Composite values map of recoded Log 10 values (2018). Produced by the author with ArcMap 10.1.](image)
corporate extents of Cary at the time the data were collected. The shades on the map represent composite values for recoded Log10 from all parks whose buffer overlays a given location. Total values range from zero (no shading) to 8. Additional performance measures for the entire system of parks can be extracted from the GIS using this information. For example, 30.30 square miles of Cary’s total land mass of 55.60 square miles (55%) fall within a buffer, meaning that anyone living within that area can be considered to have walkable access to parks with features that support some degree of healthy activity. Figure 4 shows areas with value at or above the median recoded Log10 score of 2.

![Threshold map with recoded Log 10 values for parks in Cary, NC (2018). Produced by the author with ArcMap 10.1.](image)

A wide variety of possible performance metrics are available once scores have been assigned to parcels and imported into the GIS. For example, census data can be imported to compare the demographics of residents within different parts of the community with the level of service offered by parks to assure equitable access.
5 DISCUSSION AND CONCLUSIONS

The study showed that data from park inventories can be combined with empirical measures from the literature to generate an index that can be used to analyze individual parks and systems of parks for their potential to stimulate use and physical activity within a subject community. Feasibility of obtaining data with the GRASP®-IT audit tool has been demonstrated by its use within the parks and recreation field to prepare inventories of parks for over 100 master plans. However, the overall reliability of the tool may be a limitation for its application in some research studies. Using other audit tools or improving the GRASP®-IT tool could improve the reliability of the GRASP®Active index. However, one aspect of the GRASP®-IT tool that differentiates it from others is that it incorporates subjective measures of the quality of park features in addition to their objective presence or absence. Quality may be an important variable in the propensity of a park to attract users and encourage activity. One solution is to develop and test reliable measures of quality for parks.

Another limitation of the study is that it did not test the validity of the results or establish a scale against which they should be interpreted. The scores for Cary’s parks were not confirmed against a gold standard to determine if they accurately reflect the differences between parks, nor was a range of scores established for what constitutes a desired, acceptable, high, medium, or low value for a given park or location within a community.

Finally, while the index demonstrated here is intended to reflect the relative potential for a park to encourage physical activity and is therefore strongly influenced by the AEE ratings, it also incorporates variables that are associated with increased use of parks, both passive and active. This suggests that high GRASP®Active values may indicate a higher potential for the park to contribute to other health outcomes that are associated with simply being exposed to a park, such as stress reduction. Further studies may allow for the development of a more complex and comprehensive index that incorporates multiple variables into a ranking of a park’s potential to affect a broader public health outcome. Conversely, focused indices may be developed that target a park’s potential to address specific health issues, such as recovery from stress, emotional disorders, and social interaction.

6 REFERENCES


EXPERIENCE WITH COLLABORATIVE RESEARCH ON THERMAL CHARACTERISTICS OF LOW IMPACT DEVELOPMENT STRATEGIES

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1 ABSTRACT
As the urbanization increases, stormwater runoff heated by urban surfaces during summer directly flows into lakes, streams, and bays, where it mixes and potentially increases the base temperature of receiving waters. Low impact development (LID) control measures are well known to tackle urban stormwater runoff, but little is known about the potential of these LID control measures in reducing the stormwater runoff temperature. To examine this potential, a controlled test is designed and conducted in the Green Infrastructure Laboratory (GIL) at Auburn University. The goal of the research is to assess how LID stormwater control measures affect stormwater runoff temperature. Particularly, pervious and impervious concrete, sod, brick pavers, and rain gardens are involved in the test. Since there are the very limited reference for this kind of research, the focus on process and result of the test weighs equal in achieving better research outcomes. Thus, instead of showing the core testing results, this paper aims to discuss the test setup, research methods and process. More importantly, professor and students from the Department of Landscape Architecture at Auburn University have involved in this laboratory-scale research. By discussing how we contribute to the research from the aspects of test-oriented work and test outreach, we start to examine the ability of landscape architecture to actively engage experiment-based research. This also pushes the boundaries of landscape architecture to a much more detailed material thinking, and helps to understand complex landscape performance of LID practices through the thermal aspect.

1.1 Keywords
Collaboration, Thermal Impact, Low Impact Development, Maintenance, Outreach
2 INTRODUCTION

As urbanization increases, massive development changes natural landscape (forest, prairie, grassland, wetland, etc.), and alters the urban ecosystem and micro climate. The process of urbanization also posts pressures on the hydrologic cycle (Shuster, Bonta, Thurston, Warnemuende, & Smith, 2005). Particularly, developed urban surfaces such as residences, buildings, parking lots, roads, and other types of artificial surfaces dramatically reduce the area that stormwater runoff flows through. This results in the decline of stormwater infiltration and the increase of the risk of flooding. Low impact development (LID) is known as a land development strategy for managing stormwater at the source with decentralized micro-scale control measures (Ahiablame, Engel, & Chaubey, 2012). These control measures innovatively increase stormwater infiltration, and relieve the conventional infrastructure’s pressure during extreme storm events under potential climate change. Many studies have focused on the capacity of LID control measures in the aspects of volume absorption, effectiveness of vegetation, and pollution reduction. However, the thermal characteristics of these LID control measures have not been fully understood (Green Infra Lab, 2017). The thermal regime of the environment is altered when urbanization constructions happen. Urban imperviousness increases surface temperatures in hot summer days (Morabito et al., 2017). Research has shown that the thermal properties of paving material can reach temperatures in excess of 60 °C, with much of the heat concentrated near the surface (Asaeda, Ca, & Wake, 1996). The pervious pavement has been studied for mitigating urban heat island effect (Kaloush, Carlson, Golden, & Phelan, 2008), as well as the impact on the stormwater management (Li, Harvey, Holland, & Kayhanian, 2013). There are few studies focusing on the brick pavers, sod and rain gardens and their combinations. In our research, we intend to know how these LID control measures affect the warm water temperature separately and in combination.

The present paper has two sections. The first section focuses on the test setup, methods and process. We believe that they are as important as the test result in order to facilitate future related research. A controlled test has been designed and constructed to understand the thermal characteristics of LID strategies. The research is based on the assumption that the LID strategies can affect the thermally polluted stormwater runoff in some degree. The second section focuses on the collaborative work and contribution our group of landscape architecture has made to the research. The Green Infrastructure Laboratory (GIL) is a joint laboratory including the disciplines of Building Science, Biosystems Engineering, Horticulture, and Landscape Architecture. The team has tried to build a collaborative model on the thermal impact study in the laboratory. In this case, except for the benefit brought directly by the research outcomes to stormwater management, the overall research agenda also examines the potential of the collaboration between those disciplines above.

3 MATERIALS AND METHODS

3.1 Study area and summer temperature characteristics

Before the controlled test was designed and conducted in the laboratory, a study on a specific area was conducted to better understand the thermal impact in the built environment. The study area is Mobile, Alabama, it is at the west side of the head of Mobile Bay. Mobile county is home to Alabama state’s only seaport, and the city of Mobile has developed through this seaport economy. The city of Mobile is also recognized by the rich water resource and multiple water ecosystems such as estuarine, freshwater, and marine. It brings various recreational fishing opportunities and commercial fishing industry (Mobile Area Chamber of Commerce, 2014). The water quality and habitat protection in delta, estuary, and bay area are the critical factors to maintain the fish population and biodiversity. Mobile Bay and its tributaries provide a wide array of important services for fish, crustaceans, and wildlife including nursery habitat for a period of their life cycles. Urbanization has changed the surface characteristics of Mobile. During a rainfall event, stormwater runoff carries the heat and distributes it into streams, rivers, lakes, and bays. The warmer stormwater runoff mixes and potentially increases base temperature, which will affect the thermally sensitive species or communities of receiving waters.
It is recorded that over 90% developed area are imperviously constructed in the City of Mobile (Figure 1). Previous studies have shown that the higher the urban intensity or imperviousness, usually the higher the land surface temperature (Oke, 1973). The summers in Mobile are long and hot, and the winters are short and cold. Over the course of the year, the temperature typically varies from 42°F to 90°F and is rarely below 28°F or above 95°F. Although the recorded average temperature is not extremely high in summers, the peak temperature of day and direct sunlight can result in an even higher temperature effect to the specific urban surfaces. In some cases, the temperature of stormwater runoff (first inch of flow) flowing over heated impervious surfaces in downtown Mobile can be as high as 50°C during the month of July (Green Infra Lab, 2017). Warm water temperatures can affect aquatic systems and alter stream flow patterns (Poff et al., 1997), and it potentially affects fish species and aquatic organisms. For most fish, a 10°C increase in water temperature will approximately double the rate of physiological function (Di Santo & Bennett, 2011). Fish needs more oxygen at higher temperatures because of the increased respiration rates, which can be detrimental if rates remain raised for an extended period of time (Pearson Education, n.d.). However, most fish species are vulnerable when water temperature exceeds 34°C, because temperatures above 35°C can begin to denature, or breakdown, enzymes, reducing metabolic function.

3.2 Material use and experiment setup

The test had four phases (P1, P2, P3, P4). We tested several different samples separately and their combinations. The testing samples are pervious concrete (PC), impervious concrete (IC), sod, brick pavers...
with gravel joint (permeable paving approach for brick pavers in built environment), and rain gardens (Table 1). Four cells (C(a), C(b), C(c), C(d)) were constructed to hold the samples. Phase 1 and 2 focused on the impact of each sample to warm water temperature, and phase 3 and 4 focused on the impact of the combination of PC/IC, sod, bricks with rain gardens to warm water temperature. The combination test schedule implied our research scope. We realized that in the real environment, stormwater runoff flows through different LID practices at the same time during a rain event, and it is a complex process. Therefore, a combined impact of these LID practices is needed to be examined. In this case, at least one type of combination for the research would make more sense through the lens of landscape architecture. By testing the combination of LID practices, we are expected to understand complex landscape performance through thermal discourse.

Table 1. Test phase map (Table by the authors).

<table>
<thead>
<tr>
<th>Cell</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(a)</td>
<td>IC</td>
<td>Sod</td>
<td>Sod – rain garden (a)</td>
<td>Sod – rain garden (b)</td>
</tr>
<tr>
<td>C(b)</td>
<td>PC</td>
<td>Brick pavers</td>
<td>Brick pavers – rain garden (a)</td>
<td>Brick pavers – rain garden (b)</td>
</tr>
<tr>
<td>C(c)</td>
<td>IC</td>
<td>IC</td>
<td>IC – rain garden (a)</td>
<td>IC – rain garden (b)</td>
</tr>
<tr>
<td>C(d)</td>
<td>PC</td>
<td>PC</td>
<td>PC – rain garden (a)</td>
<td>PC – rain garden (b)</td>
</tr>
</tbody>
</table>

This study required a series of equipment to acquire, monitor and analyze water temperature. The types of equipment and how they are used is critical to the research (Table 2). As mentioned above, four cells were designed and constructed to hold the samples as well as their appropriate installation components (base, and sub-base aggregates). The probes system, heating, and cooling system were attached to the samples in a specific way. Take phase 1 for example, two PC and two IC were placed in each cell with four heat lamps on the top separately. Each sample was associated with five probes recording the temperatures of different places. Three probes collected temperatures of surface, middle, and bottom of the samples separately. The fourth probe of each sample was in a pan designed for collecting artificial runoff. A fifth probe was left for phase 3 and 4 where rain gardens would be introduced. These temperature probes transferred temperature data at 1-minute interval to a datalogger where it connected a laptop for analyzing purpose.

Table 2. Equipment used in the research (Table by the authors).

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Model</th>
<th>Power</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat Lamp—Solaira Weatherproof Infrared Heater</td>
<td>Alpha HI</td>
<td>1.5kw/120V</td>
<td>Heating cycle</td>
</tr>
<tr>
<td>Sprinklers—Rainbird 8 Series (8Q) Plastic Rotator</td>
<td>1806</td>
<td>32 psi</td>
<td>Cooling cycle</td>
</tr>
<tr>
<td>Probes/Data Logger—Roctest</td>
<td>\</td>
<td>\</td>
<td>Acquire temperature</td>
</tr>
<tr>
<td>SENSLOG Data Acquisition System</td>
<td>CR1000</td>
<td>\</td>
<td>Data analysis</td>
</tr>
<tr>
<td>FLIR Thermal Camera</td>
<td>T450sc</td>
<td>-20° C to 1500° C</td>
<td>Thermal imaging</td>
</tr>
</tbody>
</table>

The initial design of the cells was done by the students and professors from Building Science and Biosystems Engineering. The cell was 32” tall, and the concrete paving samples were 18” x 18” x 4”, weighing between seventy to one hundred twenty pounds each. All of the cells were constructed out of sturdy 2” x 12” pieces of lumber with 4” x 4” posts as legs. A room was also designed next to the samples for collecting “stormwater runoff” from the surface of the IC samples (Sample A and sample C), and each cell had holes at the bottom to transfer filtered “stormwater” to the pan (Figure 2).
3.3 Test procedure

A heating cycle and cooling cycle were designed for simulating the weather condition (rainwater and sunlight). The heat lamps simulated the natural sunlight, and the sprinkler system simulated the natural rain event. The concrete samples were initially held under heat lamps for approximately three or four hours in order to raise their temperatures to comparable levels found in pavements under intense summer sunlight (50°C - 70°C). Twenty sample events (replications) were recorded. The result showed that each place of the sample increased the temperature in some degree with different growing patterns. Following a four-hour heating cycle, the samples were sprayed with water (32 pound per square inch) from an irrigation system for one hour. During the test, water that either ran off (impervious) or infiltrated through the samples was collected in a pan below the stands. The phase 2 had one PC, one IC, brick pavers with gravel joint, and a sod sample. They then connected to rain gardens separately for phase 3 and 4 through a PVC pipe at the bottom pan of each sample cell. During the cooling period, artificial runoff was transferred to the plant component and was infiltrated through soil, finally flowed into another vessel with the fifth probe recording the temperature (Figure 3). Pretest showed that the sod and pervious brick paver samples heated up quickly than we expected. The PCs, ICs, pervious brick pavers, and sod have longer heating cycle than their cooling cycle. The PCs heat up faster than their impervious counterparts in a four-hour heating duration. This may be because of their higher porosity. However, the PCs also tend to cool down faster, giving up its stored thermal energy for the same reason it captures it so quickly.
LANDSCAPE ARCHITECTURE INVOLVEMENT IN THE RESEARCH

The GIL was characterized by the interdisciplinary work. The research team included professors and graduate students from Building Science, Horticulture, Biosystems Engineering, and Landscape Architecture, which a dynamic research framework was expected to be established. In this section, we intend to present the major work the group of landscape architecture has contributed to the research, and how it helps to achieve a more validated and accurate research outcome. We summarize the research work into five categories: Design/update, Maintenance/craft, Materiality, Analysis/manipulation, and Outreach. And each type of work can be done by the lab, cell, test, and sample scale. A brief description for each category is presented to understand the type of work in detail:

- **Design/update**: The thinking process needed for every scale of work. We made agenda for the test running, cells' form and function, sample size and PC/IC mix configuration, laboratory layout, and test presentation. In addition, workflow was also designed before actual test implementation.

- **Maintenance/craft**: The making process in the construction, installation and replacement of cells, tests, and laboratory devices. The maintenance of the plant species, and other labor work needed for the research.

- **Materiality**: The preparation of the materials. We prepared aggregate and cement for PC/IC; gravel, soil for brick pavers and sod. The lumber, nail material for the stands and cells. The mulch, soil, and sand mix for the plant component.

- **Analysis/manipulation**: The implementation of the test. It included the connection of sensor devices with samples, actual running the cooling and heating cycle, collecting temperature data, and analyzing data.

- **Outreach**: The presentation of the research. Various approaches were used to bring the research process and findings to broader audience, such as video, website, handbook, and public demonstration.
Table 3. Collaboration matrix map.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Scale</th>
<th>Design/update</th>
<th>Maintenance/craft</th>
<th>Materiality</th>
<th>Analysis/manipulation</th>
<th>Outreach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab</td>
<td>BS, BE</td>
<td>BS, BE, LA, HC</td>
<td>BS, BE, LA, HC</td>
<td>LA, HC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P1</td>
<td>Cell</td>
<td>BS, BE</td>
<td>BS, LA</td>
<td>BS, BE</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Test</td>
<td>BS, LA</td>
<td>\</td>
<td>BS, BE, LA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sample</td>
<td>BS, BE</td>
<td>BS</td>
<td>BS, LA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lab</td>
<td>BS, BE</td>
<td>BS, LA</td>
<td>BS</td>
<td>BS, LA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td>Cell</td>
<td>LA, BS, BE</td>
<td>LA</td>
<td>BS, LA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Test</td>
<td>LA</td>
<td>\</td>
<td>LA, HC</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sample</td>
<td>LA</td>
<td>LA</td>
<td>LA, BS, HC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lab</td>
<td>BS, LA</td>
<td>BS, LA</td>
<td>\</td>
<td>LA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3</td>
<td>Cell</td>
<td>LA</td>
<td>LA</td>
<td>LA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(P4)</td>
<td>Test</td>
<td>LA, BS</td>
<td>LA</td>
<td>LA, HC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample</td>
<td>HC</td>
<td>LA</td>
<td>HC, LA</td>
<td>LA, HC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: BS—Building Science; BE—Biosystems Engineering; LA—Landscape Architecture; HC—Horticulture.

The responsibilities of LA have largely penetrated the research process. The collaboration matrix map also presents the responsibilities of the other three disciplines during the research (Table 3). BC and BE first dominated the test in phase 1 and then decreased in phase 2 and 3 (4); LA and HC started to participate from phase 2 and 3 (4). The team had consent that this transition was predictable and reasonable. The samples we tested were from PC/IC to plant-oriented component through four phases (Table 1). Although we collaboratively work together, each discipline had its own research scope and goals. BE and BC focused more on the thermal nature of the concrete material, so they developed an initial test method for testing PC/IC. Horticulture focused more on the impact of warm stormwater to the plant root system. LA showed more interest on how PC/IC, brick pavers and rain gardens affected warm stormwater runoff for the urban settings. This gave the reason why LA and HC intensively participated the test when plants were introduced. Our test setup and process accommodated all these intent within one test structure. It is fair to conclude that the research framework we designed allows each discipline to benefit from the test. It is also important to acknowledge that the collaboration matrix map aims to show the degree of the diversity of the work each discipline was involved in. It does not emphasize the degree of the importance of the work of each highlighted category. We believe that these categories are highly integrated and naturally combined for forming the research. To better understand our responsibilities, we summarize the work into two parts. The first part was about test-oriented work, which included the stands, plant maintenance, and the rainfall distribution test. The other part was about the test outreach, which included the visual communication and the media representation. A few examples are presented below to exhibit the contribution of LA to the research.

4.1 Stands maintenance
One of the test-oriented work was the stands maintenance, and it mainly happened in phase 1. In the GIL, decay occurred. Pretty much like in the exterior environment, the stands gradually rot when water
met the wooden structures for a certain period of time. The degradation of the stands has potential to cause leak problem. Since the cooling cycle was one of the essential procedures which cannot be adjusted to avoid the degradation, it brought a concern on the use of the materials for building more appropriate cells and other associated construction elements. During phase 1, we suggested the use of water-proof paint for the wooden pieces for the updated stands. In addition, the design of the cells should take consideration of the sample’s life cycle, weight, maintenance, and replacement. Due to the different porosity rates, the concrete samples weighed seventy to one hundred twenty pounds. One the one hand, they were very heavy to be moved in and out of the cells when the samples needed to be replaced. On the other hand, heavy samples may cause the crash of the cells if the load was not calculated in advance. To ensure the cells to hold the samples firmly, we added two metal brackets for each cell, and initiated a design activity for a movable and modular stand.

4.2 Plant maintenance

As the sod sample started to be introduced in phase 2, the plant component has become another part that needed a careful maintenance. We provided the plant with the adequate light, moisture, and nutrients, and most of the plant components grow well in the indoor environment. However, the sod sample showed the different growth conditions. The grass in the edge grew faster than the grass in the center. It was because the sod sample was 18” x 18”, and the heat lamp was 18”x10”, which the sod sample was not fully covered by the heat lamp. When the heat lamp turned on, the center part of the sod sample was exposed to the stronger heat energy than the extra part.

In addition, one of ink berry (Ilex glabra) shrubs died during the phase 3. We found that it was affected by the spider mite (Tetranychidae), which was a type of arachnid sticking on the leaves. By applying the pesticide on the leaves, the spider mite was removed from other three ink berry shrubs. A new ink berry was planted as well. However, the pesticide has become an unknown factor that may impact the test result. We decided that all the ink berry shrubs should be replaced by a new batch of plants. In phase 4, we kept inkberry species, and added two more plant species into each plant pot. Mixed plant combination can better simulate the rain garden conditions than the single species. These three species were selected based on Low Impact Development Handbook for the State of Alabama (Katie L. Dylewski, Jessica T. R. Brown, Charlene M. LeBleu, & Eve F. Brantley, n.d.) by the professor from the Department of Horticulture. Southern wax myrtle, dwarf yaupon holly, and inkberry holly are the common shrubs for rain gardens and bioretention in Alabama, and relatively easy to maintain in the indoor environment. So they are suitable for our research at this stage.

<table>
<thead>
<tr>
<th>Common name</th>
<th>Southern Waxmyrtle</th>
<th>Dwarf Yaupon Holly</th>
<th>Inkberry Holly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific name</td>
<td>Morella cerifera</td>
<td>Ilex vomitoria ‘Schilling’s Dwarf’</td>
<td>Ilex glabra ‘Shamrock’</td>
</tr>
<tr>
<td>Growth habit</td>
<td>15 - 20' H x 15 - 20' W</td>
<td>4 - 6' H x 6 - 8' W</td>
<td>3 - 4' H x 3 - 4' W</td>
</tr>
<tr>
<td>Light Req.</td>
<td>Full Sun to Part Shade</td>
<td>Part Sun to Part Shade</td>
<td>Full Sun to Part Shade</td>
</tr>
<tr>
<td>Moisture Req.</td>
<td>Medium to Wet</td>
<td>Dry to Wet</td>
<td>Medium to Wet</td>
</tr>
<tr>
<td>Hardiness Zone</td>
<td>Zone 7 - 10</td>
<td>Zone 7 - 10</td>
<td>Zone 4 - 9</td>
</tr>
<tr>
<td>Characteristics</td>
<td>Wet &amp; Drought Tolerant</td>
<td>Salt &amp; Drought Tolerant</td>
<td>Wet Tolerant</td>
</tr>
</tbody>
</table>

4.3 Rainfall distribution uniformity test

The cooling system is critical to the test, non-uniform rainfall distribution may cause the ineffective test result. To improve the accuracy of the test, we did a supplemental test to see if the “rainfall” was occurring uniformly across four samples. During the test, four containers were placed on the four corners of each sample, and a thirty-minute spraying from cooling system was applied to the sample and the containers. Then “rainfall” collected by sixteen containers were measured by a measuring cylinder. The result for each sample was illustrated as four blue bars. They showed the volumes of “rainfall” collected in
each container. The overall distribution uniformity rate was seventy-seven percentage. By analyzing the “rainfall” distribution area of each sample, the red-dot area showed the highest uniform distribution rate in the test model (Figure 4). This result revealed that a better test may be improved by clustering the sample stands at the center of the irrigation system.

4.4 Data visualization

To better present the research analysis and result, we tried to make the test data visually friendly. The exploration on the visual presentation of data by researchers and designers is not new. This approach manages data in such a way that viewers can visually communicates with data, making viewers quickly draw the information from a set of numeric data. To make the test result readable, data visualization is needed for our research. Since real time temperature data was collected by twenty probes, data analysis software generated the line graph that one line stood for one probe. In phase 1 and 2 there were 16 lines separately showed the temperature change, and 20 lines in phase 3 and 4 separately showed the temperature change. The overlay of these lines made the certain parts of the result not perfectly readable. In this case, we tried to redesign the graph and made it more readable. However, we found it very difficult to show the temperature within the sample itself and temperature change across the different samples in one graph. For instance, we illustrated the temperature change of the surface, middle, and bottom of each sample by using four graphs, but the graphs failed to illustrate the temperature relationship of the same location across different samples (Figure 5). Because the research has not been completed, data visualization at this stage is an ongoing process, as it needs the iterations and refinement to find the better approach to describe the result.
4.5 Media representation

It is important to use multiple medium to facilitate this collaborative research. We believe that the value of this research not only lies in the test result, but also can be credited by the collaboration. The team intended to spread our collaborative work form to broader audience, which can make dynamic conservations happen in and out of the laboratory. In this case, we tried various approaches to disseminate our thermal impact study. For instance, a “How to book” with text and photos was created to introduce the research basis, share the specific test language and described the test steps and methods. By reading this we can minimize the impact caused by the individuals’ experiment manner to the test, which helped to maintain the test quality and improve work efficiency for different testers from different disciplines. It can also be a good medium for spreading our research when we interact with different groups in and out of the GIL. A website was established to exhibit the research progress, archive test events and laboratory documents. It also had the function which we can receive comments or feedback from the public. In addition, a three-minute video was filmed and incorporated in the website. It described the test setup, methods, objectives, and importance of the research. The video showed the experiment devices, heating and cooling system, and the laboratory environment, which gave viewers a more tangible picture of the research context.

In conclusion, Landscape Architecture has largely involved in this thermal impact research through multiple perspectives, and we have had many findings throughout our work. From the test-oriented perspective, we have found that the sod sample is more sensitive to the heat, and requires more maintenance and replacement than the PCs, ICs, and brick pavers. The cells should change to a waterproofed and lightweight material that properly accommodate the samples. From the outreach perspective, data visualization and media representation help to disseminate the interdisciplinary research, which opens the opportunity of the conversations and interactions. From the collaboration perspective, there is no reason for a collaborative team not to have varying research scope. Varying research scope is acceptable and welcome if the team can strategically make research framework for each discipline’s good.

5 Conclusion

Urbanization and climate change have changed hydrological cycle and ecosystem. In the urban settings, stormwater runoff heated by hard surfaces in summer flows into the receiving waters, potentially affects the aquatic life. LID practice is a common approach to address the urban stormwater issue. To find out how LID practice can affect the stormwater temperature, we set up a laboratory test in the GIL at Auburn University. An interdisciplinary team was also established for this research, as four disciplines collaboratively work together with different points of the focuses and scope. The ultimate goal of the research is to find out how LID practice affects water temperature. Besides this, we believe that the test setup, research methods and process are also critical for achieving a favorable research outcome, as it can help us to see the difficulties and opportunities embodied in the research. What is more, it provides a basis for related future research. This paper also discusses the collaboration pattern and highlights the role of landscape architecture in the interdisciplinary team in a laboratory working environment. This complex thermal impact issue requires the collaboration across different disciplines, where landscape architecture can offer the ability to synthesize and visualize complex data, a familiarity in construction and craft process, and skills in stimulating the conversations between teams and public (Ahern, Leduc, York, & Foundation, 2007). Moreover, this interdisciplinary team builds a unique working model in the laboratory scale. Through “To learn by doing”, landscape architecture obtains the opportunity to move out from the “comfort zone”, tries to expand research boundaries and understands complex landscape performance of LID practices through the thermal aspect rather than the application perspectives.

REFERENCE


EFFECTS OF SPATIAL FORMS OF GREEN INFRASTRUCTURE IN BLOCK SCALE ON PM\textsubscript{10} AND PM\textsubscript{2.5} REMOVAL—A CASE STUDY OF THE MAIN CITY OF WUHAN

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1 ABSTRACT
Particulate air pollution is a common challenge in the process of rapid urbanization of developing countries. Under the overall particulate air pollution in urban, there are significant differences in the concentration of particulate air pollution in urban blocks, and green infrastructure is an important factor. This research focused on the spatial forms and influence extent of green infrastructure on PM\textsubscript{10} and PM\textsubscript{2.5}. PM\textsubscript{10} and PM\textsubscript{2.5} data were obtained from eight national controlling points and two self controlling points by a research group in Wuhan. And landscape pattern index of green infrastructure of ten blocks was calculated by Fragstats. Correlation analysis showed that concentration was highly correlated in the urban block, spatial forms of green infrastructure and PM\textsubscript{10}/PM\textsubscript{2.5}. PM\textsubscript{10}/PM\textsubscript{2.5} concentration were negatively associated with the total area of patch (CA), but positively associated with patch mean nearest (MNN), patch density (PD), and edge density (ED). Besides, largest patch index (LPI) was almost not associated with PM\textsubscript{10}/PM\textsubscript{2.5} concentration. Stepwise multiple regression analyses indicated that the most significant influencing factor on the moderation of particulate matter was the total area of patch (CA), while mean nearest distance of patches (ENN\_MN) exhibited a negative impact. According to our findings, we propose that increasing the area of the UGI patches and decreasing the distance among different green patches are two key strategies to reduce the particulate air pollution, which can enrich a new dimension of green infrastructure planning and design.

1.1 Keywords  
Green Infrastructure, Particulate Matter, Spatial Forms, Block Scale
2 INTRODUCTION

Particulate air pollution is a common challenge in the process of rapid urbanization of developing countries. With the high density urban morphology, industrialization and popularization of private cars, the problem is becoming more and more serious. PM$_{10}$ and PM$_{2.5}$ are the main pollutants, also known as inhalable particle and fine particle, whose aerodynamic diameter is less than 10 microns and 2.5 microns respectively. According to Environmental Performance Index (EPI) report published by Yale University and Columbia University, China ranked the last fourth place comparing air quality among 180 countries in the world. Therefore, solving the air pollution problem is imminent.

According to the preliminary data investigation, there were significant differences in the concentration of PM$_{10}$ and PM$_{2.5}$ in urban blocks under the overall particulate air pollution in urban. Air samples taken from sites with less green space frequently had high concentrations of PM$_{10}$ and PM$_{2.5}$ than other sites (Irga et al. 2015). Urban green infrastructure (UGI) was considered an important factor (Pugh et al. 2012). It is an interconnected network composed of natural areas and other open spaces. It emphasizes the preservation of the value and function of natural ecosystems in order to maintain clean air and water (Benedict & McMahon. 2006). Compared to the traditional green space system, the urban green infrastructure contains new greening types, such as greenway and green roof. In urban blocks, UGI which is mainly composed of vegetation, including lawn, shrub and tree helps to decrease particulate air pollution by the way of trap of vegetation’s leaves (Ottelé et al. 2010). The leaf secretions and the roughness of the blade and the length of the villi are beneficial to intercept and accumulate atmospheric particulate matter, so as to decrease the airborne particulate matter concentrations (Beckett et al. 2000). Vegetation transpiration can also create a relatively humid and low temperature environment, which is in favor of the deposition of atmospheric particulate matter (Cardelino & Chameides. 1990). The deposition rate of atmospheric particulate matter can also be promoted via several vegetation arrangements, contributing to the alter of wind field through their geometric characteristics, or interception effect by acting as physical barriers (Khan & Abbasi. 2001). In addition, vegetation communities formed by different tree species play more effective role in decreasing particulate air pollution (Freer-Smith et al. 2004). In summary, the reduction effect of green space on particulate matter is a complex process, depending on various aspects. According to statistics, 234.5kg PM$_{10}$ could be removed by 19.8 ha of green roofs in one year, accounting for 14% of the total amount of air pollutants (Yang et al. 2008). Simulate result revealed that increasing total tree cover in West Midlands from 3.7% to 16.5% reduces average primary PM$_{10}$ concentrations by 10% (McDonald et al. 2007). In addition, there are other urban factors which could contribute to mitigation of air pollution. The water body such as lakes can also reduce particulate matter by increasing air humidity (Mesut & Bayram. 2010). In residential areas, building density is positive associated with PM$_{10}$ and PM$_{2.5}$ Concentration (Fan et al. 2017).

Among the aforementioned studies on the particulate matter pollution effect of UGI, most of them focused on the indicators of the number of UGI, such as green coverage, but almost no attention was paid to the spatial form of UGI. In addition, parks, forests or road greenbelts were the main study subjects, lacking of study on the UGI in urban common blocks constituting a fabric of urban space. Since the common blocks are the major components of city and are strongly associated with people’s daily life, it is necessary to further reveal and emphasize the positive effects of UGI on particulate matter. That can provide evidential bases and available knowledge for landscape architects or urban planners to improve the urban air quality by means of planning and design strategies of green space.

The current work uses on-site data to reflect air quality of different blocks in Wuhan. Meanwhile, using landscape pattern index calculated by Fragstats as criterion of the spatial form of UGI in urban blocks. The landscape pattern indexes include size, shape, concentration and fragmentation. In order to assess the impacts of those UGI indexes on the air quality improving-effect of UGI, the study focuses on the following key contents:

1) Is there a correlation between the spatial forms of UGI and the concentration of particulate air pollution in general urban blocks?
2) What kinds of and to what extent spatial forms of UGI can affect the concentration of PM$_{10}$ and PM$_{2.5}$?
3 METHODS

3.1 Study area
The study was conducted in Wuhan, the largest city in Central China. It is located in the intersection of the Yangtze and Han Rivers and is divided by the two rivers into Wuchang, Hankou and Hanyang. According to the 2016 global air pollution database published by the World Health Organization, Wuhan was the 12th worst particulate matter air pollution among 210 cities in China. Thereby, it becomes a target site of many studies relevant to urban particulate matter air pollution (Chen et al. 2015, Lu et al. 2017). The total area of the main city of Wuhan is 95515 hectares. By the end of 2015, the green coverage of the built-up area was 39.65%.

3.2 Sample sites
Ten air quality monitoring stations were relatively evenly spread around the main city of Wuhan, including eight national automatic monitoring stations and two self-monitoring stations set by research group (see Figure 1). Since Wuhan is a plain city, the monitoring stations are located in the similar height varying from 5 m to 27 m. The prevailing wind direction is northeast. This paper serves ten blocks of 1000m’s diameter, whose the center is each monitoring station, as study subjects (see Table 1). There are no pollution sources around the blocks, most of which are residential land, commercial land.

![Figure 1. Distribution of 10 monitoring stations in the main city of Wuhan. Diagram by the author.](image)

<table>
<thead>
<tr>
<th>No.</th>
<th>Site</th>
<th>Coordinates</th>
<th>General land use</th>
<th>The composition of UGI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Zhuankou New area</td>
<td>(30.4753, 114.1525)</td>
<td>Commercial area</td>
<td>Street trees</td>
</tr>
<tr>
<td></td>
<td>Hankou Huaqiao</td>
<td>(30.6197, 114.2836)</td>
<td>Residential area</td>
<td>Street trees and planted residential areas</td>
</tr>
<tr>
<td>2</td>
<td>East lake Pear orchard</td>
<td>(30.5719, 114.3672)</td>
<td>Parkland area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hankou Marshland</td>
<td>(30.5947, 114.3008)</td>
<td>Residential and parkland area</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Ganzhou, Qingshan</td>
<td>(30.6103, 114.4272)</td>
<td>Residential and commercial area</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>East lake High-tech area</td>
<td>(30.4822, 114.3894)</td>
<td>Residential area</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Yuehu Lake, Hanyang</td>
<td>(30.5514, 114.2511)</td>
<td>Residential and parkland area</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Attributes of the ten blocks.
8 Ziyang, Wuchang (30.5494, 114.3006) Residential area Parkland and planted residential areas
9 Nansi, Huazhong (30.5113, 114.4050) Educational and residential area Street trees, planted residential and public facilities areas
10 Design Institute, Huazhong (30.5162, 114.4085) Educational area Street trees and planted public facilities areas

3.3 Particulate matter data measurement
Particulate matter data measurement was from two aspects. PM_{10} and PM_{2.5} concentration of national automatic monitoring stations originated from Wuhan environmental air quality real-time publication system (http://ft.whepb.gov.cn:8090/Default.aspx), which recorded the PM_{10} and PM_{2.5} concentration data per hour. Two self monitoring stations were set in Huazhong University of Science & Technology. Measurement of PM_{10} and PM_{2.5} in air was by Laser Dust Monitor. One group of data is measured once a minute and 9999 groups of data can be measured at a maximum of one measurement period (2 weeks).

According to the pollution situation of Wuhan in 2015, PM_{10} and PM_{2.5} sample data of 36 days was selected with the rate of 10% of the whole year. The data selection criteria was mainly based on 2-4 days per month for different levels of pollution under the sunny, windless weather conditions. The PM_{10} and PM_{2.5} concentration values of the 36 days in 10 blocks were averaged respectively to analyze the overall pollution.

3.4 Spatial form index calculation of UGI
UGI in the current study is defined as “any vegetation found in the urban environment, including parks, open spaces, residential gardens, or street trees” (Kabisch, & Haase, 2013). Trees, grass, and trees, grass in green roof were used as UGI in my research design. UGI of 10 blocks were extracted from remotely sensed imagery (GF-2) taken from a China-made satellite, whose spatial resolution is 0.8 meter and acquisition date is September 1, 2016. The imagery was bought from remote sensing bazaar (http://www.rscloudmart.com/). The imagery was first preprocessed by radiometric and geographical corrections, and was then pan-sharpened to capture the structural features more precisely. Finally, based on the object-oriented classification technique, which is a method to extract different objects according to their features, such as texture, size, length and width, ENVI (The Environment for Visualizing Images) can achieve the automatic recognition and extraction of vegetation target from high-resolution remotely sensed imagery. Thereafter, combined with artificial visual interpretation, the results of extraction were optimized (see Figure 2).

Aforementioned UGI extracted from remotely sensed imagery was applied to Fragstats to calculate the spatial form index. According to former studies (Wu et al. 2015, Shen et al. 2014), Six representative indexes were selected to measure UGI spatial form in ten blocks in Wuhan based on the four aspects (size, shape, concentration, fragmentation) of spatial form based on principles including (1) theoretically and practically important, (2) interpretable, and (3) little redundancy (see Table 2). The selected spatial form indexes were applied to reflect the size, shape, concentration, fragmentation and separation of the UGI class level. The total class area (CA) and largest patch index (LPI) are patch composition index measuring the total area and core patches of landscape. Patch density (PD), edge density (ED) are landscape configuration indexes describing the spatial distribution of patches within the landscape. Landscape shape index (LSI) is a landscape shape index representing the irregularity of the perimeter of patches. Mean euclidean nearest neighbor distance (ENN_MN) at class level signifies the concentration characteristics of all patches.
3.5 Statistical analyses

First, the trends for PM$_{10}$, PM$_{2.5}$ and UGI spatial form were conducted to understand the characteristic of the ten blocks. Second, bivariate relationship was evaluated between the air quality indexes (the values of PM$_{10}$ or PM$_{2.5}$ concentration) and the UGI spatial form indexes including CA, LPI, LSI, ENN_MN, PD, and ED, where UGI spatial form indexes are independent variables and air quality indexes are dependent variables. Finally, stepwise multivariate regression analysis was conducted to assess the contribution of those indexes to PM$_{10}$ and PM$_{2.5}$ concentration quantitatively, according to a predictive equation (Eq. 1).

\[ Y = b_0 + b_1 \text{CA} + b_2 \text{AREA} + b_3 \text{PARA} + b_4 \text{ENN} + b_5 \text{LPI} + b_6 \text{DIVISION} \]  

Where Y stands for the values of PM$_{10}$ or PM$_{2.5}$ concentration, CA, LPI, LSI, ENN_MN, PD, and ED are the indexes previously described, $b_1$-$b_6$ are the coefficients for each variable, $b_0$ is the constant. The statistical analyses were carried out using SPSS 19.0 software.

4 RESULTS

Trends for PM$_{10}$ and PM$_{2.5}$ are displayed in Figure 3. The concentration of PM$_{10}$ and PM$_{2.5}$ in the ten blocks has great difference and similar tendency. Samples taken from the sites that exhibited the lowest concentrations of green space, such as Zhuankou New area, Hankou Huaqiao, generally had the highest concentrations of PM$_{10}$ and PM$_{2.5}$. Conversely, the site that had the most green space, such as Design Institute, Nansi, recorded the lowest PM$_{10}$ and PM$_{2.5}$, which were significantly lower than other eight sites.

Trends for UGI spatial form indexes of ten sample sites are displayed in Figure 4. The configurations of UGI spatial form varied significantly. The maximum values of CA, LPI, LSI, ENN_MN, PD, and ED were all regarded as “1”, and the maximum values of these six indexes were appeared in Design Institute, East lake Pear orchard, East lake High-tech area, Yuehu Lake, Zhuankou New area, Ziyang. The minimum values of these six indexes were only 0.14 (e.g., Zhuankou New area), 0.10 (e.g.,
ZHUANKOU NEW AREA), 0.08 (E.G., EAST LAKE PEAR ORCHARD), 0 (E.G., EAST LAKE PEAR ORCHARD), 0.005 (E.G., DESIGN INSTITUTE), 0 (E.G., EAST LAKE PEAR ORCHARD), RESPECTIVELY.

FIGURE 3. AVERAGE CONCENTRATIONS OF PM$_{10}$ AND PM$_{2.5}$ FOR EACH SAMPLE SITE. DIAGRAM BY THE AUTHOR.

FIGURE 4. TRENDS FOR UGI SPATIAL FORM INDEXES OF TEN SAMPLE SITES. DIAGRAM BY THE AUTHOR.

4.1 Relationship between UGI spatial form and PM

There was a certain relationship between UGI spatial form indexes and concentrations of PM$_{10}$ and PM$_{2.5}$ (see Table 3). CA had the most significant impacts on particulate matter (negative relationship, P<0.01), but there was no apparent relationship between LPI (r=-0.085, -0.116), which illustrated that UGI spatial form affected particulate matter air pollution mainly through a large size. ENN_MN, LSI, PD and ED were weakly positively correlated with concentrations of PM$_{10}$ and PM$_{2.5}$ (0.3<r<0.5). The results illustrated that the more patches are, the greater the edge density is, and the more serious the degree of fragmentation is, the more serious particulate matter pollution is. We could improve air quality through increasing the area and aggregation of patches.

Table 3. The correlation coefficient (r) between UGI spatial form indexes and PM.

<table>
<thead>
<tr>
<th></th>
<th>CA</th>
<th>ENN_MN</th>
<th>LSI</th>
<th>PD</th>
<th>LPI</th>
<th>ED</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM$_{10}$</td>
<td>-0.824**</td>
<td>0.420</td>
<td>0.436</td>
<td>0.463</td>
<td>-0.085</td>
<td>0.460</td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>-0.756**</td>
<td>0.474</td>
<td>0.344</td>
<td>0.305</td>
<td>-0.116</td>
<td>0.428</td>
</tr>
</tbody>
</table>

** Significance at the 0.01 level.
4.2 The kind of UGI spatial form that significant influence on the PM

Stepwise multiple regression analyses of those aforementioned UGI spatial form indexes on PM$_{10}$ and PM$_{2.5}$ values were conducted to evaluate the contributions of those indexes on the air quality modification effect. Result is displayed in Table 4. The correlation coefficient ($R^2$) serves to describe the proportion that can be explained by the variables (difference UGI spatial form indexes) of the regression model. The coefficient (B, Beta) of each variable allows assessing the variation and contributions extent of the target parameters (i.e. PM$_{10}$ and PM$_{2.5}$ values in the current case) upon the corresponding variable. In that respect, more than 80% of the variation in PM$_{10}$ and PM$_{2.5}$ values can be explained by those UGI spatial form indexes, since the $R^2$ value is 0.878 and 0.819, respectively.

Total area of patches (CA) was the strongest influential indexes toward air quality improvement, since the corresponding significance level is lower than 0.01. The values of B coefficient of the CA was -1.843 and -0.662 respectively, which means that 10 hectares increased in the total area of UGI patches would decrease about 18.43 $\mu g/m^3$ and 6.62 $\mu g/m^3$ in PM$_{10}$ and PM$_{2.5}$ concentrations. Since the main vegetation type is street trees, this positive effect of UGI patches area reflects that UGI plays an important role in decreasing the particulate matters through vegetation leaves (Hagler et al. 2012, Tong et al. 2016).

A weak negative impact of the mean nearest neighbor distance (ENN_MN) on PM$_{10}$ and PM$_{2.5}$ concentrations was observed (Sig.= 0.012, 0.017). And it can be concluded that 10 meters increase of the mean distance of patches would increase about 29.60 $\mu g/m^3$ and 12.9 $\mu g/m^3$ in PM$_{10}$ and PM$_{2.5}$ concentrations. It indicates that UGI patches’ nearest distance is also associated with atmospheric particulate matter concentrations. This also means that fragmented patches are not good for air quality.

According to the results of stepwise multiple regression analyses, it also could be concluded that the impact of LSI, PD, LPI and ED are indeterministic toward the reduction of PM$_{10}$ and PM$_{2.5}$ in the current case.

Table 4. Stepwise multiple regression profiles of UGI spatial form indexes with regard to PM$_{10}$ and PM$_{2.5}$ values.

<table>
<thead>
<tr>
<th>Variables</th>
<th>PM$_{10}$</th>
<th>Coefficient</th>
<th>B</th>
<th>Beta</th>
<th>R$^2$</th>
<th>Sig.</th>
<th>PM$_{2.5}$</th>
<th>Coefficient</th>
<th>B</th>
<th>Beta</th>
<th>R$^2$</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>141.480</td>
<td></td>
<td></td>
<td></td>
<td>0.000</td>
<td></td>
<td>Constant</td>
<td>74.877</td>
<td></td>
<td></td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>-1.843</td>
<td>-0.838</td>
<td></td>
<td></td>
<td>0.000</td>
<td></td>
<td>CA</td>
<td>-0.662</td>
<td></td>
<td>-0.771</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>ENN_MN</td>
<td>2.960</td>
<td>0.446</td>
<td></td>
<td></td>
<td>0.012</td>
<td></td>
<td>ENN_MN</td>
<td>1.290</td>
<td></td>
<td>0.498</td>
<td>0.017</td>
<td></td>
</tr>
<tr>
<td>LSI</td>
<td>0.002</td>
<td>0.878</td>
<td></td>
<td></td>
<td>0.993</td>
<td></td>
<td>LSI</td>
<td>-0.078</td>
<td></td>
<td>0.819</td>
<td>0.706</td>
<td></td>
</tr>
<tr>
<td>PD</td>
<td>0.014</td>
<td>0.946</td>
<td></td>
<td></td>
<td>0.946</td>
<td></td>
<td>PD</td>
<td>-0.177</td>
<td></td>
<td>0.458</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LPI</td>
<td>0.107</td>
<td>0.594</td>
<td></td>
<td></td>
<td>0.594</td>
<td></td>
<td>LPI</td>
<td>0.136</td>
<td></td>
<td>0.577</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ED</td>
<td>0.268</td>
<td>0.098</td>
<td></td>
<td></td>
<td>0.098</td>
<td></td>
<td>ED</td>
<td>0.177</td>
<td></td>
<td>0.411</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5 DISCUSSION

Based on these results obtained from the work, some measures suggested should be taken by landscape designers, policy makers and city managers for improving the urban air quality as follows.

1) Increasing the area of the UGI patches, including trees, grass, bushes, and so on. Although it is common sense that larger coverage of vegetation can always bring benefits for urban particulate matters, our results further show a strong correlation between the area of vegetation and the values of PM$_{10}$, PM$_{2.5}$ concentration in the urban common blocks. This means that the vegetation, especially great trees, should be protected positively, which is beneficial for increasing the vegetation quantity and its coverage. In addition, strengthening the three-dimensional greening, mainly through the construction of the vertical landscape interface, such as green roof, vertical greening and other ways increases green quantity, improve the green coverage.

2) Decreasing the distance between different green patches, so as to increase the connectivity between patches. It indicates that the closer between the patches, the more significant of their air quality modification effect. That requires not only as much UGI as possible, but also an encouragement for planting trees with large canopy so that they can bond together to form a unitive integer.

In addition, the limitations of this study cannot be ignored. Although the current work used eight national air quality monitoring stations and two self monitoring stations in Wuhan, the number of sample
sites is less slightly. The PM$_{10}$ and PM$_{2.5}$ concentration of ten blocks were measured with their centers, how to represent the whole block need a further research. Further works can also be focused on much sample sites so as to reveal the clear and deep relationship between particle matter concentration and UGI spatial form in urban common blocks.

6 CONCLUSION

The current study investigated the effects of urban green infrastructure on particulate matter in views of ten common blocks and the individual spatial form indexes (CA, ENN_MN, LSI, PD, LPI, ED). Using on-site data measured by national air quality monitoring stations and our research group, combined with UGI of ten blocks extracted from remotely sensed imagery, a relationship between UGI spatial form and particulate matters had been obtained. This study contributes to the growing literature concerning air quality improvement via UGI. This study provides a method to explore the relationship between air pollution and UGI spatial form for other cases. It also provides important implications for urban neighborhood planning, design, and management; landscape designers and city managers should consider the strong benefits of using UGI to accomplish environmental goals.

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AN ECOLOGY OF URBAN FORM: THE IMPERATIVE OF THE BIOREGION

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1 ABSTRACT
Landscape architecture has two areas significant to focus on sustainability, and urbanization, and global cities: landscape planning, i.e., bioregional planning (bioregionalism) and urban design. Compared with urban planning and architecture, landscape architecture’s status regarding bioregionalism and urban design has diminished. Bioregionalism are and urban design are reconsidered vis-à-vis sustainable urban form, globalization, and landscape architecture’s potential role. Landscape architecture’s contribution to bioregionalism was established in Olmsted’s Yosemite Valley plan and more recently the 1960s environmental movement exemplified by luminaries in the profession, e.g., McHarg, Lyle, Steinitz. Characterizing landscape architecture’s “generalist” underpinnings, embracing works of Powell, Marsh, Pinchot as well as those of Mumford, Lynch, Berry, Wilson, and Relph is also significant. Landscape architecture’s bona fides in urban design date to urban planning being largely conducted by landscape architects in the 19th century including Nolen, Peets, Manning, Kessler, the Olmsteds, and Wright. Landscape architecture’s practice of regional planning and urban design has diminished for two reasons. First, planning regionally is difficult to implement, although this is changing. Second, New Urbanism and Smart Growth have displaced landscape architecture. Nevertheless, landscape architecture is poised for leadership in a number of areas – to realize an “ecological tapestry of urban form” in a global era. Sustainable practices of the land-water nexus while addressing carbon emissions are essential. Ecology’s natural systems model within bioregions dictates broadly defining urban form. Interrelationships within watersheds are paramount, e.g., regarding carbon and hydrological cycles as complex bounded systems, conservation of areas of ecological value, multinuclear and multimodal settlement, and urban agriculture.

1.1 Keywords
Regionalism, Globalization, Urban Design, Urban Form
2 INTRODUCTION

Large scale landscape planning of a regional nature dates to the earliest practices of landscape architecture in the United States. Seminal in this regard is the commission headed by Frederick Law Olmsted established by Congress that resulted in the Yosemite Valley landscape management plan.

Drawing from Congress’ 1864 enactment, the following statement identifies regional considerations for a major portion of a watershed:

“Cleft” or “Gorge” in the Granite Peak of the Sierra Nevada Mountains, situated in the county of Mariposa . . . and the head-waters of the Merced River, and known as the Yosemite Valley, with its branches and spurs, in estimated length fifteen miles, and in average width one mile back from the main edge of the precipice, on each side of the Valley, with the stipulation, nevertheless, that the said State shall accept this grant upon the express conditions that the premises shall be held for public use, resort, and recreation; shall be inalienable for all time . . .” (Whitney 1869).

This vast landscape comprising Yosemite Valley and its environs, including water runoff concerns, reflects a need for planning – and ultimately design – utilizing a geographic land unit, e.g., the watershed. Furthermore, utilization of a geographic context by Olmsted and the commission presaged the attention to “natural systems” that inspired George Perkins Marsh in the late 19th century and that is significant to urban ecology and the practice of landscape architecture today.

Olmsted’s Yosemite work was preceded by Central Park that also reflects large scale considerations of landscape architecture, but of an urban nature. Looking contextually at a large tract of an urban landscape for public park purposes, Olmsted also addressed important urban design considerations of street typologies, streets’ roles within a public right of way, and therefore urban form determination reflective of landscape architecture’s bona fides in urban design practice.

Olmsted’s seminal accomplishments regarding large scale landscape planning inclusive of natural land units, urban form, the public urban realm, and ultimately town planning is the work of genius, in responding to the centrifugal and centripetal forces of the Industrial Revolution. Furthermore, this momentum is reflected in various commissions for regional landscape planning and urban design as reflected in the work of the Olmsted sons, Charles Elliot, George Kessler, Horace Cleveland, John Nolen, Henry Wright, Elbert Peets, Warren Manning, and others. Their work constitutes the American Parks Movement, the City Beautiful Movement, and influences on the Social Reform Movement of the late 19th century, town planning (Martin 1999) and the emergence of modern urban planning. Furthermore, landscape architects’ contribution through government mandated Depression Era projects, and the easy entrance of landscape architecture into the Environmental Movement of the 1960s partially fueled by embracing earlier work of George Perkins Marsh, Gifford, Pinchot, and John Wesley Powell - are self-evident.

Moreover, Olmsted’s ground breaking work and those following him in the late 19th and early 20th centuries with more recent iterations by McHarg, Steinitz, and Lyle predates the United Nations Bruntland Commission of 1987 and the coining of the term “sustainability.” In other words, landscape architecture has pioneered practices of sustainability long before the recent rush towards “green” environmental practices.

With landscape architecture developing in response to the Industrial Revolution, its role in urban design became manifest and is reflected in the work of Nolen, Peets, Manning, Kessler, the Olmsteds, and Wright. Over a brief timeframe landscape architecture developed expertise in town planning and city design, neighborhood and district design, built and natural corridors such as livable streets, greenways, and “blueways,” as well as individual sites as recently expressed in the ASLA’s Sustainable Sites Initiative. Therefore, wherein landscape architecture practice predates recent focus on sustainability, the profession has developed and surpassed urban design as promoted by New Urbanism. Importantly, the difference here is essentially twofold. First, with New Urbanism emanating from architecture, emphasis on building design and form generally falls out of the purview of landscape architecture. Second, in evolving quickly and substantively, e.g., as reflected in The Transect’s attention to “ecology,” New Urbanism – and architecture in general - has not been convincing with respect to ecological contexts, particularly compared to landscape architecture’s bioregional focus and longstanding practice utilizing a natural and human cultural resource data base to inform sustainable design decision-making. Within this context – including the various scales of concern referenced above – this paper focuses upon relationships of bioregions and urban design to articulate landscape architecture’s historic and contemporary role in the attainment of sustainable urban form.
3 METHODS
This work relies on published data and historical method in its development, presentation, and findings. The literature has been examined and synthesized with respect to the varying definitions of the subject areas of regional landscape planning and urban design. In addition, the methodology is hermeneutical, i.e. interpretive and reflective of the author’s longtime standing with the academic community and addressing of the subject matter, as is requisite within a hermeneutical approach. Therefore, in developing findings related to regional landscape planning and urban design the author concludes that while landscape architecture’s significant historic roles have diminished, its historic legacy speaks to the capability and necessity of landscape architecture having a major role in addressing environmental challenges of the 21st century.

4 INTRODUCTION: Why the Region as a Unit of Study?
A criticism of the seminal Urban Design Plan for San Francisco created in 1971 is its ignorance of the city’s regional setting (Kenyon, 1971). While generating a remarkable and largely durable city-wide urban design plan, the San Francisco Planning Department limited its effort to municipal boundaries without a contextual regional focus including the city’s greater biosphere. Therefore, the plan is deficient with respect to landscape architecture’s environmental ethic, natural systems informing design, and subsequent sustainable urban form.

Notwithstanding landscape architecture’s perspective initiated by Olmsted, and recent proposals by others (Lynch 1976, Kelbaugh 1997, Calthorpe 2001) the region may seem like an unlikely basis for measurement, study, understanding, and application that informs urban design. Political and economic practices alone, and myopic views regarding urban design since World War II, have resulted in “disconnects” in this regard stemming from expediency and incrementalism. This is true regarding landscape architecture’s allied professions of architecture and urban planning, and landscape architecture practice that eschew the environmental ethic of bioregionalism. However, landscape architecture’s role towards sustainable urban form is important on four levels. First, the typologies typifying a bioregion – the geographical land units of watersheds, mountain ranges, or islands – provide a common unit of measure and large-scale context that cities “inhabit.” Therefore, factors of regionally based place are identifiable thereby reflecting “genius loci” as arguably the most significant facet of urban design that provides meaning and identity to built, natural, and human cultural environments.

Second, landscape architecture applies bioregions’ various features deterministically, especially with regard to watersheds, given their ubiquity on a global scale. Therefore, the profession’s addressing urban form within the regional watershed, or sub-basins therein, is justifiable given the stability and higher probability of sustainable urban form within a greater “landscape” (Forman 2008, 14; Sale 1999). Furthermore, urban form is regarded within the landscape and integral to it vis-à-vis a regional setting. Subsequently, through landscape architecture built environments can demonstrate place sensitivity, i.e., urban form inclusive of a regional context critical to sustainability. This includes natural systems and also historic relationships of bioregions and human culture, i.e., those qualities of community relative to substantive customs, traditions, craft, arts, aesthetics, language, values, agriculture, and economies passed through generations (Berry 2002; Forman 2008, Shils 2006).

Third, a geographic land unit provides a natural, logical, and clearly identifiable boundary. Moreover, the natural boundaries of ridges, rivers, or coasts have historically served to demarcate one area of human settlement from another. In contrast, modern applications of Euclidean geometry have resulted in artificial and indefensible lines of division between natural systems, natural history, and substantive cultural traditions (Rowe 2000, 20), and therefore sustainability. (See Figure 1.)

Lastly, reflecting the regional context vis-à-vis urban form may seem obtuse. However, when contemporary and ever present necessities of sustainability are factored in, this is not so. To be sustainable, urban form must be broad-based while considering the impacts of human settlement on nature’s “flows,” and to minimize extra-regional dependencies (Forman 2008). In addition, this approach can mitigate conflicts inherent in, on the one hand, compelling lower consumption of resources, and on the other, growth economies promoting ever growing GDPs (Allen, et al 2003), e.g., with an emphasis on “systems,” with the emergence of eco-industrial parks as a case in point. (See Figure 2.)
Related to the preceding four points is 20\textsuperscript{th} century regional planning’s focus on transit, and consequently extension of local jurisdictions. More recently, transit concerns have evolved regarding air quality and adversities of atmospheric carbon emissions. Therefore, addressing motor vehicle emissions vis-à-vis carbon and addressing air quality relative to climate change adds new dimensions to the regional question, with particular concern for the environmental quality. Moreover, even more recently, regional land use and water quality are gaining attention where various environmental issues are significant, e.g., sprawl, mobility options, suitable housing, along with temperature fluctuations, decreased snowpack, river and stream flow disruptions, increased cycles of flooding and drought, and sea level rise. International pressures associated with coastal zone development portend sea level rise concerns for human welfare, and wetlands, salt marshes, estuaries, and their function as ecosystem services (Piro, et al). Importantly, ecosystem services are more easily implemented and have more significant positive impact at a bio-regional scale due to their natural composition – their boundedness – that characterize sustainability (Newman and Jennings 2008, 40).

An even more recent trend concerning regionalism is emerging from boundless globalization in which global interests have “back-pedaled” to embrace the “new region” in reference to the metropolis or “city region.” This development is territorial on the parts of some global corporate interests, i.e., it is regional, urban, local, crossing local boundaries, and values actual rather than virtual proximity to partners. More significantly, the emergence of the “new region” and its business practices are comparative rather than competitive, in concert with intentional local focuses and practices (Scott 2001, 1-5; Keating in Scott 2001, 375) Moreover, this new regionalism encompasses governance – or implementation – that potentially contributes to sustainable urban form at a regional scale. Therefore, with recent advances in regional planning cited above, attention to “city regions” by global corporations is growing in importance, and, with the proper inspiration, can be a positive force towards sustainable urban form within the region-urban nexus.

5 THE ETIC CONDITION OF GLOBAL CITIES AND “NEW REGIONALISM”

Etic regions are those defined, understood, and exploited through rationally descriptive and analytical means. (Rapoport in Markovich et al 1990). Within globalization, etic bases for knowing and data application predominate, without acknowledging historic regions’ significance to development of human culture including land use. Specifically, etic considerations of regionalism in today’s global context are twofold: first, as amorphous metropolitan regions of global cities and, second, the trending “new regionalism” relative to corporate economic competitiveness, with local and regional identity based on proximity and common interests.

Etic considerations of regions fit well with globalization, not with respect to historic regional identity and culture, but through exploitation of resources understood within the narrow etic context, e.g., regional characteristics of natural resources, climate, political boundaries, demographics, transportation, food production, and proximity of inputs and outputs. The emphasis within globalism, therefore, is one of economic, political and now regional concerns of a global city, i.e., domination of a metropolitan region to gain global advantage. This is true of New York, London, Paris, Tokyo, Hong Kong, while other global cities are emerging, e.g., Mumbai, Jakarta, Addis Ababa, Manila, Sao Paolo, New Delhi (Kearny 2014). As noted, however, the state of global cities within global regions and the new regionalism relative to their composition...
in the physical areas they occupy have become integral to their governance, economics, and politics. Regardless of global cities evolution, their number, and their de facto regional context, their raison d’être is still economic and political on a global scale with little or no conscious regard for natural systems comprising physical regions. The main concern is proximity. In other words, they are narrowly characterized as etic regions and this powerful condition is ubiquitous – in the Americas, Europe, Asia, and Europe – while being embryonic and fluid. Therefore, regarding landscape architecture and environmental awareness in the 21st century, an evolution towards sustainable regionally based urban form - minimized up to now - suggests a continued evolution of the globalists’ “regional city.” To wit, while the global city and city-region phenomena are enormously complex within a rapidly changing 21st century, landscape architecture can become engaged in this change, and to be a force for sustainable urban form.

Characteristically, the local, human cultural, and bioregional qualities developed over time, are inconsequential to etic perspectives. This occurs despite comparative historic economic practices being territorial and physical. However, when compared with prior dominant forces of globalism, an important characteristic of new regionalism is its attention to localities and their territorial circumstances. To wit, the new regionalism is not limited to artificial political boundaries, and therefore exhibits an important characteristic of broadly concerned regionalism (Keating in Scott 2001, 376), i.e., the potential to function in a realm of bioregionalism.

The new regionalism and current potential for including bio-regionalism are exemplified by Honda, the Silicon Valley, the American Northwest, and others. Honda - dating to the 1980s – has been simultaneously global and regional, and therefore in the avant garde. Its operations reflect a concerted effort to be localized wherein materials, labor, production, and market have regional significance. (Mair in Cox 1997, 72, 85). Dating to World War II and evolving from defense, to semiconductors, computers, and more recently to the Internet, Silicon Valley has “recreated” itself through development of clusters wherein networking and close relationships are essential (Henton in Scott 2001).

Daniel Kemmis, former mayor of Missoula, Montana and Director of University of Montana’s Center for the Rocky Mountain West identifies several examples of a new regionalism in the American Northwest, and of a bioregional nature. These include communities around Yellowstone National Park, watershed councils with mutual interests, and cities in the regional setting whose interests in a global environment supersede artificial political boundaries. Communities around Yellowstone recognize and act upon their economic and ecological interests vis-à-vis their regional uniqueness. Similarly, watershed councils forming throughout the American West act to understand and safeguard important water assets in arid settings, thereby requiring governance for economic and ecological reasons. Beyond these developments, Kemmis further observes that cities in the Northwest such as Boise, Salt Lake City, and Spokane – each of which is in neighboring but different states – have cooperation between them that is bioregional and within a global environment. He asserts that in the global economy, “capital flows where it wants, when it wants, in search of the kinds of geographic differentiation of talent and cost and social and political structure that it wants” (Kemmis 2000). Therefore, global forces are considerable and in this context a bioregionalism is essential to impart important dimensions of sustainability.

Importantly, other recent advancements in regional planning in the United States supersede economics and politics pertinent to evolution of an urban-regional nexus. While still etic in nature, the Obama administration continued momentum of the 1990s focus on ecological “natural systems.” This included stormwater management, and therefore, water quality, air quality, and habitat through policy development and advocacy as extensions of the 1960s’ Environmental Movement. Therefore, long-term sustainability rather than five to twenty year timeframes of environmental impact assessment required by the National Environmental Policy Act gained traction. Importantly, regional and sustainability concerns continued to be etic in nature but multi-dimensional when compared with previous approaches. As such, natural systems considerations of watersheds, topographic areas such as mountain ranges or islands, and climate zones reflected greater analysis, environmental awareness and, therefore, opportunities for advanced policy development of an etic nature.

At other governmental levels, regionalism is evolving in California, Cape Cod, the Denver metropolitan area, and Milwaukee, to name a few. California has managed regional growth to protect sensitive landscapes, mandate transportation outcomes vis-à-vis greenhouse gases, and to shape land use and urban form. The Denver Regional Council of Governments is remarkable for the voluntary buy-in by nearly 60 city and county governments, responses to state and federal authority, while portending positive future development. Its main focus is largely transportation, air quality, and aging, however, land use efficiency, green infrastructure, and urban form reflect sustainability concerns. Cape Cod has
addressed growth and land use issues to protect a finite potable water resource: its sole aquifer. Milwaukee has addressed sewer and water issues by transforming outmoded and environmentally inefficient gray systems to mitigation incorporating regional scale green infrastructure through land conservation and forestry.

Beyond observations and examples of Honda, the Silicon Valley, and the American Northwest – and giving credence to them - are the pronouncements of geographer Allen Scott. Scott identifies four levels of governance ranging from the global at the top tier under which are multi-nationals, sovereign states, and – as a more recent development – regions (Scott 2001). Scott asserts that many regulatory economic functions of sovereign states are transferring “upwards” to global and multinational levels. Conversely – and equally significant - governance is beginning to reflect a "downward" direction towards regions. These developments equate to centripetal forces and displacement of sovereign nations' regulatory capacities as nations experience significant and uncontrollable transition due to a lack of fluidity in contrast to rapid adaptability characterizing the global corporate world. In this environment regions, according to Scott, “… are becoming the sites of important, if not radical, local administrative initiatives and political activities independently of the level above” (Scott 2009, 140). This response and outcome of global forces demonstrates the tangible and necessary emergence of regions nationally, internationally, and therefore, their global importance. Landscape architecture should embrace and participate in this development.

6 BIOREGIONALISM AND THE IMPORTANT EMIC CONTEXT

Recent etic developments, e.g., Honda, the Silicon Valley, and in America’s Northwest, that exemplify emergence of global city regions are localized, tangible, and inclusive of governance. By demonstrating such activities, these and other global interests realize the advantages of local environments and geographic proximity (Storper in Cox 1997, 20; Jackson, 1984). Although etic in nature these developments require extra-market intervention and implementation to compensate for the globalization’s overreach (Scott 2001, 7). Therefore, global city and regional change benefits from “horizontal” knowledge occurring in its place of origin, i.e., localities and regions such as the Silicon Valley. Additionally, “vertical” knowledge can be enhanced, and therefore contribute to balance, effectiveness, sustainability, and resiliency. As such, cooperation and information sharing – and, consequently, quality of life outcomes - are more likely to occur in contradistinction to globalized, detached, and remote competiveness. Furthermore, a beneficial byproduct of horizontal knowledge in this context is greater political legitimacy and social equity (Keating in Scott 2001), fitness for democracy movements (Scott 2000, 154), and arguably, sustainability within built, natural, and social environments.

Within social and behavioral sciences the converse of things etic, i.e., elements that are rationally defined and analyzed, are conditions identifiable as emic. Emic regions are those perceived anthropologically through local populations with regard to their history, broadly based culture, “connections” to their settings, sense of place, and inherent meaningfulness. Examples of emic regions abound because they have been crucibles of human settlement, culture, and civilization over the millennia of the pre-industrial period. In other words, substantive cultural meaning embodied in emic regions – elements that historically are easier to grasp than the etic for their local, more human scaled, cultural, and tangible dimensions - has been ignored in the globalization’s onslaught. Remarkably, however, meaning and uniqueness of emic regions defining their “world” evolved from regional differences, e.g., in language, craft, art and artisanship, built form, etc., give striking signs of desirability, survival through time, and therefore resiliency not withstanding global forces (Rapoport 1990, 282).

Consideration of emic regions is not new. Bioregionalism, emanating from the 1960s and 1970s Environmental Movement, addresses economy, politics, and society that are perceived, understood and practiced locally. Ecology comes into play here but does so in emic – not etic – terms. Furthermore, the bioregional movement is in the lineage of Patrick Geddes’ Valley Section demonstrating that cities should be considered and conceived as a “region-city” inclusive of the regional, natural, and human cultural elements supporting them.

Economy, politics, and culture within emic bioregionalism of the last fifty years are “eco-deterministic.” Economy in this regard eschews mainstream market forces that represent merely the “surface of society . . .” wherein “. . . there is no probing . . .” that distinguishes between primary materials extracted from nature and those that are manufactured or secondary (Schumacher in Sale 1985, 5.) In other words, environmental, social, and economic impacts wrought by the global marketplace are poorly understood or ignored. By contrast, bioregional economies are grounded in understanding impacts
contextually within the region, i.e., its scale, cohesiveness, sense of place, and community that are manifested particularly in watershed, sub-watersheds, or other ecoregions.

Politics and governance in bioregionalism reflect what global interests, e.g., the Silicon Valley and Honda, have learned thorough experience, i.e., that decision-making is more likely to be effective when scale and diversity – both natural and cultural - are in play, thusly allowing for interaction that is simultaneously vertical and horizontal. This is in contrast to “giantism,” centralization, hierarchy, and “monolithicity” typifying governance in today’s world (Sale 1985). The implications for urban form, therefore, are significant.

An ancillary to emic bioregionalism is communitarianism (Etzioni 1996). Communitarianism emphasizes relationships between individuals and their community, and in the context of sustainable urban form, is inclusive of a neighborhood unit or so-called “urban village” within a regional context. In this respect, German sociologist Ferdinand Tönnies’ (Tönnies and Harris 2001) work concerning gesellschaft and gemeinschaft is revealing, where the former is equivalent to various manifestations of etic “society” and the latter is aligned with the emic in terms of “community.” Therefore, with a focus on the emic, communitarianism professes that meaningful lives are enhanced by community relationships, while not eschewing individualism. While nuclear families are significant in communitarianism, related and ongoing interactions between people in given geographical settings, e.g., neighborhoods, cities, and regions - with inherent shared interests - are more important than rational, regulatory, and formal relationships found in etic, societal, or state contexts. Attention to regional, cultural, and civic landscapes, their characteristics and form fits concerns of landscape architecture and advancement of it roles in this respect.

Further consideration of regionalism, communitarianism, and urban form, are concepts associated with place or “sense of place.” Espoused by a host of individuals - Edward Relph (1976), Yi Fu Tuan (1977), Christian Norberg-Schulz (1980), and others - and within the landscape architecture lexicon, place is exclusively emic, where special qualities found in natural environments, built environments, and human cultural conditions are factored into the landscape architect’s design decision making.

Given the preceding discussion, sustainable urban form for the 21st century must be inclusive of regionalism – reflective of Geddes, Sale, Berg, as well as Tonnies’ concept of gemeinschaft - but not of an isolated or provincial nature. A corollary found in nature is “mutualism,” where two co-occurring species have a positive influence on each other, much as contemporary global forces are becoming more complementary than competitive. Broadly defining urban form to be inclusive of regional green infrastructure and agriculture is essential along with cities in which people, neighborhoods, and communities in the bioregional setting derive meaningfulness, as has historically been the case. Therefore, within a geographical land unit, collaboration and cooperation are enhanced, as is exchange, and acting in mutual best interests (Sale 1985). There is a normative quality to these considerations, but in the sense that nothing new to the human condition is proposed. Newness, however, lies in delivery and experience of what constitutes sustainable urban form. Landscape architecture can fulfill this important 21st century role.

7 ELEMENTS OF FORM AT THE REGIONAL SCALE

Inspired by ecologist Richard Forman, landscape architecture’s role toward achieving sustainable urban form follows three rules of thumb (Forman 2008), inclusive of the “mosaic of patches” referred to below, along with cultural considerations, infrastructure, and sound planning as follows.

- First, locate urban growth and development in areas of lower ecological value to maintain environmental health
- Second, to avoid sprawl, concentrate and direct development through careful location and expansion of infrastructure
- Third, avoid coalescence of adjacent communities, sprawl, and “giantism” through careful attention of “soft” and “hard edges” characterizing natural and built environments
- Along with the rules of thumb, maintain cultural landscapes reflecting customs, practice of craft, and agriculture in peri-urban and urban areas
- Broadly apply green infrastructure that often typifies cultural groups and approaches used over time
- Avoid incrementalism and, hence, focus on a bioregional context

More specifically, achievement of sustainable urban form at the regional scale requires retention of various typologies of greenspace. Such greenspaces are essential to well-conceived cities and towns and
therefore built and natural systems in this respect are of equal importance and integral to each other in sustainable and regional contexts. An important real and metaphorical model in this regard is the “patch,” “matrix,” “corridor” dynamic fundamental to landscape ecology where their spatial configurations, adaptability to change, and connectivity are important. Therefore, the following elements are foremost relative to form at the regional scale.

- Interconnected and multinuclear\(^1\) settlement, scale and compactness, and multiple land uses inclusive of built environments associated with healthy ecosystems and greenspaces
- Sustainable agriculture
- Sustainable and intelligent uses of energy associated with carbon.

Therefore, the region should be viewed as a mosaic of patches (discrete domains) comprised of matrixes of greenspaces, cities and towns, agriculture, and the like, each of which is connected via natural and human-made corridors, the latter providing multiple forms of transit, especially with respect to energy efficiency.

### 7.1 A Mosaic of Patches: Multinuclear, Interconnectivity, Compactness, and Scale

Town and city arrangement reflecting a mosaic of patches should be a multinuclear framework along with multi-modal transit as the essential building block of sustainable urban form at the regional scale. This precept speaks to the basic relationship of transit and land use. However, historically land use and transit have been implemented incrementally with resultant sprawl and external impacts adversely affecting environment, social justice, economics, and energy use (Kelbaugh 1989; Magnaghi 2005).

Regional transit should reflect two essential facets of sustainability of built form and energy conservation. First, transit should be multi-modal beyond the motor vehicle dominance of most regional transportation planning, i.e., to accommodate automobiles, trucks, commuter buses, and fixed rail passenger and freight. Each of these is important, however, other circulation choices should be available to a greater populace and over a greater area. Specifically, these include a regional trail system comprising footpaths as well as simple and strategically located rest stations with seating and shelters. Similar provisions are essential for bicycles including paths distinguished from those for pedestrians in high use areas, bike racks and lockers, and linkages to regional public transit. Walking and biking trail infrastructure is cost-effective, more socially just and with fewer adverse environmental impacts, in contradistinction to high-speed rail and multi-lane freeways.

A second facet of sustainable regional transit is multinuclear arrangement of towns and cities. Through service by a multi-modal transit system, multinuclear town and city arrangements and locations are important for an ecological and therefore sustainable complexity of human order. While the region itself has the important characteristic of being bounded, towns and cities require bounding inherent to manageable and compact size and scale. i.e., the opposite condition of sprawl. In this respect other land uses are possible and desirable within the region such as conservation of habitat, watershed protection, recreation, i.e., the green spaces referenced above, sustainable agriculture, and appropriate industry, e.g., eco-industrial parks, of an exurban nature.

Within a regional context interconnectivity – likened to Wendell Berry’s concept of synecdoche when applied to human scale – is desirable relative to sustainable urban form. As discussed above, to be sustainable, reduction of automobile dependence in concert with public transit, and ample opportunities of walkability and cycling should be part of a regional transit and multi-nucleated land use framework (Kelbaugh 1989; Levy 2012). Moreover, land use sensitive to a bioregional context precludes sprawl wherein a multinuclear layout of cities and towns is readily apparent, and agriculture as an essential land use providing food sources along with appropriate industry towards value-added agricultural products. And as discussed below - provision of open space that assures watershed integrity, carbon offsets, wildlife habitat, and opportunities for education and recreation are inclusive of sustainable urban form in a regional context.

Along with energy savings and carbon footprint reduction multimodal and multinuclear regional urbanization allow for two emic and requisite qualities in the 21st century. First, is the primal need for sense of place (Hiss 1991; Norberg-Schulz 1991; Schurch 1994; Tuan 1977; Relph 1976, 2008; Shils 2006) wherein a bioregional milieu can inspire identity through meaningful built environments, i.e., those that have vernacular qualities, a sense of topophilia (Tuan 1990), and human cultural resources through any variety of substantive traditions established in place through time and that are adaptable to changing circumstances. A fundamental way to consider true sense of place is relative to the elements of built environments, the setting of a given natural environment, and lastly, human culture that has evolved through local and regional
forces and that are the bases of meaningful and longstanding traditions. Each of these three elements has value in its own right, but in combination are rarely experienced in the global era due to their fragility and obscurity due to hyper mobility and rapid change. Nevertheless, they are to be conserved and allowed to evolve where they do exist, and to be developed and nurtured in localities and regions where they are largely lost. Importantly, architects, urban planners, and most significantly landscape architects should provide guidance and leadership in these respects.

A second 21st century requisite – and related to sense of place - is attainment of human scale, i.e., that important condition understood through time as reflected in settlements of ancient Greece those of today reflecting precepts of landscape architecture, New Urbanism, and Smart Growth. As a necessity, human scale is attainable by choice and integral to achieving a sense of place. Within a bioregional context, sensitivity to scale would likely require attention to “sub-regions,” for example drainage basins for water courses and water runoff where the bioregion of a watershed is too large to experience or behold on a daily basis. When human scale predominates and pedestrian experiences in built and natural environments are prevalent – including within the regional scale - some sense of autonomy, feeling of “connectedness,” and greater likelihood of social wellbeing are more likely to occur (Jacobs 1961; Sale 1980; Mumford, 1938, 1961; Rapoport 1990; Jacobsen 2012). In relationship to “place,” these conditions are significant to fundamental needs for meaningfulness that contributes to positive individual identity, community identity, and sense of belonging.

7.2 Ecosystems, Ecosystem Services, and Land Use: Watersheds, Forests, Grasslands, Streams, Wetlands, Coastal Plains

Watersheds, forests, grasslands, streams, wetlands and coastal plains comprise critical natural components of sustainable urban form at the regional scale. They are important for their ecological complexity particularly in achieving a state of resiliency and as evidenced by important but usually overlooked centripetal and centrifugal forces of urbanization. The benefits associated with these critical components – when they retain their ecological integrity – can minimize adverse environmental and economic impacts. Consequently, their inherent ecosystem services can flourish and therefore stem reduced quality of life that otherwise occurs “downstream” when they are degraded. Furthermore, by understanding their ecological functions and value, these six components can be a source of biomimicry wherein regional ecosystem services comprise a green infrastructure and green urban form that are largely “natural” but of human origin. Significant to each of them is the hydrologic cycle as one of two important natural systems to life on Earth and understanding that as a system it is highly complex, fragile, open, but not readily visible, and therefore subject to widespread degradation as has historically occurred.

As previously referenced, the watershed is a desirable urban and regional context because of its characteristics as an ecosystem and boundedness that present relatively clear identification and metrics by which sustainable design intervention occurs and environmental integrity can be assessed. To these ends, a hierarchical consideration of what typifies a vast watershed land area can often – or should - be dealt with at a sub-watershed scale inclusive of the larger watershed context. The advantage of this approach stems from effectively managing impacts of land development on the environmental integrity of streams, wetlands, and coastal areas critical to healthy watersheds, realization of sustainable urban form, doing so within sub-watersheds and interactively with adjoining sub-watersheds.

Critical to relationships of watersheds, sub-watersheds, and sustainable urban form is land use. In this respect, the United States EPA recommends three land use strategies to realize sustainable urban form and that pertain to the bioregion. These are comprised of careful attention to 1.) amount and type of development, 2.) minimization of impervious surfaces such as streets, roofs, parking lots, and sidewalks, and 3.) protection of sensitive environmental areas, e.g., watersheds and the streams, wetlands, and coastal plains within them.

Land use, and therefore built urban form, is the single most important consideration regarding watershed protection and subsequent benefits of ecosystem services. To achieve sustainable built form, and to avoid adverse land use impacts associated with impervious surfaces at the regional scale, policies related to urban growth boundaries (UGB) (See Figure 3) and infill development can result in positive outcomes through avoidance of sprawl. Urban growth boundaries provide a demarcation between cities, suburbs, and towns and surrounding areas that can protect environmental and rural resources of urban consequence, including farmland, conservation area, and greenspaces critical to ecosystem services.
While UGBs can be poorly implemented, planning protocols call for them to be established for a period of ten to twenty years, and reviewed intermittently in consideration of needed modifications.

In concert with UGBs, strategic infill can direct development to transitional urban areas and simultaneously protect watershed integrity, avoid sprawl, and contribute to district and neighborhood redevelopment. The scale and design of infill can vary to allow for social and economic concerns, as well as those of an environmental nature, including consideration of critical habitats, aquatic corridors, hydrologic reserve areas, and important human cultural resources. Importantly, determinations as how much of a watershed to be conserved should be factored into the design and form at the regional scale inclusive of geography and climate.

With respect to climate and impervious surfaces, stormwater management is fundamental to maintaining watersheds’ ecological integrity. Minimization of runoff reduces flooding and consequently erosion, pollutants, and degradation of various life forms and their ecological wellbeing. Furthermore, the relationship of reduced impervious surfaces and therefore avoiding increased ambient temperatures is significant in that runoff temperatures are less likely to reach levels adversely affecting ecological integrity through excessive algal blooms, harm to game fish and other life forms. Research shows that watersheds exceeding 10% impervious surface cover are less likely to support high quality stream systems. Moreover, watersheds with more than 25% impervious surfaces are classified as having non-supporting stream systems with likelihood of eroding banks, high bacterial counts, and poor biological diversity (Center for Watershed Protection 2008).

Within watersheds aquatic environments including rivers, streams, lakes, wetlands, and coastal embayments typically require protection through buffers on their edges and perimeters. By example, buffers for streams should comprise three zones that vary in width – up to 300’ - and form according to regional conditions, and up to 1000’ for lakes (Kusler, 2009, 49). In the American Northwest and East, streamside zones would likely be forested land. A middle zone adjacent to this would require a forested area with some clearing allowed, and an outer zone usually about 25’ wide and wooded although other vegetation is acceptable. Buffers’ overall form varies by region and locality requiring careful attention to existing vegetation, topography, soils, land use, and stream width (Austin, 2014, 155).

Where streams’ environmental quality is substantially degraded or gray stormwater conveyances have been piped and buried with a “hard” outfall, Regenerative Stormwater Conveyance (RSC) is a reasonable replacement for reintroduction of natural processes. As such, RSC restores a complex stream ecosystem in which an appropriately engineered series of stepped pools, weirs, and plantings replicates a wetland system. Typically, these address a 100-year storm event along with construction parameters mimicking natural ecosystem services. Therefore, as with buffering, RSCs vary according to their regional and local conditions.

Wetlands fulfill different but equally important ecological functions as those of stream ecosystems. To these ends, wetlands are important for flood control, pollution removal, carbon sequestration, and provision of critical habitat. As with stream courses, wetland vegetation – especially forests and native grasslands – remEDIATE nitrogen dioxide, carbon monoxide, ozone and particulate matter. In combination with the wetlands themselves, air temperature reductions are realized thereby limiting temperature-dependent pollutants such as ozone. Therefore, wetlands in undisturbed states should be conserved and constructed wetlands should be developed inclusive of environmentally sensitive water harvesting strategies to reduce pollutant loads in aquatic ecosystems, reduce volume and frequency of stormwater runoff, and manage peak stormwater flows from urban catchments, particularly in arid regions.

Runoff reduction through stormwater interception, storage, and evapotranspiration is also a function of wetlands. Each of these conditions along with provision of habitat is a valuable ecosystem service. A case in point is isolated wetlands within South Carolina’s greater watersheds wherein water storage capacity approximates 460 billion gallons (The Southern Environmental Law Center 2004, 9). The cost to construct “gray” stormwater infrastructure to detain the equivalent amount of water exceeds $200 million (Brown and Schueler in Cappiella and Fraley-McNeil 2007, 10). Moreover, wetlands and smaller streams fulfill important roles as nutrient sinks, and therefore removal of excess nutrients - as well as sediment retention - that otherwise would result in imbalances in downstream accumulation (Meyer et al 2003 in Cappiella and Fraley-McNeil 2007, 10).

Along with isolated wetlands, headwater streams fulfill significant and often overlooked watershed and downstream ecosystem services. Importantly, they are highly vulnerable to adverse environmental impacts due to their small size and fragility. Therefore, they are easily and heavily impacted by various forms of land development in the watershed – urbanized, agricultural, logging, mining, etc.
The benefits accrued from headwater streams include their unique biological nature that supports hundreds to thousands of species including bacteria, fungi, algae, higher plants, invertebrates, fish, amphibians, birds, and mammals. Headwaters are also important for primary concentration and processing of organic matter flowing downstream. Besides functioning within freshwater ecosystem food webs, they also fulfill ecosystem services more efficiently than larger streams while simultaneously preventing downstream degradation of water quality by minimizing excess organic matter. Moreover, in conjunction with wetlands, headwater streams moderate downstream floods and maintain water flows during dry periods that are ecologically sustainable due to their typical large surface areas, amount of available water, and therefore groundwater discharge.

Related to form, wetlands and stream enhancement and restoration are important design considerations in watershed or sub-watershed contexts. Enhancement, restoration, and design – such as RSC and constructed wetlands - likely become localized within larger scale environmental considerations. Therefore, site issues vis-à-vis sustainable urban form must be addressed along with larger scale form, and design-related strategies should require establishment of resource protection areas, e.g., through vegetation and soil protection zones (VSPZs). By example, The Sustainable Sites Initiative of the ASLA requires application of VSPZs with especial attention given to greenfields and brownfields within 100-year floodplains. The initiative also calls for protection of wetlands through VSPZs, towards safeguarding significant ecosystems to avoid adverse impacts from adjacent development.

Designated resource protection areas should largely include flood plains and hydric soils, i.e., those soils formed under conditions of saturation, flooding or ponding during the growing season, and that are characterized by anaerobic conditions in their upper portions. To assure environmental integrity of flood plains and hydric soils the flowing measures should be practiced.

- Maintenance of native vegetation
- Identification, quantification and mapping of wetlands
- Identification and mapping of headwater streams
- Identification and mapping of intermittent streams
- Identification and mapping of ephemeral streams

Relative to intensive land use considerations affecting stream and wetland ecosystems as discussed above, the following are significant and directly related to formation of resource protection areas.

- Removal and minimization of impervious surfaces.
- Forecasting and quantifying impervious surfaces additions
- Avoidance of “gray” stormwater conveyance in lieu of “green” stormwater infrastructure
- Implementation of resilience standards pertaining to grading, cut, and fill operations

Coastal areas are critically important watershed environments because of their downstream location, ecological complexity and diversity, tidal fluctuations, role with respect to carbon sequestration, and international trends of population immigration. Coastal wetlands are particularly significant as the most bio-diverse and productive ecosystems. For example, the rich habitat of wetland estuarine areas and coastal marshes provide wildlife nurseries important for shellfish and commercial fish species. In addition, well established science identifies the important ecological functions of barrier islands and sand dunes that – in concert with wetlands - provide flood and severe storm protection (McHarg 1969).

Critical issues of coastal development include attention to impervious surfaces, establishment of perimeter buffers, and protection of large and sensitive environmental areas. Urban design utilizing these strategies, with particular concern for environmental impacts of development within coastal areas, is usually localized, i.e., a topic that addresses urban form at a municipal scale with ignorance of a greater context. Therefore, with the complexity of environmental and social issues affecting coastal areas, a compelling case for urban form encompassing bioregionalism is outstanding.

### 7.3 **Agri+Culture: An Integrated Approach**

For millennia, the human condition has centered on agriculture relative to location, town building, development of customs, crafts, and trades, processing of food stuffs for sustenance, leisure time, and technological advances. These endeavors have been requisites for advancement of civilization and culture. However, since the Industrial Revolution outmigration from farms and rural areas to urban locations has occurred internationally and without cessation to the extent that recent estimates show the world’s population has become predominantly urban (World Bank 2010), with 1% to 2% of Americans directly engaged in agriculture (Berry 2009).
Within a bioregional context inclusive of urban form, agriculture and human settlements should be reciprocating, localized, and inter-regional. Agriculture – especially in peri-urban setting - should also contribute to the form of intense urban development and reflect the interconnectivity and characteristics of synecdoche that define ecologically complex, holistic, and therefore good urban form within the bioregional context (See Figure 4).

Where agriculture is integrated with urbanization in the bioregion several sustainable practices can occur. For example, sustainable agriculture can provide a community a familiarity over time to its food source and practices associated with it. American thinker and writer Wendell Berry is well known for advocating sustainable agriculture in which longstanding familiarity realized through agricultural practices fosters and preserves a “working capital” paying dividends over time and providing cultural meaning. The sense of history and environmental awareness – and stewardship - acquired in this regard is also uniquely important within a bioregional context to “grow” “ecological capital,” e.g., interconnectivity and mutually benefitting relationships regarding ecosystem health. In furtherance of these points, Berry argues that localized farming practices, e.g., within an urban and peri-urban context, do not assure sustainability, unless an understanding of historic and broad definition of “husbanding” of agriculture resources are applied, rather than blindly following narrow edicts of science, technology, and their inherent specializations. Therefore, practical wisdom - the environmental awareness derived from hands-on, sustainable practices of agriculture - can “mediate” between nature and community, and the various linkages and obligations inherent in them, doing so in emic terms. Conversely, modern etic technology dependent agri-industry provides this benefit minimally – if at all - no matter how many monitoring stations are provided in the exercise of “smart” practices, within remote locations. This is not to say that smart practices should be eschewed, but instead emic-based stewardship and “hands-on” approaches towards practical wisdom are superior and can thereby accrue.

7.4 Agriculture and the Land-Water Nexus

The land-water nexus as regards sustainable land use and urban form is important in the watershed context in general and particularly with respect to agriculture. Within adverse or positive agricultural practices, landscape familiarity, and the outcomes inherent in them either contribute to or degrade sustainability with potentially profound effect.

At a minimum, prime agricultural land occupying peri-urban locations must be protected and used for agricultural purposes and in a manner compatible with the land-water nexus characterizing sustainable urban form in the watershed and bioregion. Prime agricultural land in this case is that land pressured by development, and relatively flat, well drained, and best suited for food, forage, fiber, and oilseed crops (Carver and Yahner 1992, 2). Importantly, given an urban location, high-valued crops (vegetables and fruits) should take precedence over other agricultural production. Emphasis here is on food security in peri-urban and urban settings to provide for populations located there. Agriculture in this context can offer scenic pastoral landscapes as a variation of open space within an urban-rural watershed context, as well as economic development through product value-added endeavors, agri-tourism, you-pick opportunities, contract growing, and farm to table endeavors. Opportunities for recreation and education can abound for school children, inhabitants, and visitors through sustainable urban agriculture.
Beyond land use, many practices of sustainable agriculture are essential to long-term environmental and human cultural wellbeing, e.g., by mimicking the complexity of resilient ecosystems. These include value-added industry that increases the worth of agricultural product to build markets, develop sustainable economies, and allow for place-based built and landscape environments in which these activities might occur. In addition, energy can be conserved by reducing dependency on long-distance transport typifying agri-industry and through avoidance of farming practices having high levels of embodied energy, e.g., chemical fertilizers, pesticides, and herbicides. Also, a “closed loop” approach through recycling and waste management can occur through proximity of producers and consumers and their shared experiences of a range of agricultural practices.

All in all, mutual dependencies between agriculture, urban form, and urban inhabitants speak to tangible and intangible conditions of sustainability in the bioregion and within a whole systems context inclusive of watersheds and sub-watersheds. Therefore, agriculture is highly significant with respect to the land-water nexus along with an incumbent provision of undisturbed areas comprising buffer zones, ecologically complex riparian zones, forests, wetlands, and headwaters.

7.5 Carbon, Ecosystems, and Land Use

Atmospheric carbon can be mitigated at various scales from individual buildings and sites to global levels. In the range from buildings to regions, a bioregional focus is desirable to avoid collective adverse impacts of greenfield conversion, increases in impermeable surfaces, and subsequent additions to atmospheric carbon. Conversely, benefits of appropriately managed ecosystems — including land use - can affect the balance of carbon (Pataki et al 2006) to avoid adverse impacts vis-a-vis the carbon cycle.

Through understanding of a regional context, the atmospheric carbon challenge can be circumspectly addressed. By example, the regional imperative is particularly true when considering North America where — ironically - population impacts increase significantly in the midst of declining population growth. To wit, demographic change has resulted in greater numbers of households, reduction in household size, subsequent sprawl, and a subsequent larger carbon footprint. This phenomenon occurs in the United States, Canada, and Mexico where 40% of emissions originate from fossil fuels with the preponderance of emissions emanating from transit and residential land uses (World Resources Institute in Pataki et al 2006). Therefore, land use planning and urban design that guide form should be holistically considered and the bioregional scale is an appropriate milieu in which to do so. Moreover, particularly important with respect to a holistic bioregional perspective are population densities and housing. When these factors are ignored or partially mitigated, urban sprawl results along with more atmospheric carbon (Gonzalez in Pataki et al 2006). Aside from population and housing density, undisturbed ecosystems, robust public transit, and sustainable agriculture play important roles in reducing carbon release, carbon sequestration, and resilience of the carbon cycle.

Within ecosystems numerous variables are significant to carbon sequestration, including factors of time, location, climate, land use, etc. Importantly, carbon sequestration occurs through regional plant communities, i.e., in trees, shrubs, grasses, and soils that offset atmospheric carbon buildup, and therefore, within ecosystems comprising bioregions. For example, much data has been accumulated that reflect trees’ importance to carbon sequestration. A 1991 study by Rowntree and Novak demonstrates that the amount of carbon storage by trees is linear. That is to say, the greater the amount of tree canopy in the landscape the greater the amount of carbon sequestration (Rowntree and Novak in Tratolos et al 2007, 310). However, an ecosystem service in the form of a biological carbon sink, natural ecosystems — including forested lands - will not unilaterally allow for offsetting of carbon emissions in urbanized areas, but must be considered within a larger policy framework that includes cities and their component parts (districts, neighborhoods, corridors, sites, and buildings).

In recent years, attention given to agricultural practices that, instead of contributing to atmospheric carbon, have enhanced carbon sequestration (Warnet 2015 and Melancon 2015) through soils management. Additionally, coastal wetlands are efficient sources of carbon sequestration along with other ecosystem services they provide. Specifically, coastal wetlands contain high amounts of submerged – and therefore anaerobic – soils. Due to these soils’ low oxygen content and high growth levels of plants in wetland ecosystems, they sequester great amounts of carbon (NOAA 2016).

8 CONCLUSION

In planning, design, and management as emphasized herein, a regional context, i.e., the watershed-bioregion nexus, is the suitable milieu for contextual urban design, i.e., urban form reflecting the
need to be inclusive of a larger built and natural fabric to achieve sustainability. With global population growth, demographic changes affecting land use and energy consumption, wide-scale loss of habitat and attendant life forms, much work must be done on all levels. This includes, comparisons of diverse regions, and types, amounts, and uses of renewable energy sources – including fossil fuels – and carbon budget “accounting” to achieve sustainable urban form.

Additionally, responsibility, oversight, and enforcement are inherently problematical at local levels emanating from political jurisdictions inspired by Euclidean geometrics and narrower regional perspectives limited to transportation and economic activity. These conditions are exacerbated by the recent evolution towards global “transnationalism,” although some global interests have made strategic retreats in this regard without foregoing global enterprises. This bodes well for sustainability and resilience of urban form as applied to bioregions and maturation of the city-region concept. The role of landscape architecture towards these ends suggests considerable opportunity for the profession.

9 ENDNOTES
1. “Multinuclear” refers to urban form wherein distinct urbanization has not coalesced into sprawl.

10 REFERENCES

URL Sources

TAKING GOLF OUT OF GOLF COURSE: TRAJECTORIES TO CONVERT FACILITIES TO PARKS AND OPEN SPACE PRESERVES

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1 ABSTRACT
Over 1,500 golf courses nationwide have closed in the past ten years according to National Golf Foundation (NGF) research. The purpose of this study is to identify closed golf course facilities that have turned into parks or open space preserve and examine the details of these conversions having to do with ownership and funding. These precedents serve as examples for stakeholders who are trying to figure out what to with these closed golf courses. Methods included gathering filtered observational data to identify the cases to review and follow up on those cases with a survey. Based on a sample of 21 U.S. golf course facilities that have been converted to public parks or open space, 11 of the parks were formerly public golf courses and 10 were formerly private golf courses. 18 of the parks and open spaces are owned by public entities, and three are owned by non-profits. They were acquired and repurposed using many diverse solutions including partnering with land conservation organizations and other non-profit organizations and gathering diverse public funding sources. Closed golf courses offer the potential for conserving large parcels of open space to fill community needs such as ecosystem enhancement, recreation, habitat, and stormwater detention. 42% of the 365 closed golf courses examined in the initial stages of this study had no clear plans for future use. Identifying how other courses have been able to convert to parks provides valuable examples for golf course owners, municipalities, neighborhoods and other stakeholders that are currently looking for ways to move forward with repurposing closed golf courses.

1.1 Keywords
Golf Course, Land Use Change, Parks, Open Space Preservation
2 INTRODUCTION

Golf course facilities in the U.S. have been closing in large numbers during the past ten years. According to the National Golf Foundation (2017), 1,500 18-hole equivalent golf course facilities have closed. In 2016 alone, 200 golf course facilities closed nationwide (NGF, 2017). Every state in the U.S. in the last ten years has experienced golf course facilities closing, proving the problem is widespread. The main reason for a large number of closures can be attributed to the building of golf course communities in the late 1990’s and early 2000’s in order for developers to sell homes at premium prices, not due to the demand for golf. This issue is coupled with a decline in the number of people who play golf, which has created a surplus in golf course facilities with a less than adequate supply of golfers to support them (NGF, 2017). Slowly, over the last decade, the market has been correcting itself with this increase in golf course closures. Golf course facilities are predicted to continue to close for several more years (NGF, 2017). The more significant problem with golf course facility closures is that these large parcels of open space are suddenly becoming available for new land uses including for potential development. If these parcels are lost to development, the benefits that these facilities offer as open space are also lost.

Turning golf courses into parks or preserved open space seems like a sensible alternative as parks provide many of the benefits that the golf courses provide including recreation, ecosystem enhancement, stormwater detention, and urban wildlife habitat. However, turning golf courses into parks have proven to be challenging. Private landowners want to develop the defunct golf course land to make a profit while government stakeholders do not have the means for acquiring and maintaining a park or open space. Many local homeowners are still holding out for the golf course to return or some other solution to present itself while the golf course sits vacant. Stakeholders involved in these land use change debates are looking for solutions as to what to do with these closed and often problematic deteriorating golf course facilities.

This paper found examples of public parks and preserved open spaces that have been converted from golf courses and identifies some of the financial aspects of how they were converted and what amenities they offer on what is normally a large parcel of land for a park. The goal of this paper is to provide examples of how the preservation of land, from closed golf courses to parks and open space is happening to provide a resource for golf course facility owners and other involved stakeholders who are facing this issue.

2.1 Previous literature

The critically reviewed literature on converting golf courses to parks and open space was almost non-existent. A few Master of Landscape Architecture (MLA) thesis reports were found that discuss repurposing golf courses but were found to lack specific information about the practical aspects of land acquisition and funding, and rather tended to focus more on specific design and restoration strategies for a particular course. This paper attempts to fill that gap.

In more general terms, however, a wide body of research shows the benefits of open space. Open space has proven beneficial for real estate values (Irwin, 2002; McConnell & Walls, 2005; Brander & Koetse, 2011) for providing biodiversity and habitat (Kong, et al., 2009; Threlfall & Kendal, 2017), for mitigating stormwater (Tourbier,1994; McGuckin & Brown, 1995; Demuzere, et al., 2014), for providing public health benefits (Chiesura, 2002; Fuller, et al., 2007; Lee & Maheswaran, 2011), for mitigating the urban heat island effect (Avissar,1996; Wong & Yu, 2005) and providing ecosystem enhancement in general (Bolund & Hunhammar, 1999).

Golf courses, like open spaces, often provide many of the same benefits. For example, golf courses can create riparian, and wetland habitats for animals and are often areas of relatively high biodiversity compared to other urbanized environments (Merola-Zwartjes and DeLong, 2005; White and Main, 2005, Colding & Folke, 2009). Golf courses are also valued similarly in terms of the views that they provide to those living adjacent. Nicholls & Crompton in 2005 surveyed over 400 homeowners in a golf course subdivision in College Station, TX. They found that only 29% of homeowners actually played golf regularly on the golf course yet most homeowners abutting the golf course reported views of the golf course as being the most common reason for choosing that subdivision (Nicholls & Crompton, 2005).

While golf courses can confer many benefits as open spaces, it can be argued that they are often not as ecologically or socially beneficial as parks, and open space preserves. Studies have shown that golf courses can have negative impacts on water quality. Use of chemical fertilizers and pesticides have been shown to run off into nearby watercourses, which can change the algal composition of associated bodies of water, harm wildlife, ecosystems, and even golfers themselves. Additionally, groundwater may be impacted due to leaching of chemicals through the soils and into the water table (Smith and Bridges, 1996;

While the use of reclaimed water for golf courses can offset the cost of using water resources especially in the arid and semiarid Southwest, reclaimed water use is linked with soil salinization which decreases soil fertility, as well as the build-up of other compounds, such as nitrogen, calcium, magnesium, boron, and even pharmaceutically active chemicals (Qian & Mecham, 2005; Candela, Fabregat, Josa, Suriol, Vigues & Mas, 2007; Chen, Yao, Sun & Chen, 2014).

Though golf courses often provide wildlife habitat, the quality of habitat is greater when it has a greater structural complexity of native habitat remnants which is often when the land is utilized as open space (Hodgkison, Hero & Warnken, 2007). Therefore, non-native turf grass-dominant golf courses do not have the same conservation potential as other types of open space unless they are specifically designed to maximize conservational features (LeClerc & Cristol, 2005). As a simplified ecosystem, a golf course can only provide simplified ecosystem enhancement.

Finally, there is the benefit of free public access to parks which has multiple implications. Golf courses serve only those willing and able to pay to use the course and the skills to do so. Parks are able to serve a broad reach of the public. This value can be seen in the comparison of research on proximate home values near parks and golf courses. Research shows that homes abutting golf courses pay 4.6% to 28% premiums over similar homes not on golf courses (Do & Grudnitski, 1997; Asabere & Huffman, 1996; Grudnitski, 2003; Schultz & Schmidtz, 2009; Nicholls & Crompton, 2007). Homes abutting parks were found to pay similar premiums at 20%-33% (Crompton, 2001; Espey & Owusu-Edusei, 2001; Hammer, Coughlin & Horn, 1974). The difference lies in the home values for those near golf courses or parks but not abutting. Research shows that homes near parks are valued higher than homes near golf courses. One study found that homes one-half mile away from a golf course had a value increase of only .76% (Asabere & Huffman, 1996) while other researchers found no effect on value at only one-quarter mile away (Lutzenhiser & Netusil, 2001). In contrast, home values up to one-half of a mile away from parks were found to have a premium of 4.2% (Hammer, Coughlin & Horn, 1974) and one-quarter of a mile away premiums of 6.5%-10% (Espey & Owusu-Edusei, 2001; Crompton, 2001).

Public access to parks and nature has also been found to benefit public health. Researchers have found access to parks may prevent mental illness (Maller et al., 2005), decrease anxiety (Nutsford et al., 2005), encourage people to walk more (Sugiyama et al., 2010; Sugiyama & Thompson, 2008).

3 Methods

The data collection for this paper took place in several parts. The first part involved identifying closed golf course facilities across the United States that had closed since 2006 when the number of closed golf courses started to outnumber the number of openings. Those facilities were then evaluated for their plans or lack thereof, for land use change. The second part involved identifying closed golf course facilities that have been repurposed as parks or open space within that national database in order to gather more specific information on those facilities. A mixed methods approach to research design was employed in order to embrace different findings (Andres, 2012).

3.1 Phase 1 Data Collection

The National Golf Foundation tracks golf course facilities that close but only makes the general data of how many golf course facilities and in which states available to members. Beyond that, there appears to be no publicly available database of closed golf courses. Therefore, a more specific list of closed golf course facilities was necessary. An overview of the methods used in phase 1 can be found in Appendix A.

First, an online search of hundreds of local newspaper articles and business journals turned up names of golf course facilities that had closed. The websites of these golf courses were then searched as well as golf course review websites to verify their closure. Verified closed golf course facilities were added to a closed golf course database. Each state was searched for closed golf course facilities. At least 20% of the number of golf courses reported closed by the National Golf Foundation for each state in the past five years were identified (National Golf Foundation, 2013-2017). Inherently, throughout the research, more closed golf courses were discovered, and the list continues to grow and change. The data included in this paper is as of December 2017.

Once the closed golf courses were gathered and verified, an online search of over 400 local
newspapers, business journals, and public documents were conducted to find out if and when the course was repurposed and if there were plans for the redevelopment of the parcel. Any plans for repurposing were noted in the database along with the date of publication.

3.2 Phase 2 Data Collection

After the closed golf course facilities were identified and the facilities that had been repurposed or had plans for repurposing were identified, the facilities that had been repurposed as parks and open spaces could be identified. There were several courses that had been repurposed partially as parks and partially developed that were not included. This omission was made mainly due to the larger number of facilities this would include and the complications that may result from adding development to the findings. Also, the purpose of this research sought to look for examples of golf courses that had been preserved as parks or preserved open space only. See Appendix A, Figure 2 for the phase 2 methods flowchart.

Next, the courses that were identified as parks or open space were examined. Some were identified as having new private uses such as cemeteries or RV parks and were therefore not included in the sample. Many were identified as still being in an early stage of planning or acquisition or showed no signs of progress and therefore were not included in the sample population. A couple of golf course facilities were identified as still being owned by the golf course owner and are being minimally maintained and open to the public until another future use is established and also discarded. This left a sample population of 28 golf course facilities that have been repurposed as parks and open space to examine in more depth.

3.3 Survey Design

The purpose of the questions asked in the survey was to identify specific facts about how each golf course facility was converted. By collecting the same factual data from each park, any trends in how these parks are converted could be identified or denied. The method of coming up with a survey of questions for each park was chosen for the ability to have a quick turn around and to gather the main facts and info for each park. The nature of the data is cross-sectional in that the data were analyzed from a specific subset at a specific point in time (Creswell, 2009). All data gathered is as of December 2017.

The managers of the 28 repurposed golf courses were contacted by email and asked to complete the self-administered survey questions. 12 parks responded directly to the survey questions. Six more were then contacted by phone in order to enhance the response rate. Ten courses did not respond to inquiries. Of the ten that did not respond, there were three that researchers were able to find most of the information in publicly available data sources such as maps or official city websites. Therefore, 21 parks were examined in this study. The data collection methods were chosen for this data collection based on the fact that they appeared to be the most reliable means of finding out the information in a quick and efficient manner.

Questions for the parks and open space managers were formulated by determining the information thought to be most useful in answering the research question. Understanding the land ownership transactions, funding and specific intentions for park upgrades or amenities appeared central to understanding how the land use change materialized.

Table 1. Questions for park or open space preserve managers

<table>
<thead>
<tr>
<th></th>
<th>Questions</th>
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<tbody>
<tr>
<td>1</td>
<td>Name of the golf course and park or open space:</td>
</tr>
<tr>
<td>2</td>
<td>Who owned and operated the golf course?</td>
</tr>
<tr>
<td>3</td>
<td>If it was publicly owned, where did the funds come from?</td>
</tr>
<tr>
<td>4</td>
<td>Who owns the property as a park/open space/ nature preserve?</td>
</tr>
<tr>
<td>5</td>
<td>If the property changed ownership, how was it acquired?</td>
</tr>
<tr>
<td>6</td>
<td>Who is operating the property as a park/open space/nature preserve? (If different than the owner)</td>
</tr>
<tr>
<td>7</td>
<td>Were there or are there significant changes in store for the repurposing or rehabilitation of the property?</td>
</tr>
<tr>
<td>8</td>
<td>What are the proposed changes? Are there new amenities? Are there new income generating activities?</td>
</tr>
<tr>
<td>9</td>
<td>Who is funding any new changes?</td>
</tr>
<tr>
<td>10</td>
<td>Who is paying for continued operations and maintenance?</td>
</tr>
</tbody>
</table>
11. Do you have any before and after data such as water use, user numbers, bird counts/habitat quality or quantities, etc.?

12. List any other interesting or pertinent information you have to share.

The data analysis for this project was both quantitative and qualitative. Most of the information obtained was factual however the implications of some of the data was approached from a qualitative standpoint. Field notes from phone interviews and raw email responses were assessed, and answers were sorted into a spreadsheet with various categories (see Table 2.) Quantitative data were compared by park and across categories while looking for themes and connections amongst results. Ways of representing the data were explored, and a list of larger implications was compiled.

### Table 2. Categories for data analysis

<table>
<thead>
<tr>
<th>Type of conversion</th>
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</thead>
<tbody>
<tr>
<td>Name of Park</td>
</tr>
<tr>
<td>Size of park</td>
</tr>
<tr>
<td>Golf course owner/operator</td>
</tr>
<tr>
<td>Acquisition funding sources</td>
</tr>
<tr>
<td>Acquisition process</td>
</tr>
<tr>
<td>Park owner/operator</td>
</tr>
<tr>
<td>List of changes/new amenities</td>
</tr>
<tr>
<td>Clubhouse information</td>
</tr>
<tr>
<td>Conversion funding sources</td>
</tr>
<tr>
<td>Operations &amp; maintenance funding sources</td>
</tr>
<tr>
<td>Revenue generation resources</td>
</tr>
<tr>
<td>Before and after information</td>
</tr>
<tr>
<td>Miscellaneous information of interest</td>
</tr>
</tbody>
</table>

4 Results

365 closed golf course facilities from across the nation were identified. 210 of those courses had some plan for future land use, and 46 courses included some form of park or open space, often with development. From that list, 28 were identified as having been repurposed solely into public parks and open space preserves. Information was collected for 21 of those parks and included in the results of this study.

4.1 Ownership transition

Overall, the parks and open spaces studied consisted of 11 public regional or recreational parks, nine open space preserves, and one non-profit that is half open space preserve and half Community Supported Agriculture.

The results show that the majority of golf courses preserved as parks and open space were public golf courses that are now managed as public parks, so the owner did not change. This was expected due to the fact that no acquisition had to take place and municipalities decided to simply change the function and manage the land differently. One golf course remained public but is now owned and operated by a different public entity. Five of the 21 parks were privately owned golf courses that have become public parks or open space. Interestingly, all five privately owned golf courses acquired by public entities were purchased with one main source of funding, in many cases a city’s general fund or one large private donation.

Increasingly, non-profit organizations are acquiring golf course land for open space preservation and habitat creation. All three golf courses acquired by non-profit organizations are now open space preserves with habitat restoration and preservation as one of the primary goals. Two more of the precedent studies were private golf courses that have become public parks through the active involvement and financial support of non-profit organizations. This finding suggests that public-private partnerships may be
a viable alternative for stakeholders who don’t have the means of preserving parks or open space on their own.

4.2 Acquisition funding

Eleven of the 21 facilities changed ownership in their transition to park and therefore, had to be acquired. The results revealed that three of the 11 golf courses were purchased by cities using their general funds. These parks happen to be located in somewhat affluent areas which might account for the entities having more money in their general funds. Three more private golf course facilities were acquired with the help of funding that came from private donors. Two were acquired via funds from land conservation organizations. One course was acquired through a Public Lands Management Act that had provisions that allowed for new land acquisition. The final three courses reported a combination of funding sources for acquisition that included special assessment district taxes, city and county open space bonds, private donations, a variety of water and land conservation funds. Of these 11 acquired golf courses, ten were acquired as one transaction, and one was acquired in phases over several years.

4.3 Park Conversion

Now that these golf courses are parks and open spaces, we wanted to know, more specifically who owns them. The majority of these parks are now owned and operated by cities (10 of 21). Four of the parks are operated by regional park districts, three are owned and operated by non-profits, including one land trust, and two are state parks. Finally, one park is now a county park, and one is owned by a water authority, serving a dual purpose of park and stormwater management.

Funding for the conversion of the golf course into a park was found for only 20 of the 21 precedent studies. Table 3 shows the various specific funding sources for conversion. The majority of the precedents are getting funding for conversion through a combination of sources. The results also reveal that there appears to be no real trend in funding. The funding these parks are finding come from a wide range of sources and several admitted to the fact that they were still looking for sources.

Table 3. Conversion and restoration funding sources

<table>
<thead>
<tr>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neighborhood assessment districts, citywide bods, joint bonds with the</td>
</tr>
<tr>
<td>city, parks district and school district, park in-lei funds, use of</td>
</tr>
<tr>
<td>land as mitigation land</td>
</tr>
<tr>
<td>City and town funds</td>
</tr>
<tr>
<td>Property tax that dedicates money each year to construction projects,</td>
</tr>
<tr>
<td>&quot;imagine your parks&quot; tax initiative</td>
</tr>
<tr>
<td>Municipal liquor enterprise, sale of a portion of the property to</td>
</tr>
<tr>
<td>commercial development and park dedication fees</td>
</tr>
<tr>
<td>State funds and federal funds for creating protected wetlands</td>
</tr>
<tr>
<td>City bonds and private donations</td>
</tr>
<tr>
<td>Capital Improvement Program; botanic garden=non-profit</td>
</tr>
<tr>
<td>Recreational Trails Grant and TBD</td>
</tr>
<tr>
<td>County funds</td>
</tr>
<tr>
<td>Public Lands Management Act</td>
</tr>
<tr>
<td>External grants from state and federal agencies and the Conservation</td>
</tr>
<tr>
<td>Fund</td>
</tr>
<tr>
<td>State greenspace program, state EPA water resource restoration program,</td>
</tr>
<tr>
<td>federal grants, state funds</td>
</tr>
<tr>
<td>State conservation fund and parks district funds</td>
</tr>
<tr>
<td>Water authority=design; non-profit conservancy paid for implementation</td>
</tr>
<tr>
<td>with donations</td>
</tr>
<tr>
<td>Non-profit members and contributors, grants from their partners</td>
</tr>
<tr>
<td>State stewardship program, private donations and American Recovery</td>
</tr>
<tr>
<td>and Reinvestment Act</td>
</tr>
</tbody>
</table>
Private donations and by work of founders, staff and community volunteers

Funding for continued operations and maintenance were primarily provided by city and county funds for city and county parks, state funds used for the state parks and Park District funds for the four parks that are part of the Parks Districts. More specific info on how the Park Districts were funded was not acquired. Three of the parks are solely operated and maintained by volunteers, community groups and donations and a few more reported a combination of grants and general funds.

4.4 Amenities
The amenities included in the plans of these new parks reveal that all but one prioritize trails as a major amenity of the park or open space, as shown in Figure 1. Similarly, almost all of the parks are preserving large areas of the parcel as open space. Almost half of the parks and open space areas include picnic areas and restrooms. This is likely due to the larger size of the parcel and therefore the park or open space. As expected, preserved open space has more educational components, wetlands and restoration projects while the parks have more traditional forms of recreation such as sports fields, playgrounds, dog parks, etc. Some unique amenities found included BMX tracks, mountain biking trails and drone operation areas which may reveal new trends in park amenities having to do with evolving recreational preferences.
4.5 Revenue generation

This study also roughly looked into some of the new amenities that offered the owners of the parks a revenue source. We found that 14 of the 21 had no revenue-generating amenities and offered everything completely free of charge to the users. Seven of the 21 precedent studies offered some form of revenue generation that includes amenities such as rental pavilions, clubhouse rental, pay-to-use disc golf, leases.
to putt-putt golf course owners, etc. Four parks that currently do not have revenue-generating amenities mentioned that they would like to add revenue-generating amenities in the future showing a possible trend in finding additional funding sources to help support operations and maintenance of these parks. See Table 4 for a full list of revenue-generating amenities.

**Table 4. Revenue Generating Amenities.**

<table>
<thead>
<tr>
<th>Active recreation parks</th>
<th>Disc golf (lease)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Athletic field lights</td>
</tr>
<tr>
<td></td>
<td>Pavilion rentals</td>
</tr>
<tr>
<td></td>
<td>Kayak and canoe rentals</td>
</tr>
<tr>
<td></td>
<td>Shelter rentals</td>
</tr>
<tr>
<td></td>
<td>Event spaces</td>
</tr>
<tr>
<td></td>
<td>Baseball fields</td>
</tr>
<tr>
<td></td>
<td>Putt-putt golf course run by an independent entity</td>
</tr>
<tr>
<td></td>
<td>Skate park</td>
</tr>
<tr>
<td>Passive recreational open space</td>
<td>Clubhouse rented to a catering company</td>
</tr>
<tr>
<td></td>
<td>Gift shop</td>
</tr>
<tr>
<td></td>
<td>Guided tours</td>
</tr>
<tr>
<td></td>
<td>Conference room/classroom rentals</td>
</tr>
<tr>
<td>Organic farm &amp; Open Space</td>
<td>On-the-job training</td>
</tr>
<tr>
<td></td>
<td>Community Supported Agriculture</td>
</tr>
<tr>
<td></td>
<td>Retail store</td>
</tr>
</tbody>
</table>

Information on the golf course facility clubhouses was also compiled as it can sometimes be a problematic issue if the clubhouses are deteriorating. The results varied widely as to what their future use would be. Some of the nicer clubhouses continued to be rented out for events and used as a revenue-generating source for their owners. Along the same lines, another was being rented out to a concessionaire. Others are being adapted as new offices, maintenance headquarters, and gift shops. One clubhouse that included a hotel was sold off to a hotelier to pay for some of the changes to the park. In general, clubhouse and pavilion rentals appear to offer the most consistent opportunity for generating revenue on site and generating revenue appears to be more necessary in the operations and maintenance of parks.

5 DISCUSSION

The results of this study reveal that many of the golf courses repurposing into parks are doing so using a variety of funding sources and partnerships. Public entities these days do not appear to have the funding sources to take in closed golf courses on their own unless they happen to be in more affluent municipalities. There also appears to be an inclination for non-profit organizations to acquire golf course land for open space preservation and habitat creation. All three courses that are now solely owned and operated by non-profits are nature preserves, one of which is also unique in that it is partially a farm and orchard that offers job training and Community Supported Agriculture (CSA) for their community.

The data revealed some potential trends in priorities for conversion of the land. Half of the parks had current plans for the active restoration of meadows, watercourses or wetlands. Almost all of the parks preserved large quantities (1/3 or more) of the golf course as open space or natural areas. This is likely due to the large nature of the parcels but could also reveal a move toward prioritizing space for habitat and ecosystem enhancement.

As mentioned previously, the courses that have become primarily open space preserves are owned by non-profit groups and provide few amenities beyond trails, nature viewing and education. This could also be due to a limited source of funding. However, trails appear to be the highest demand amenity in almost all of the parks. By preserving the land, maintaining it minimally with trails and allowing public access,
these golf courses can provide associated benefits listed in the literature review at a fraction of the cost of larger parks full of amenities. Ironically, of the parks that had the more extensive list of amenities, the majority had not been built yet nor did they have a reliable source of continued funding for the implementation. One park with a more extensive list of amenities did have more robust funding sources and a solid plan for additional revenue generation. It would be a worthwhile study to look into the use of the various amenities to see which are actually used by more people. One park mentioned relying on commercial development elsewhere on their parcel to help fund the conversion. This mention of new development funding the preservation of the rest of the land conversion is worth noting for future research.

5.1 Before and After

Unfortunately, many parks were not able to report on before and after statistics as they were either lacking information from the previous owner, the conversion wasn't complete yet or they just were not tracking anything. Based on some of the comments received, however, four parks reported noticing immediate increases in bird abundance and richness once the turf was no longer being maintained and more diverse plant species started to come in. Two parks reported significant water reductions in their first year after closing the golf course. What was interesting was that one of those courses planted new orchards and uses half of the course for agriculture yet still reported using millions of gallons of water less than the golf course used. The other course claimed they used less than half as much water as the golf course did while still maintaining a mostly turf grass park meanwhile reusing the irrigation system to establish new native grasses. Another interesting comment that was received had to do with the number of people who would have access to the site. As a golf course, their course was serving about 300 people per week for golf recreation purposes while they predict they will be serving several times more people each week in an underserved community with free access to recreation, once their program is complete and fully implemented. Because much of this data is qualitative, future research should be done in quantifying this data.

6 CONCLUSIONS

The research revealed that 210 of 365 (58%) closed golf course facilities had plans, which means that 155 (42%) had no plans that could be found and almost all of those courses are sitting vacant. Many developers, municipalities, home-owners, and stakeholders are still looking for solutions for these closed golf courses that don’t involve total development. Creative approaches to preserving the land as parks and open space exist for privately-owned facilities. In cases where funding for conversion was not easily accessible, many of the parks operated as a passive recreation space with just trails and a few benches until additional funding could be found, providing access to the open space with less initial investment. Non-profits and public stakeholders that need financial assistance should look for partnerships and multiple creative funding sources to acquire the means for acquisition and repurposing.

These parks and open space conversions should serve as examples for conserving golf courses as open space. Conserving golf courses as open space upholds and improves upon the valuable qualities that the golf courses provide in the first place while providing public access and greater benefits to the ecosystem and the community.

This study focused solely on closed golf courses that have been transformed into publicly accessible parks and open spaces. Future research could look into the golf course facilities that have been transformed into a new development that also include large parks and open space. How much of those parcels are being preserved as open space? Is it being funded by the development or some other source and what are the benefits versus impacts of those developments? Other future research could identify how the lack of municipals funds for parks and maintenance are affecting the amount and quality of urban open space.

7 REFERENCES


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Appendix A. Figure 1. Phase 1 Data Collection

Where are the closed golf course facilities and what are they being repurposed for?

Search local papers and business journals online for closed golf courses nationwide

Were multiple sources found showing the course had closed?

Added to database of closed golf course facilities

Search for new land uses or plans for repurposing in local papers, business journals

Plan found

No plans found

Aerial imagery examined for current status

Signs of land use change

Closed and vacant

Secondary evidence of closure &/or dated aerial

Still open

No other evidence of plans moving forward

No

Does it match the plans?

Yes

Database of golf course facilities with plans

National Golf Foundation
Data=Number of closed golf course facilities in each state

No

Throw Out

Noted but not included

No

Noted but not included

Yes

Noted and included
Appendix A. Figure 2. Phase 2 Data Collection
COLLABORATIVE DESIGN-BUILD AS A STRATEGY FOR COMMUNITY INVOLVEMENT: THE EXPERIENCE OF CONTRADA NICOLO' ALONG THE SIMETO RIVER, SICILY, ITALY

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1 ABSTRACT
Through direct engagement in an Action Research process, we have documented a collaborative design-build exercise for the ecological regeneration of a riverine site in the Simeto basin, Sicily, IT. The site, Contrada Nicolò, presents numerous opportunities to convey connections between the river and the contiguous municipalities. Despite its ecological value, for years Nicolò has been no more than an illegal dumping ground. In contrast, a community-based group, whose characteristics are discussed in the paper, decided to act for revitalizing the site, encountering several challenges along the way. The authors - as engaged-scholars in the field of landscape architecture and ecological planning - have made the effort of supporting the grassroots' initiatives at Nicolò, acknowledging the sense of stewardship that some community members have developed for the site. Our common goal has been to show that ecological restoration can be conducted through a process of a wider community engagement, collaborative design-build and management, testing a variety of techniques on the ground. Our role, as engaged-scholars, has been crucial in catalyzing the process of collaborative design. At the same time, our community partners have been active co-constructor of the Action Research process in its whole cycle, from questions' framing (and reframing) to implementation and evaluation. Some pitfalls occurred, such as weaknesses and discontinuities in the process of community engagement itself. Notwithstanding, the process provides some key lessons that were worth sharing, presenting details and critical reflections and discussing one year of on-site work in depth.

1.1 Keywords
Ecological Restoration, Watershed Planning, Collaborative Design-Build, Action Research, Community-University Engagement
2 INTRODUCTION

"Planting trees is planting hope": this is a key lesson from Wangari Maathai, Nobel laureate in 2004 and author of Unbowed (2006). This lesson has inspired the work of local Non-governmental organizations (NGOs) along the Simeto River, Sicily, Italy, in partnership with the University of Catania Ecological Design Lab (LabPEAT) and visiting scholars from Mississippi State University, USA. This partnership is framed within a broader one1, the Simeto River Agreement (SRA), which was formally established in 2015. The partnership has been generated after a decade of work along the Simeto River, which is the largest river of Sicily by water flow. The river runs for 113 km in eastern Sicily and drains a watershed of 4186 km². The valley is going through a long-lasting phase of exploitation of resources, abandonment and social challenges, which have been strongly determined by the powerful control of the mafia on the land (Gravagno, 2008; Armiero et al., 2017). In this paper, we present our reflections related with a collaborative project, at the site of Contrada Nicolò, that is part of a wider Action Research process (Whyte 1997; Reason and Bradbury, 2001; Saija 2014b). Engaged scholars (Boyer, 1990) of the LabPEAT and a network of local NGOs have worked tightly since 2009 (Gravagno et al., 2011; Saija, 2014a; Raciti, 2016; Gravagno and Pappalardo, 2017; Pappalardo and Gravagno, 2018), humbly trying to follow an alternative trajectory in contrast to the dominant one.

In 2015, 10 governmental agencies and other actors, together with the aforementioned network of NGOs and the University of Catania, signed the SRA with the aim of pursuing the social-ecological regeneration (Gunderson and Holling, 2001) of the valley, innovating the governance of common goods (Ostrom, 1990) with a polycentric and multi-level approach (Ostrom and Janssen, 2004; Ostrom, 2010). The SRA is an ambitious experiment that should involve a multitude of actors, but it is encountering various obstacles along the way. In this paper we do not want to deepen the SRA broader framework, we are rather focused on one piece of the puzzle, the project that has been developed at Contrada Nicolò. The project was originally conceived in 2009 during a community mapping initiative (Saija et al, 2017) when activists of local NGOs - one of them called Vivisimeto (together with LabPEAT's engaged-scholars) developed action-research jointly. During the initiative, they identified one special piece of land of about 3 ha close to the river, which local people identify as Contrada Nicolò, in the Municipality of Paternò, a town of about 50,000 inhabitants in the Metropolitan Area of Catania, Sicily, Italy. The site stands close to the east bank of the Simeto River and it is located about 6 km from the historical center of Paternò (see figure 1). The land is publicly owned but it is not publicly managed anymore and the site is in a derelict status. It is the place where a project of a depuration plant was planned to be located. After significant public resistance, the plant relocated and was built in another place, and the area remained abandoned. The place is one of the last public accesses to the river, as other ones have been mostly "privatized" by farmers. It is a Site of Community Importance and a Special Protection Area accordingly with EU Directives (79/409/EEC Natura 2000 ecological network. It is used at the same time as a grazing land and as an illegal dumping ground. Being one of the last public accesses to the river, conservationists, ecologists, environmentalists, and small-scale/organic farmers aim to restore the site. They have organized several volunteering days for cleaning the site but these activities were not enough to keep the site viable for visitors and clean. Something more radical was needed. During the community mapping initiative, Contrada Nicolò was identified as a place where activities forming collaboration amongst public actors and NGOs could practically manage common spaces for open access for the enjoyment of the landscape. Planting trees was immediately identified as a simple yet powerful act for involving various actors, restoring the site and producing overall benefits for the whole local community. All of the involved actors have the common purpose of changing the status quo but each of them has a peculiar idea of what the site is meant to be: diversities and conflicts often arose. Furthermore, key-actors (such as the institutional boards in charge of managing Contrada Nicolò) and the general public have not been immediately and easily engaged in the process of envisioning a different asset for the site. As a consequence, this simple act was not so simple to implement. After a series of public meetings and a first phase of community design conducted in 2010-2011 (Raciti, 2016), the project of Contrada Nicolò has encountered a variety of obstacles.

In this context, through our direct engagement in the process, in 2016 we decided to propose a set of techniques for meeting the objectives of community engagement, empowerment and ecological

1 The University of Memphis and University of Massachusetts-Boston are other Institutions that have been involved in the partnership.
restoration simultaneously, through collaborative design-build (Badanes, 2008). Our assumption is that only a deep and aware involvement of various actors in the design/implementation/management of the site may produce a long-lasting, positive effect.

Inspired by the work of eminent thinkers such as Danilo Dolci, Paulo Freire and John Gaventa, the goal is to allow the empowerment of the local community. Based on action-oriented research approaches (Whyte, 1997; Reason and Bradbury, 2001; Saija, 2014b), we, engaged-scholars, have acted as catalysts of the process and community partners have acted as co-constructors. We have used collaborative design-build as a means for enabling the local community to take direct care of places, having raised ecological awareness. The ultimate aim has been to allow a renewed perception of the problems through a direct experience on site. This has been conducted with an attitude of constant reciprocity between researchers and community members (Reardon, 2006).

In this paper, we discuss the overall process of revitalizing Contrada Nicolò and focus on one year of activities. After presenting its relevance both for the international debate and the local context, first we refer to the state of the art of action research for landscape research and community participation in design-build projects. Then we specify the characteristics of actors that been involved in the process of community-engagement for Contrada Nicolò. Finally, we discuss the strategies that we have observed on the ground, in a whole year of work and monitoring. We highlight the importance of having key-actors that embrace the project with perseverance for engaging other actors and give continuity to the process. In conclusion, we identify key-lessons (successes and pitfalls) for collaborative design-build as a stratagem for community engagement and empowerment, based on the practical experience of doing things together on the site.

Figure 1. Contrada Nicolò: location map
2.1 The relevance of Contrada Nicolò in the international debate about ecological systems

The Millennium Ecosystem Assessment (2005) lists 6 important cultural ecosystem services categories that are derived from ecological systems. Three of the six categories take priority at Contrada Nicolò. The cultural ecosystem services of particular interest at our sites are Heritage Value, Cultural Identity, and Recreation. Heritage Value describes sites of historical significance for a community. This service was eliminated in recent years by the use of the site for illicit trash dumping and as a site for dredged fill soils from the creation of a levee system near the river. Historically, people from Paternò and the surrounding communities came to Contrada Nicolò to access the river, but more recently this has not been the case. The Cultural Identity associated with the Simeto River and community interaction with the river is tied to the importance of the river system, and particularly its spring-fed tributaries, to the agricultural systems of the surrounding landscape. The livelihood of numerous local residents is dependent on the water systems of the Simeto River watershed and also, therefore, to the cultural importance of people’s connection to the main channel of the river, visible and accessible from Contrada Nicolò. The recreation services provided by the site have been compromised in recent years, but current efforts to restore the site will provide opportunities for hiking, camping, birdwatching, and picnicking. Contrada Nicolò provides opportunities for river advocates to demonstrate that the community cares about the cultural services that the watershed provides.

Contrada Nicolò presents numerous opportunities to convey connections between the site (or any other site) and greater watershed needs for conservation and ecosystem management at the watershed scale. If successful, visitors will see the value of habitat restoration, collaborative design, and collaborative management. An overarching goal of the project is to convey native forms of streamflow and riparian habitat so that visitors might employ similar approaches on private and public lands that they manage. Applicable stream forms include stream cut banks, point bars, riffles, and pools, and also their associated riparian plant communities. The site will demonstrate rehabilitated ecological conditions and communicate an increased appreciation for the ecosystem services provided by the watershed, including but not restricted to agriculture, recreation, plant and animal communities, clean water, clean air.

2.2 The process of community-engagement for Contrada Nicolò in the Simeto River Valley

Through recent years, a local environmentalist non-governmental organization (NGO) called Vivisimeto, funded in 2006 and based in Paternò, has focused on the idea that Contrda Nicolò could be a significant place where local people can establish a connection with the river and its ecosystem. Volunteers have spontaneously organized cleanup activities once a year. On average, 20 people took part in them from the network of other environmentalist associations (such as a nation-wide association called Legambiente). Invitations were made using flyers distributed among the members of the associations and via advertisement through the local media. This first set of cleanup activities occurred before the establishment of the partnership between Vivisimeto and the LabPEAT. Cleanup activities were limited to one-day events without developing any planning strategy and design for the site.

Then, the partnership with engaged-scholars of LabPEAT started in 2008-2009. Raciti (2016) discussed the main steps between 2009 and 2011. In this phase, specific planning strategies were developed:
- A community mapping initiative (for details, see also Saija et al., 2017; Pappalardo, 2017) has served the overall purpose of engaging a variety of inhabitants, farmers, and NGOs in defining a bottom-up plan for the Valley. The partnership developed this phase from December 2009 to April 2010; about 500 people participated from Paternò and three other municipalities nearby. Not only did flyers and advertisement circulate; also door-to-door knocking served the purpose of engaging various inhabitants to participatory events. During the community mapping initiative, Contrada Nicolò has been identified as a place where to start implementing a simple yet significant project aimed at reconnecting people with the river ecosystem.
- After a reflection about the choice made during the community mapping initiative, a group of volunteers and engaged-scholars (10 people on average) took part in a series of weekly meetings for defining how to set up and implement a bottom-up plan and ecological design for Contada Nicolò. A first experiential learning workshop took place in November 2010; meeting on-site has allowed a
direct understanding of ecological dynamics beyond maps and indoor meetings. Then, volunteers and engaged-scholars established an *Ecological Lab* (ECOLab): on average, 20 people continued meeting on a weekly basis for setting up a design for Contrada Nicolò. Finally, in April 2011 a *Spring Fest Charrette Initiative* took place: it was a two-day initiative aimed at implementing on the ground what the ECOLab has discussed, involving a wider audience, including a class from the middle school of Paternò (details in Raciti, 2016).

Despite the growing enthusiasm between 2009 and 2011, participatory activities for Contrada Nicolò did not last for long due to a combination of issues. On one side, a lack of volunteers’ availability and economic resources restricted the initiatives that the partnership could conduct, despite the effort of collecting donations. Above all, the lack of institutional support paralyzed our work: the Agencies in charge for the management of the site barely listened to the request for collaboration showing indifference for this bottom-up effort.

Engaged-scholars and volunteers did not give up. In 2013, we applied for a EU funded project (*Life Program*). Meanwhile, we were in the process of establishing the Simeto River Agreement, signed in 2015. But none of these initiatives produced benefits for supporting the bottom-up effort at Contrada Nicolò. The proposal for the *Life Program* was not successful due to disengagement within the boards of the Municipality of Paternò. The SRA is generating a very positive effect in terms of innovating the democratic governance structure of the Valley (see for example Pappalardo and Gravagno, 2018) but it is encountering problems in implementing practical projects, still due to a lack of funds and weak institutional involvement in some of these projects (Nicolò being one of them).

A phase of stasis occurred, with the exception of a Summer Camp Project in August 2014. *Vivisimeto* and other 3 NGOs organized the camp, involving 10 volunteers from abroad and 10 locals in a 13-day activity of clean up and arrangements for the accessibility of the site.
In 2016 the project gained momentum again. Thanks to an Office of Economic Cooperation and Development Fellowship, Contrada Nicolò could benefit from the work of another engaged-scholar that joined the team. In this phase, implemented two main strategies: collaborative design workshops and collaborative design-build. These strategies have contributed to the implementation of two sub-phases on-site: The Water Experiment and Bosco Experiment. The following paragraphs discuss the part of the process that occurred between 2016 and 2017.

2.3 Action research, collaborative design workshops and design-build

According to the Action Research approach, we have been involved in a bottom-up process, with the absence of a single decision maker communicating their will on a group to carry out a project. Rather, we aimed to involve as many parties as possible in each step of a cyclical process, such as defining questions, goals, implementing, and evaluating. The lengthy process that led to the River Agreement now in place in the Simeto Watershed is an example of this approach. Other site-specific projects recently undertaken by the communities along the Simeto River also reflect this approach (see for example Raciti and Saija, 2018).

Community-based projects require the implementation of techniques for the co-creation of knowledge and spaces, plus the co-development of management skills. With this aim, collaborative design and design-build are emerging in various fields - from architecture to service design - producing social innovations (Dean, 2005; Stickdorn and Schneider, 2011; Canizaro, 2012; Manzini, 2015). During collaborative workshops, diverse participants are called to share ideas based on their background and expertise. During collaborative design-build, participants are called to avoid the separation of design, art, and craft, embracing the challenge of constructing what they design (simultaneously with the design process).

During the collaborative process, some participants will be the users of the project; some called to manage it. Others (in our case, engaged scholars) are co-designers and co-implementers, with the role of facilitating the process, but the ultimate goal is to deliver the project to the hands of the community for the long run.

A variety of strategies and techniques for enhancing collaboration have been outlined by previous researchers. Sheppard and Meitner (2005); Schroth et al. (2011) and Opdam et al. (2013) stress the concept of "visualization" and the importance of developing proper tools (such as 3D scaled models and user-friendly maps) in order to facilitate the understanding of the ecological dynamics in landscapes, which is a goal of the overall Simeto River Agreement. Bidanes (2008) and Kellum (2010) describe a bottom-up, collaborative design-build process that is applicable at the site scale, which is the appropriate scale of observation for the on-the-ground projects associated with the Simeto River Agreement itself.

Our workshops and design proposals focused on visualizing and finding site design solutions that are "legible" (Kaplan 1979). At Contrada Nicolò, the elements contributing to landscape legibility include the native plants used in the demonstration, the landforms associated with the stream-like irrigation canals, the entrance connection to the access road, and that all site improvements and operations, even those occurring over long periods of time, must be legible and should be tied to the ecological/historical past. The purpose for creating legibility is for the site to make sense upon a person's first visit by communicating a perceived structure, and by encouraging their future involvement in the site.

As the community participates in the design process, they must continuously recognize and evaluate the design approach to the site, including in their evaluation elements that form positive site perception such as mystery, complexity, and coherence.

3 METHODS

3.1 Engaging the community of Contrada Nicolò

In participatory processes, the engaged-community varies depending on the evolution of a process. In 2016-2017, the involved actors for the collaborative efforts at Nicolò have been: Vivisimeto volunteers (25 persons in total); other volunteers from Vivisimeto network of NGOs (Lega Italiana Protezione Uccelli and the Simeto Participatory Presidium; 20 persons); volunteers from the World-Wide Opportunities in Organic Farming (WWOOF) community hosted at La Casa delle Acque - a foreseeing permaculture farm belonging to the WWOOF network that has given most of the support for the project (approximately 10);
farmers close to the site (5 farmers), the general public (approximately 20, see table 1). They have been engaged through flyers distributed among volunteers, advertisements in the local media, social networks (Facebook and email), and door-to-door knocking. Students did not take part to the 2016-2017 activities but they have been previously involved in service learning projects that have produced actionable knowledge for the overall process, through master theses and PhD dissertations dedicated to Nicolò (5 graduate students). In 2016-2017, three engaged-scholars have contributed organizing the activities and dealing with differences (Forester, 2009), i.e. transforming conflicts in creative opportunities for moving forward.

Conflicts arose between environmentalist volunteers and some local farmers and grazers that were initially skeptical about the project but have started understanding its value after having seen the volunteers' hard work. For some farmers that live close to Nicolò, the skepticism has not been targeted yet.

Conflicts arose also between various participants with different ideas about what to do and how to do things. Two main different approaches to practice can be reported: a first one is concerned with doing things regardless of the lack of involvement of institutions; a second one is concerned with doing things only with the involvement of institutions. A common ground has been found in the idea of doing things for stimulating the involvement of institutions. Some of these conflicts are still in place and they are opportunities for enriching an open-ended debate.

3.2 Research objectives, Action Research objectives and implementation

From a traditional academic standpoint, our objectives were to: 1) document the Collaborative Design-Build approach as a bottom-up process for site-scale design and construction; 2) engage local community groups for the realization of community-led site improvement projects that increase site biodiversity; and 3) quantify community participation and site improvements resulting from the implementation of the Collaborative Design-Build approach.

From an engaged-scholar standpoint, we have built our objectives together with our community partners within the Action Research process. Specifically, we wanted to increase community involvement, awareness and stewardship in respect of a site, Contrada Nicolò, that has been identified as a strategic one for its ecological and symbolical relevance.

The approach for increasing community involvement, awareness and stewardship in the site restorations at Contrada Nicolò included engaging laypersons more and more in problem assessment, identifying multiple possible interventions and selecting outcomes, collectively planning projects for installation, and setting up a collective monitoring and evaluation system.

The practical implementation of this approach led to the adoption of more concrete categories of activities including: preparatory meetings and focus groups in order to discuss the general idea of "planting trees" at Contrada Nicolò with various groups of actors; the collection of material/funds, such as pipes, trees, and money, in order to collectively contribute to the implementation of the project and to create a sense of community ownership of the project; collaborative design exercises in order to collectively design the process and the project, moving from the general idea of "planting trees" to a more defined organization of the space, the project itself, phases, and actors for implementing the project; and numerous on-site activities, including walks for site surveys, trash clean up, preparing the soil, planting, irrigation and art installations. All these activities occurred almost three times a week from June to September 2016 in a very intense fashion.

Following a series of meetings to acquaint the researchers with past individual works, grassroots and authorities' works conducted in the watershed, materials were prepared in support of proposed future collaborative design exercises. Maps and research outcome summaries from previous workshops and a 3-dimensional model were prepared for display at the first exercise as a tool for visualization (Sheppard and Meitner, 2005; Schroth et al., 2011; Opdam et al., 2013).

On August 5, 2016 a key-community collaborative design exercise was conducted at La Casa delle Acque. The participants (in this case, about 30 people from the aforementioned groups of actors) were asked to brainstorm the perceived positives and negatives associated with previous community design experiences, and then to propose solutions to any negatives that they identified. They were then asked to consider and evaluate all existing on-site materials and to give their opinions of what the forms in the landscape should be, specifically with regard to roads/pathways, soil/rocks, water, and plant forms. Then, prior to the consideration of design alternatives, all participants agreed to seek a diversity of options, to
accept open consideration of all ideas and options, to work together to effectively narrow the choices for site design, and finally, to avoid the separation of design, art, and craft (the “build” portion of design/build)

### 3.3 Collaborative Design Techniques

The first major activity was to finalize a process for determining planting design solutions that included, as an outcome of initial public meetings, to:

1. Conduct a site inventory using the layout of a 50mx50m site grid at Contrada Nicolò to facilitate existing plant community mapping for future comparisons following site design implementation;
2. Inventory approach/entry views at Contrada Nicolò;
3. Determine future views of site entrances to draw people into the site, make them more legible, and communicate larger site and watershed goals;
4. Determine plant communities, what degree of forest vs. open landscape;
5. Determine visitor use areas; and
6. Identify local materials as potential landmarks (distinctive plants/trees, use of rocks and other historic materials) related to the site.

Using ideas generated at the August 5 workshop and through continuous dissemination/response by the community throughout the fellowship via numerous meetings, workdays and social media, a four-phased approach for site rehabilitation at Contrada Nicolò was proposed. Sub-Phase 1 is called “Water Experiment”, Sub-Phase 2 is called “Bosco Experiment”, Sub-Phase 3 is called “Restoration and Succession”, and Sub-Phase 4 is called “River Connection”. At the time we write this article, sub-phases 3 and 4 have not been implemented yet.

The second major activity was to take this community-generated process and produce a site design for Contrada Nicolò for review by the local and regional actors. Final site designs were adopted by participants of the August 5 workshop and exist now as living documents for continuous review and continued implementation (Figure 3).
3.4 Design Implementation Sub-Phase 1: Water Experiment

Sub-Phase 1 was named “Water Experiment” due to the need to determine whether irrigation canals could effectively deliver water throughout the site, whether inexpensive methods of attaining and successfully establishing plant materials were feasible, and finally, once initiated, whether site construction would be supported by the surrounding community. Entrance and Parking for the entry to the site required a significant cleanup of trash, the inclusion of native accent plants, and space for visitors to park their vehicles. Parking was placed along the existing north access road with a rock border defining the edge of the site. A Thick Plant Border was planned and installed along the northern and western edges of the site, made of Tamaricio, Oleandro, and Ginestra. The border defined the site edges and deters entry to the site by grazing cattle that are common in the area. The three small tree species were added to the existing vegetation found on steep slopes that comprise the edges of the site. Above these slopes the site is very level, and provides opportunity to establish examples of numerous local plant communities. Irrigation Canals deliver water to all new plants via a canal system fed by excess irrigation runoff from surrounding farms. Because the site is very flat in its upper elevations, it was proposed that a connected series of canals be used to distribute water for the establishment of new plant material. The depth of the canals varies from 25 to 50 cm. A River Terrace was located on the western edge of the site, overlooking the river. A break in the Thick Plant Border allows for views of the river, with shade provided by a Bosco Pioppo to the east. A Low Shrub Meadow is planned uphill from the parking area on the northern end of the site. The meadow will be created by adding Artemisia shrubs to the existing vegetation, which contains other asters, fennel, and grasses. A Picnic Area is planned for just beyond the main entrance to the site. Edges of this area will be planted with edible plants such as figs, mulberries, bagolaro, mandorlo, carob, corbezzolo, alloro,
pomegranate, elicriso, melissa, rosemary, oregano, salvia, lavanda, alloro, and lippia citriodora. The Picnic Area is only area where local habitat models were not used in the planting design. The area is intended to provide an appreciation for the numerous food crops available in the region. Species chosen are not commercially in high demand, and should be available for visitors to grab and enjoy with other picnic foods that they bring onsite. The area will have to be managed in an open manner to provide spaces for people to spread out. Walking Paths provide connections to all parts of the site described above, and are created within the footprints of existing roads through the site. They can also be used as exercise pathways.

3.5 Design Implementation Sub-Phase 2: Bosco Experiment

Where Sub-Phase 1 focuses on the northern and western edges of the site to create a legible border, Sub-Phase 2 is located in the center of the site and is dedicated to creating shaded pathways and two woodlands: Boschetti Olea and Boschetti Quercia. A Tree-lined Walkway through the Center of the Site will be defined by a combination of large trees (Celtis australis) and medium-sized trees (Ulmus minor and Spartium junceum) with pathway intersections marked by Rhamnus alaternus. The Boschetti Olea (The Wild Olive Woodland) is a homage to the agricultural heritage of the surrounding region, while also representing the importance of native woodlands in the Mediterranean region. The woodland will provide shade and should be managed with an open understory to allow views from the central path to the north, across the low shrub meadow described in Sub-Phase 1. The spring bloom should be allowed to finish completely prior any management activity in this area, and any native shrubs that become established should be allowed to stay, while maintaining an open character. The Boschetti Quercia (Oak Woodland) lies to the east of the River Terrace described in Sub-Phase 1, and represents the most conservative of all of the proposed plant communities. It will take many years and significant patience to allow for the establishment of this woodland. Similar to the Wild Olive Woodland, this area should be managed with an open understory preserve the long views across the site and to allow for circulation under the oaks and the White Poplars in the adjacent River Terrace. The spring bloom should be allowed to finish completely prior any management activity in this area, and any native shrubs that become established should be allowed to stay, while maintaining an open character.

A major accomplishment was the installation, with the involvement of various actors, of over 400 locally-grown native plants at Contrada Nicolò during a series of planting activities in September 2016. Then, in January 2017, an internationally-renowned artist arrived at La Casa delle Acque to donate the creation of a rock installation that has been made with the rivers' stone in the entrance of the site. The installation has been done with the help of the WWOOFers; it has been discussed and celebrated during a public event in January 10 2017 with the involvement of several actors. The creation of this piece of art has been the another important step for implementing the idea of legibility on site (Figure 4).
4 RESULTS

4.1 Potentials in terms of community engagement

Collaborative design-build at Contrada Nicolò has increased cooperation among various categories of actors that were not used to cooperating. This has been possible because of the need to face the practical challenges related with the project. What has been of relevance is having a project to implement, rather than just vague topics to discuss during meetings. This opportunity has attracted actors that are not interested in participating just for the act of participation itself; one participant has clearly stated that he would be available "...only when we put our hands in the dirt, because I am tired of just talking...". The local association Vivisimefo, which has been in charge of promoting the whole project, could reach actors that where not usually engaged in the association’s activities thanks to the practical character of the project. The simplicity embedded in the act of planting trees has been a key characteristic for improving the level of community engagement step by step, although more steps still have to be taken. This statement was validated by summarizing the status of involvement for each activity connected with the project, in the timeframe we have described in depth (2016-2017) and that we were also able to monitor, some precisely, others by estimating community involvement.

Table 1 shows levels of engagement in on-site activities, especially the walks, the trash clean up, the act of planting itself, the participation and visits to the art installation. These activities have mostly attracted volunteers and the general public. La Casa delle Acque and WWOOFers have given a
fundamental contribution in terms of preparing the soil and irrigating with pipes that were assembled temporarily. The main criticisms were related to the involvement of the neighbors/farmers that have contributed only in the collection of the pipes that are needed for creating a long-lasting irrigation system. The collection of pipes has been successful, though. The needed 400 meters of reused pipes have been collected thanks to the neighbors' contribution. Further activities will have to be settled for improving all the neighbors' interests in respect to certain aspects of the project, such as safety/security and increased traffic to the site.

Table 1. The status of involvement for each type of activity connected with the project

<table>
<thead>
<tr>
<th>Categories of actors</th>
<th>Vivisimeto volunteers</th>
<th>Other NGOs volunteers</th>
<th>La Casa delle Acque and WWOOFERS</th>
<th>Farmers [neighbors of La Casa delle Acque]</th>
<th>General public</th>
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<td>Art installation</td>
<td>10*</td>
<td>5*</td>
<td>10*</td>
<td>-</td>
</tr>
</tbody>
</table>

*estimated values in 5-person increments*

4.2 Benefits in terms of ecological dynamics

Six months after the planting activities, the survival rate of the species has been monitored mainly from Vivisimeto and La Casa delle Acque community partners. The main challenge for supporting the growth of plants has been irrigation. As a matter of fact, at this point the irrigation system has not been built in its permanent configuration and irrigating has been based on voluntary work for about three days a week in early autumn; during the rainy season of 2017, rainfall was abundant (about 500 mm) and it has been the only source of water for plants. Other challenges were connected with the grazing activities that could interfere with the existence of the growing plants. Thanks to the involvement of the shepherd, cows were directed in different areas so that the plants could be preserved. Another expected threat was the illegal dumping and deliberate human damage. Illicit trash disposal has been strongly reduced after the last clean up and the planting activities of September 2016. No damages have been reported. Given these surrounding conditions, the survival rate can be considered in line with the target (about 50% of survival). Specifically, Tamaricio has a rate of about 100% of survival, Oleandra has a rate of about 10% of survival, Ginestra has
a rate of about 50% of survival; in the Bosco, 40% of Populus alba survived. Further activities will consider the desire to increase and manage biodiversity on the site.

4.3 Opportunities for public/private collaboration

The necessity of having constant activities on site is related with the opportunity for Vivisimeto to adopt the area, not only in an informal fashion as it is already happening, but also through an institutionalized public/private partnership. We have already pointed out that several issues arose regarding institutional involvement. The lack of institutional involvement cannot stop the activities on site but institutional involvement still remains a goal for the long run.

Contrada Nicolò presents opportunities for the overall framework of the Simeto River Agreement (SRA). The SRA is a multi-centric and multilevel public/private partnership: it is multi-centric because it involves 10 municipalities along the river and a network of NGOs; it is multilevel because it is related with local governmental agencies, regional boards, national departments and EU policies. The SRA has experienced some pitfalls in terms of implementing tangible projects on the ground.

The experience of Contrada Nicolò has been conceived and supported by several public and private actors that are also part of the SRA partnership: Vivisimeto, the Municipality of Paternò, and the University of Catania. At the same time, it is not fully embraced by all SRA actors and it is still not included in the SRA action plan. Other key actors for Contrada Nicolò are also quite skeptical about the overall aim and effectiveness of the SRA. On one side, Contrada Nicolò still suffers the lack of the necessary public/private partnership for managing the site, which Vivisimeto is in the process of establishing with the Municipality of Paternò and the regional boards that are in charge of the management of the area. On the other side, Contrada Nicolò is one of those practical projects that can inspire other practical projects for the SRA. The governance of Contrada Nicolò needs to be multilevel as well as the governance of the SRA; at the same time, the practical activities at Contrada Nicolò can be one of the focal points of the multi-centric organization of the SRA. Further Action Research is needed for connecting these two worlds that were born together but are currently following separate trajectories.

4.4 Limits and pitfalls

In 2016, like in 2009-2011, Contrada Nicolò has been a place where various actors have worked tightly, forming a community that has learned and impacted reality simultaneously (accordingly with action-oriented approaches). But again, like in 2009-2011, the process of community engagement and the care for the site paused. This is due to the same limits encountered in 2011, more or less:

- a lack of resources (not only economic ones but also a restricted availability of voluntary forces and difficulties in planning incremental activities that can be sustained in the long run);
- a lack of institutional support;
- a lack of deep commitment from a stable group of actors (although Vivisimeto, WWOOFERs and La Casa delle Acque are fully committed to the project, this is not enough in order to create a robust core group in charge of implementing it).

In other words, the most involved volunteers have experienced an increasing fatigue in embracing this bottom-up effort in the long run. So do engaged-scholars. Contrada Nicolò may be trapped again in a phase of stasis and abandonment. But, what we have learned from 2009-2011 and the subsequent experiences in 2016-2017 is that this phase of stasis could only be a temporary one. Moreover, the SRA is in place: it needs to be tuned and adjusted, such as the process at Contrada Nicolò, but it constitutes an existing framework that may lead to more organized and effective actions, in collaboration with institutions as well. Up to this point, Contrada Nicolò and the SRA have a resilient story that is still in place and can evolve toward better configurations, if the actors will be resilient as well.

4.5 Perspectives

Having visited the site September 2018, we have witnessed three major successes and confirmed the pitfalls. Success is related to: a rate of survival of about 100% rate in Tamaricio and of 50% in Ginestra, regardless another phase of stasis between January 2017 and September 2018 and the absence of irrigation; a significant decrement in illegal dumping; the persistence of the art installation. Evaluating the process with 4 key-actors from the Vivisimeto, La Casa delle Acaque and the WWOOF community, we have
confirmed the necessity of improving the community engagement process in order to catalyze a rise of awareness for the local community in "being a community", starting with simple yet articulated projects such as "planting trees for planting hope", following Maathai (2006). We focused on the importance of doing things also for stimulating the involvement of institutions. We confirmed the necessity of focusing on "bringing back water on the site as bringing back life to the site".

![Figure 5. Monitoring activity, 2018 September 11th](image)

### 5 CONCLUSIONS

We highlight the importance of having key-actors that embrace the project with perseverance and act as catalysts and co-constructors for engaging other actors, give continuity to the process toward the empowerment of local community. Our experiences thus far highlight the need for organizations willing to persistently undertake small, on-the-ground legible projects (Kaplan 1979) in order to improve sites for community use. Without key-actors such as La Casa delle Acque, WWOOF and Vivisimeto participating in planning and installation, projects such as Contrada Nicolò can devolve into top-down experiences guided by a single landowner or government entity that might disregard the public desire or need for engagement.

We identified key-lessons for collaborative design-build as a stratagem for community engagement and empowerment based on the practical experience of doing things together at the site, rather than just discussing with no effects on the ground, according with the Action Research approach. We have learned that collaborative design-build is effective in generating ideas and moving towards unison for a legible site asset, but there is not overwhelming evidence that involving people in the design process motivates them to be involved in implementation, which mirrors results of Kellum (2010). We confirmed the necessity of
developing techniques that facilitate the visualization of current status and possible transformation of the site, such as maps and 3D scaled-models (Sheppard and Meitner, 2005; Schroth et al., 2011; Opdam et al., 2013). These tools do not substitute the build component of design-build which is a way for boosting co-design processes for social innovation (Dean, 2005; Stickdorn and Schneider, 2011; Canizaro, 2012; Manzini, 2015).

We feel that it is too early to judge long-term community involvement, and that success will ultimately be defined on numerous levels: ecological (habitat metrics, erosion control, soil-building, etc), societal (education opportunities, recreation, place-making, etc.), and economic (low budget, government investment, etc.).

We feel that the public and some local administrators were open to ecological design and supported the adoption of design criteria driven by ecological parameters, and in fact insisted on this approach in all stages of discussion. As a result, 7 new dominant native species were introduced at the site, with 14 more identified for inclusion in Sub-Phases 1 and 2. Animal diversity should increase with corresponding increases in the structural diversity of site plant communities. Site soils should also be stabilized by the implementation of the proposed design.

We are unable to project long-term levels of involvement by the local community. We anticipate that the Vivisimeto, La Casa delle Acque and WWOOF volunteers will remain engaged and active at the site, but some of them (the WWOOF) are temporary residents. As role models they project attitudes that we hope are adopted by the community: "work is fun, the environment is important, as well as work together to attain a goal, new friendships forged in work are meaningful, all ideas are important, and that exposing yourself to new ideas leads to personal growth". The authors have benefitted both personally and professionally from their relationships with Vivisimeto, La Casa delle Acque and WWOOFers and it cannot be underestimated how important it is for a project to have a strong proponent to build and carry momentum through a long-term design and implementation process.

In the end, the process of building community engagement, seeing cultural changes take place and community empowerment is very slow. As action-researchers, we commit to long-term processes with an attitude of reciprocity as in Reardon (2006), and must stay involved as observers, participants and - if needed - catalysts and co-constructors together with our community partners Ultimately, if we disengage from the process, we should report this outcome as a failure. If at some point we are unable to show evidence of momentum towards stated goals and outcomes, then our experiment in the collaborative design-build process leading to increased community engagement and empowerment cannot be supported.

In this respect, the next challenge is to build the conditions for continuity, including the need of a more stable and suitable cooperation with institutions, as well as transforming the collaborative design-build in opportunities for local development. This point is open to further discussion focused on identifying the conditions for the sustainability of community engagement in the long run, in terms of "costs" of human and economic resources for keeping catalyzing and co-constructing the engagement and empowerment process.

Acknowledgements and dedication

The authors feel committed to recognize that this paper would not exist without the engagement of volunteers from Vivisimeto, La Casa delle Acque and the WWOOF community. We also dedicate this paper to Saro, a friend that has been connected to the Simeto River and worked at Contrada Nicolò with a deep understanding of the significance of such a long-term project.

6 REFERENCES


PEOPLE-ENVIRONMENT RELATIONSHIPS

Edited by Deni Ruggeri & Ole Sleipness
THE USEFULNESS AND MEANING OF RURAL GREENWAYS:
USER EXPERIENCE AT THE TANGLEFOOT TRAIL IN NORTHEAST MISSISSIPPI

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1 ABSTRACT
The Tanglefoot Trail is a 43.6-mile greenway in rural, northeast Mississippi. The trail follows a portion of a now abandoned railroad corridor and consists primarily of a multi-purpose pathway that connects six, small communities with a total population of just over 20,000. Community advocates from the area first met in 2005 to begin discussing the idea of the trail. In ensuing years, supporters of the Tanglefoot Trail secured federal and state grant funding to construct the asphalt trail as well as a series of “whistle stop” rest facilities for trail users. The trail was completed in 2013 and is currently used for hiking, biking, running and associated community events. The Tanglefoot Trail was a multimillion-dollar investment. Trail supporters tout the trail’s “transportation, health, environmental and economic benefits” (Interpreting the Trail, n.d.). Recent literature on urban greenways suggests that recreational benefits may outweigh the cost of construction and maintenance (Lindsey, Man, Payton, & Dickson, 2004), that trails may increase the value of surrounding property (Nicholls & Crompton, 2005), and that trail expansion is economically justifiable in some situations (Crompton, 2012). As a result, urban greenways have a fairly straightforward argument. For rural trails, the case is more difficult. The lack of surrounding density and services means that rural greenways are likely to have far fewer users. The health benefit argument may also be more difficult as a recent study of a metropolitan greenway was unable to demonstrate an improvement in the physical activity behaviors of proximate users (West & Shores 2015). All of this may make it challenging to defend a rural greenway’s expense against skeptics. This raises the question: What is the usefulness and meaning of a rural greenway? Anecdotal evidence suggests that the Tanglefoot Trail is highly appreciated by its users, some of whom travel vast distances to use the trail. If rural greenways have a worth beyond simple quantification, perhaps the answer lies in the social and experiential aspects of such trails or their increased significance to a smaller number of users. This paper explores these issues through examination of the results of an online survey of Tanglefoot Trail users; the survey examined user preferences, their motivations for using the trail, and what they found meaningful about the experience. This information is intended not only to increase overall understanding of rural greenways, but also to provide advocates and designers with data useful in their promotion, design and improvement.

1.1 Keywords
Rural Greenways, Rails-To-Trails, User Experience, Walking, Biking, Active Living
2 INTRODUCTION

The Tanglefoot Trail meets the definition of a “greenway” as defined in David Little’s 1990 seminal text, Greenways for America. Little includes in his definition “any linear open space” that travels “along a railroad right-of-way converted to recreational use” (Little, 1990, p. 1). The Tanglefoot Trail is one of the more recent rails-to-trails conversions which have resulted from a recognized “greenways movement” that according to greenway expert Julius Fabos (1995) began in the 1980s. In subsequent decades, greenways have received considerable attention as a tool for sustainable design due to their obvious benefits which include promotion of health through active living, advancement of non-motorized transportation options such as biking and walking, and preservation of much-needed greenspace for recreation, water management and wildlife habitat.

While the literature on greenways continues to evolve, there has been an emphasis on user experiences (Akpinar, 2016; Byrne, Wolch & Zhang, 2009; Gobster, 1995; Jim & Chen, 2006; Lee & Moore, 2002; Shafer, Lee & Turner, 2000) due to the obvious need to understand behaviors, perceptions and preferences. While these prior investigations have increased understanding of greenways generally, they have also demonstrated that each trail is a specific case with unique conditions and therefore differing user motivations, understandings and preferences. For example, Shafer et al. (2000) studied three Texas trails and found that some flatter trails were used more for biking while those in a more urban context were useful for commuters or lunchtime exercise. They found that trail context, connections and characteristics made considerable difference in how and why the trails were used. As they summarize in the article, “Greenway trails, like roads, are used in different ways and for different reasons” (Shafer et al., p. 174).

The literature on greenways has also focused most heavily upon trails in an urban context (Akpinar, 2016; Byrne, Wolch & Zhang, 2009; Gobster & Westphal, 2004; Jim & Chen, 2006; Lindsey, Han, Wilson & Yang, 2006; Palardy, Boley & Gaither, 2018; Weber, Boley, Nathan & Gaither, 2017) which may not be generalizable to rural situations. For example, Gobster and Westphal investigated trails around the Chicago River corridor and identified “six interdependent human dimensions” of importance which included “cleanliness, naturalness, aesthetics, safety, access and appropriateness of development” (Gobster & Westphal, 2017, p. 147). Some of these dimensions such as safety (which in their case included crime concerns), would seem context-specific and perhaps less applicable to more rural settings like those surrounding the Tanglefoot Trail. In their 2002 article regarding motivations and attitudes of suburban trail users, Lee, Scott and Moore argue directly for further research in “other urban proximate locations” to determine generalizability of findings (Lee et al., 2002, p. 34).

Finally, much of the greenway literature focuses upon survey of active, on-site users (Akpinar, 2016; Byrne, Wolch & Zhang, 2009; Gobster, 1995; Lee, Scott & Moore, 2002). While this is a logical approach for understanding basic use patterns in an urban context, it is less practical in a rural setting with dispersed access points and more sporadic use. Furthermore, survey of exercised-focused, on-site users may result in less thoughtful, reflective or thorough answers to questions regarding topics such as usefulness and meaning. With this in mind, this study was designed to advance understanding of greenways by presenting data and findings from a survey of supporting users of the Tanglefoot Trail, a highly rural rails-to-trails greenway in northeast Mississippi.

3 METHODS

This paper is the result of a survey of supporters of the Tanglefoot Trail. The survey was conducted online with a link, announcement and subsequent reminder posted on the Tanglefoot Trail Facebook page (Tanglefoot Trail Facebook Page, n.d.). The survey took an average of nine minutes to finish. The survey included Likert-scaled statements, some basic demographic questions and a few open-ended questions for topics that required greater input or reflection. 256 people started the survey with 210 completions (82.03% completion rate). The survey attempts to answer the following research questions:

- Who uses and supports the Tanglefoot Trail?
- How and when do they use the Tanglefoot Trail?
- What motivates them to use the Tanglefoot Trail?
- What do they enjoy most about the Tanglefoot Trail?
- What does the Tanglefoot Trail mean to its users?
There are some obvious limitations to this survey approach. This was a survey of supporters and not on-site users; it therefore captures those who are supportive of the trail and who have Internet access and use Facebook. Although those supporters who had not actually used the trail were excluded by an early question, it should not be viewed as a complete survey of users. As previously mentioned, there have already been many surveys of on-site greenway users and it was decided for the purpose of this study to elicit more in-depth and thoughtful responses. The findings should, however, be viewed with this context in mind.

Figure 1. View of Tanglefoot Trail (2016). As a converted rail line, the Tanglefoot Trail is comprised of long, uninterrupted stretches of asphalt that cut through the rural Mississippi landscape. With the limited intersections, very subtle elevation changes and several miles between stops, the trail is primarily attractive to recreational bike riders. Photos by the authors

4 FINDINGS

4.1 Who uses and supports the Tanglefoot Trail?

Respondents were somewhat older than might be expected with an average age of 51. While this is influenced by the exclusion of those under 18 from the survey, it does seem to reflect the older demographic one typically witnesses using the trail as well as the aging population of the state which has a median age of 36.5 (United States Census Bureau, n.d.). Additionally, there were very few respondents in the 18-24 age bracket (2) and the highest proportion of respondents from the 54-65 age bracket (63). This is further discussed in the conclusions below.

Other significant demographic information collected from respondents included gender and primary residence. In terms of gender, 56% of respondents identified as male and 44% as female. 77% of respondents identified Mississippi as their primary residence with 96% residing in Mississippi or an adjacent state. While trail supporters often mention those who have travelled vast distances to use the trail, the majority of the respondents were from north Mississippi and almost half (49%) from towns directly along the trail route.
Figure 2. Tanglefoot Trail Overall Map. The 43.6 mile trail navigates through a rural Mississippi landscape comprised of agriculture, pasture, mixed forest, and 6 small communities. Rest areas at each community (referred to as “whistlestops”) provide restroom facilities and public parking for trail users. Image by the authors.
4.2 How and when do they use the Tanglefoot Trail?

79% of respondents reported that biking was their primary Tanglefoot Trail activity. 14% of respondents reported walking/hiking as their primary use while 6% reported running and 1% reported another use such as using a golf cart or skating. The dramatic emphasis on biking is unsurprising given the length of the trail, the low surrounding density (which prohibits much destination walking), and the relative flatness of the route.

Respondents were also asked, “How many people do you typically travel with?”. Most respondents reported traveling with someone when they used the Trail. Only 17% reported traveling alone while 57% reported traveling with one or two companions and 26% reported traveling with three or more in their group. Some trail documents encourage using the trail “with a partner” for safety (GM&O Rails-to-Trails Recreational District of North Mississippi, 2), although this is not an official regulation. There does, however, seem to be an aspect of camaraderie to the trail (and most greenways) which was mentioned by some of the respondents in the open-ended questions which are examined below.

Respondents were asked several questions about duration and frequency of use, seasonal differences and distance traveled. When asked how much time they “typically spend on the Tanglefoot Trail?” 86% of respondents reported spending more than an hour. Only 1% reported spending less than 30 minutes and 13% reported spending 30 minutes to one hour. Respondents were also asked which seasons of the year they used the Trail. Fall (218 of 220 respondents), summer (197 or 220 respondents) and spring (220 of 220 respondents) were almost equally popular, but winter use was much reduced (92 or 220 respondents). In terms of frequency of use, 61% of respondents reported using the trail once a month or more. However, of this group, only 2% reported using the trail on a daily basis. 34% of respondents reported using the trail a few times a year and only 5% reported having used the trail just one time. In terms of distance, almost half of respondents (49%) reported traveling more than 20 miles on a typical visit to the trail. And 85% of respondents reported traveling over five miles. Only 4% reported traveling two miles or less. The distances and travel times are, obviously, influenced by mode of transportation since most reported that bike riding was their primary trail activity.

Figure 3. Basic statistics of Tanglefoot Trail users. Image by the authors
4.3 What motivates them to use the Tanglefoot Trail?

Trail users were asked to rate five motivations for using the trail on a scale of one to ten. Categories were a slightly modified version of those suggested in the Trail User Survey Workbook (2005) created by the Rails-to-Trails Conservancy. Respondents rated “Health and Exercise” (8.98 out of 10) and “Recreation” (8.79 out of 10) very highly in terms of their motivation for using the trail while “Fitness Training” (7.73 out of 10), and “Camaraderie” (5.84 out of 10) were rated as less influential. “Commuting” (2.75 out of 10) was rated the lowest in terms of influence on user motivations, which is not surprising given the rural character, distance between towns and low density of the trail surroundings.

4.4 What do they enjoy most about the Tanglefoot Trail?

Regarding their enjoyment of the trail, participants were asked to rate ten, Likert-scaled (1=Strongly Disagree, 5= Strongly Agree) statements about various aspects of the experience (see Table 1). As these were trail supporters, it is not particularly surprising that they agreed with most statements about aspects of the Trail being enjoyable. However, the extent to which respondents agreed with the various statements is enlightening. Respondents rated “the peace and quiet on the trail” (4.75) and “the natural aspects of the trail” (4.71) very highly. “Shopping along the trail” (3.12) and the “busy parts of the trail” (3.06) were rated the lowest in terms of respondents’ enjoyment. This has ramifications for trail development and is discussed in further detail in the Conclusions below.

Table 1. What do you enjoy most about the Tanglefoot Trail?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>...peace and quiet on the trail</td>
<td>4.75</td>
</tr>
<tr>
<td>...the natural aspects of the trail</td>
<td>4.71</td>
</tr>
<tr>
<td>...the towns along the trail</td>
<td>4.30</td>
</tr>
<tr>
<td>...the less busy parts of the trail</td>
<td>4.26</td>
</tr>
<tr>
<td>...the historical aspects of the trail</td>
<td>4.05</td>
</tr>
<tr>
<td>...the opportunity to meet people</td>
<td>4.03</td>
</tr>
<tr>
<td>...the cultural aspects of the trail</td>
<td>3.89</td>
</tr>
<tr>
<td>...dining along the trail</td>
<td>3.58</td>
</tr>
<tr>
<td>...shopping along the trail</td>
<td>3.12</td>
</tr>
<tr>
<td>...the busy parts of the trail</td>
<td>3.06</td>
</tr>
</tbody>
</table>

4.5 What does the Tanglefoot Trail mean to its users?

Respondents were also asked two open-ended questions regarding the meaning of the trail. The first was “What did you appreciate or find meaningful about the experience of using the Tanglefoot Trail?”. Responses were categorized and tallied; they are presented in Table 2. Most frequently mentioned was the safety the trail provides by allowing riders to avoid cars. The peacefulness of the trail and the natural environment surrounding the trail were the second and third most frequently mentioned items. Quotations from the top three categories are presented below to provide a sense of the responses.

Safety/Lack of Cars:
- “The most important aspect is its safety. You don't have to worry about people running over you near as much.”
- “I feel safer riding my bike on the trail rather than roads.”
- “I love that I can safely ride my bike for miles and miles with very little danger from vehicles.”

Peacefulness:
- “I love the peace and quiet as I ride or walk.”
“It is a peaceful experience.”
“It is relaxing to be on the trail because it’s very quiet and peaceful.”

Natural Environment:
“Just being out in nature enjoying my bike ride.”
“I appreciate the natural scenery, and the peace and quiet on the trail. I enjoy hearing and seeing birds, and other animals along the way. It is very therapeutic.”

Table 2. What did you appreciate or find meaningful about the Tanglefoot Trail?

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Mentions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety/No Cars</td>
<td>50</td>
</tr>
<tr>
<td>Peacefulness</td>
<td>34</td>
</tr>
<tr>
<td>Natural Environment</td>
<td>33</td>
</tr>
<tr>
<td>People or Friendliness</td>
<td>28</td>
</tr>
<tr>
<td>Scenic Beauty</td>
<td>26</td>
</tr>
<tr>
<td>Other</td>
<td>20</td>
</tr>
<tr>
<td>Health Benefits</td>
<td>16</td>
</tr>
<tr>
<td>Convenience</td>
<td>9</td>
</tr>
<tr>
<td>Historical Aspects</td>
<td>7</td>
</tr>
<tr>
<td>Rest Areas</td>
<td>6</td>
</tr>
<tr>
<td>Quality Maintenance</td>
<td>6</td>
</tr>
</tbody>
</table>

The second question regarding meaning was “In what ways was the experience of using the trail beneficial to you?” Again, answers were categorized and counted (see Table 3). The top three benefits were all related to health: 1. Provides exercise, 2. Provides place for biking and 3. Improved health. The fourth most frequently mentioned benefit was, again, safety from automobiles while the fifth most frequent benefit was the opportunity to spend time with family or friends. Quotes from each of these categories are presented below.

Provides Exercise:
“It has made me more physically active.”
“It provides an enjoyable way to stay active in my retirement years.”

Provides Place for Biking:
“A place I can ride my bike…”
“Just a nice bike ride.”

Improved Health:
“Since I started using the trail, I’ve lost 30 lbs. and my blood chemistry is now perfect!”
“I receive immeasurable health benefits from getting out on the trail to bike or walk. I feel happier and more content.”

Provides Safety (from Cars):
“The trail has been beneficial to me as it has allowed me to begin a new activity in biking that I would not have done if I did not have a safe, traffic free place to do it.”
“The trail has provided a safe place to ride my bike…”

Time with Family/Friends:
“It is a place where my husband and I can walk together for our health and have time to talk as well.”
“Cycling on the trail is one of the few, healthy, outdoor activities both me and my husband enjoy. The trail allows us to exercise together…”
Table 3. In what ways was the experience of using the Trail beneficial to you?

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Mentions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provides Exercise</td>
<td>59</td>
</tr>
<tr>
<td>Provides Place for Biking</td>
<td>47</td>
</tr>
<tr>
<td>Provides Safety (from Cars)</td>
<td>37</td>
</tr>
<tr>
<td>Improved Health</td>
<td>25</td>
</tr>
<tr>
<td>Time with Family/Friends</td>
<td>16</td>
</tr>
<tr>
<td>Provides Relaxation/Stress Relief</td>
<td>14</td>
</tr>
<tr>
<td>Chance to Enjoy Nature/Scenery</td>
<td>13</td>
</tr>
<tr>
<td>Close to Home</td>
<td>13</td>
</tr>
<tr>
<td>Place for Fitness Training</td>
<td>7</td>
</tr>
<tr>
<td>Provides Peacefulness</td>
<td>7</td>
</tr>
<tr>
<td>Chance for Social Interaction</td>
<td>5</td>
</tr>
</tbody>
</table>

5 DISCUSSION

This section briefly compares the results of this study with prior findings. In general, this study supports both Shafer, Lee and Turner's (2000) finding that “greenway trails, like roads, are used in different ways and for different reasons” (p. 174) and Gobster’s (1995) assertion that “location of greenway trails was an important factor in how they were used” (p. 409). The Tanglefoot Trail is used in its own way based upon its location, its rural context and the landscape characteristics of the trail. In terms of who uses and supports the trail, the Tanglefoot appears to be used by an older demographic than some greenways from prior studies (Akpinar, 2016; Byrne, Wolch & Zhang, 2009), but as previous work suggests, users are most likely to live in proximity (Akpinar, 2016; Gobster, 1995). However, distance is relative and in such a rural context this distance likely increases due to lower density and lack of alternatives.

How and when the Tanglefoot Trail is used is also affected by its rural context and landscape. Other trail studies have found far less bike usage on urban greenways (Akpinar, 2016; Byrne, Wolch & Zang, 2009, Evenson, Herring & Huston, 2005; Shafer, Lee & Turner, 2000), but because the Tanglefoot is a rails-to-trails project and therefore long, mostly flat and straight, it offers a pleasant biking environment. It also is much less crowded than many urban greenways and located in an area of the country where there are very few safe options for biking due to lack of infrastructure. Only young, serious, heavily-equipped “cyclists” would even consider braving most rural Mississippi roadways. Given all this, it is not hard to see why older riders, families and more casual bicyclists choose the Tanglefoot Trail and greatly appreciate the opportunity to ride without the risk of auto traffic.

Some studies have found more frequent use by respondents (Akpinar, 2016) and it seems likely that rural trails would have quite different use patterns due to the need for most users to travel to the site by car. This may mean that users tend to use the trail more recreationally and to stay for a longer length of time once they’ve arrived. 86% of our respondents reported staying over an hour; this is quite significant given that the US Center for Disease Control and Prevention recommends 150 minutes of moderate exercise per week (Centers for Disease Control and Prevention, 2015). Although Evenson, Herring and Huston (2005) and West and Shores (2015) were unable to demonstrate an increase in physical activity as the result of a trail, it is clear from respondent comments that at least some users are deriving considerable benefit, e.g., “I’ve lost 30 lbs.”. This may depend greatly upon context and what other recreational and exercise options are available. In the case of most rural areas, there are very few exercise alternatives in terms of organized sports, gyms or even parks. This is significant because this study supports the idea found elsewhere in the literature that trail users’ primary motivations are related to health and exercise (Akpinar, 2016; Lee, Scott & Moore, 2002; Shafer, Lee & Turner, 2000).
6 CONCLUSIONS

While some aspects of this study are comparable to prior literature, there has been little in-depth research into the meaning of trails to their users and no studies the authors are aware of that address as rural a greenway setting. This is an important area of inquiry to provide additional evidence of the value of greenways, and rural trails in particular. What does the Tanglefoot Trail mean to its users? First and most essentially, the trail simply provides a safe setting for biking and thereby a path to improved health for local residents. Second, respondents expressed thorough appreciation for the peaceful, natural setting of the trail; this opportunity for respite in nature is a major aspect of the trail’s meaning to users. For many, the attraction of the Tanglefoot is the green, tunnel-like setting which provides the pleasant, almost meditative experience of pedaling quietly along in the dense shade.

This does, however, raise a bit of a conundrum for trail managers and supporters. Trails are often touted for their tourist potential and the economic opportunities they may offer. Yet trail visitors valued most highly the “less busy” parts of the trail. Care must be taken not to spoil the trail experience for those desiring a respite in a natural environment while also satisfying residents desires for economic development opportunities. In the case of the Tanglefoot Trail, there is minimal risk of incompatible development in many areas of the trail but also little protecting the trail surroundings from such ventures. Trail users did also express appreciation for the “towns along the trail”; it would seem logical to both focus and carefully guide development efforts in these areas as they hold the greatest potential for economic development but also the greatest risk of becoming disagreeable to trail users.

When asked what they found meaningful or appreciated about the Tanglefoot Trail, respondents often mentioned the basics like safety. Just having a safe place to ride without cars was highly valued by many and clearly quite transformative for some who mentioned dramatic weight loss and other physical or mental health benefits such as feeling “happier and more content.” Many older adults choose cycling due to the reduced impact as compared to running or more active sports. Although further study is needed, this study suggests that dedicated trails through natural areas may be a useful tool to encourage older adults in rural areas to spend time outdoors and improve their physical activity. However, the specific setting is an important consideration and preference should be given to trails that provide the peaceful experience of nature that trail riders prefer while also connecting the denser areas of towns and rural communities where the greatest number of people live and necessary services can be provided.

This study suggests that the Tanglefoot Trail has had a positive impact on the lives of many rural north Mississippi residents, who otherwise have few, healthful recreational opportunities available. For aging rural populations, such trails may provide an attractive option to improved health outcomes through increased cycling in particular. Future research should examine this issue in greater depth to explore more specifically what landscape character, design features, views and amenities would be helpful in attracting and retaining users and supporters.

7 REFERENCES


SUPPORTING INFORMED COASTAL LANDSCAPES: AN ASSESSMENT OF PREFERENCES IN CAROLINA TIDAL CREEK COMMUNITIES

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1 ABSTRACT

This study assessed the values, attitudes, and knowledge that influence residential landscaping decisions in coastal areas. This effort represents the initial step of a larger initiative to engage, educate and transform tidal creek communities to foster healthy ecologies through a strategic alignment with resident behaviors. Homeowners located in two single-family neighborhoods adjacent to tidal creeks were surveyed to evaluate factors such as existing site conditions and perceptions, landscape preferences, willingness-to-pay, and level of satisfaction. Surveys also assessed homeowner knowledge of and preferences for native and invasive species common to their areas. Findings indicate good potential for small to moderate sustainable landscape interventions based on an additive combination of: low-levels of satisfaction with current landscape, clear characterization of desired improvements, and a modest willingness to pay. Findings support a need for educational programs to improve understanding of stormwater management, use of native plants, and landscape strategies to increase resilience to hurricanes and flooding.

1.1 Keywords  
Landscape Preferences, Coastal Resiliency, Residential Landscapes, Survey, Watershed Development
2 INTRODUCTION

North Carolina’s coastal areas are home to some of the most ecologically diverse and significant ecotones in the United States. The state’s coastlines support diverse habitats and fishing economies, making them tourism and recreation centers for millions of visitors each year. As outlying coastlands face increasing threats from flooding and sea-level rise, many coastal areas continue to experience increasing commercial and residential development. Along with increased development come myriad environmental impacts, including habitat loss and reduced water quality caused by non-point sedimentation and nitrification generated by poor site development and landscaping practices.

Coastal North Carolina is developing at the fastest rate ever recorded, with near exponential growth in the majority of coastal counties (Figure 1). Because the majority of coastal development is residential (Moser et al. 2014), addressing the negative ecological impacts of these land use changes requires the development of high-performance, residential-scale landscape solutions capable of simultaneously satisfying resident preferences and promoting landscaping practices that support healthy local ecologies.

![Figure 1. Population growth in coastal North Carolina counties - 1960 to 2008](image)

Data source - Wilson, Steven and Fischetti, Thomas (2010)

North Carolina is home to more than 12,000 miles of shoreline in the transition between fresh and salt water. These shorelines encompass large estuarine bodies like the Albemarle and Pamlico Sounds, while much of these interstitial waters represent hundreds of tidal creeks that are incubators of species diversity. Tidal creeks and marshes not only provide important habitat and ecological functions but also serve as “mini-estuaries” that are ideal test beds for research that would be expensive and unwieldy at the large estuary scale (Troy Alphin, Secrets of Tidal Creeks). A champion for healthy tidal creeks, Fred Holland expertly describes the delicate relationship between development and the future health of intertidal areas.

The estuaries of the southeastern United States are dynamic environments characterized by low relief, shallow depth, broad fluctuations in water quality and expansive intertidal areas dominated by shallow tidal creeks and salt marshes. These creeks and marshes provide nursery habitat and feeding grounds for fish, shellfish and wading birds. Over the next several decades [cited in 1990], the human population in the watersheds that drain into southeastern estuaries is expected to increase by over 60% from the 1960 levels. This growth will result in conversion of substantial portions of the existing forested and agricultural ecosystems into low and high-density suburban housing, transportation infrastructure, shopping centers, resorts, and industrial sites. These land cover changes are projected to adversely affect the productivity, biodiversity, and ecological
functioning of coastal ecosystems, particularly the tidal creeks which are the first-order connections between uplands and estuaries. (Holland et al, 2004, pg.152)

While substantial research supports the need for integrating human preference and ecologic function in residential landscapes (Mozingo 1997, Nassauer 2009, Nassauer 1995, Peterson et. al. 2012, Tallamy 2007), findings that characterize residential landscape preferences in the coastal context do not yet exist. Although in form and function coastal residential landscapes are similar to other areas, powerful environmental factors like directional winds, flooding, salt-water intrusion—paired with unique proximity and potential impact on key habitats—give tidal creek communities a unique need for resilience and emphasis the reality of environmental consequence. Hefland (2005) and Nassauer (1997) found that there is latent potential for sustainable landscapes both regarding willingness-to-pay indicators as well as stated desire for landscape characteristics that accept sustainable landscape practices.

Historically, residential landscapes have been designed and managed with the primary objectives of creating aesthetically pleasing views and spaces. More recently there has been increasing and consistent interest in creating landscapes that go beyond aesthetics, in addition offering depth and breadth of ecosystem service function (Lovell and Johnston 2009). As early as 1969, Ian McHarg proclaimed the imperative that our constructed landscapes must consider natural processes. Since then, theory has turned to practice, taking form in development and regulatory frameworks across the world, including conceptual frameworks like Low Impact Development (LID), Water Sensitive Urban Design (WSUD), and Green Infrastructure. The impetus to consider ecological function and stewardship is now well establish not only as a conceptual framework but also as a cross-disciplinary best practice. Certification programs like the Sustainable Sites Initiative™ (SITES®), Leadership in Energy and Environmental Design™ (LEED®), Landscape Architecture Foundation Landscape Performance Series, and Living Building Challenge have all helped to establish consensus metrics for best practices.

Despite a movement toward ecological design, the majority of American home sites demonstrate popular design of landscapes primarily driven by long-standing cultural norms and conventional aesthetics (Nassauer 1997) and traditional landscape maintenance industry standards (Ingram 2006). Over the years, agencies and organizations have been inspired and mandated to improve human-induced, or anthropogenic, impacts of constructed landscapes. Much of this work has been centered on reducing stormwater volume, peak flows, and associated pollution (i.e., sediments, nutrients, and chemicals). These efforts have resulted in the creation of numerous supporting tools, regulatory policies, and programs. Although many of these organizations have the technical understanding required to improve environmental quality, they may not have experience or expertise in designing, implementing, or managing successful, community-scale, residential landscape improvement programs (Booth and Skelton 2011).

3 OBJECTIVES & METRICS

The goal of this study was to evaluate public attitudes towards ecological landscaping practices near tidal creeks. Specifically, the study conducted a landscape preferences survey of households within Broad and Hawkins Creeks near Swansboro, North Carolina (Figure 2). These two communities were selected because they represent typical and uniform residential land development patterns that characterize the landscape/tidal creek interface. The Hawkins and Broad creek communities share many similarities (land-use, density, location, and landscape form) but have specific differences that make for a potentially revealing study (differences in average household income, lot size, and housing use).

Study objectives included capturing resident landscape preferences related to five categories that describe conditions commonly found in the waterfront residential context:

1. Low impact stormwater quality interventions,
2. Native plant communities of high ecological value,
3. Transitional shoreline characteristics,
4. Low-maintenance and water-saving landscapes, and
5. Resilience to and mitigation of storm-related impacts.

The survey was designed to elicit responses related to four metrics:
1. Satisfaction with current landscape(s) and willingness-to-pay for improvements,
2. Individual landscape preferences related to plant types and percent land coverage of turf versus planted areas,
3. Desired landscape improvements, and
4. Barriers to improvement.

4 METHODS

4.1 Site Selection and Inventory

Project partners at North Carolina Sea Grant identified two candidate tidal creek communities based on size, proximity to waterways, and known threats to water quality. Both tidal creek watersheds have considerable residential development in their lower drainages and are representative of coastal development patterns occurring along the U.S. Atlantic coast. The development style in both communities is uniformly detached, single-family housing built between the years 1950–2000. Homes in the study areas have an average size of 1,800 square feet, with values from $170,000–$500,000+. Information for the study populations within each community was gathered from Onslow County (NC) tax records and filtered to exclude: undeveloped property, multiple properties with the same ownership (selected only one for mailing), non-residential use, and multi-family housing. An initial site visit was made to inventory existing conditions and plant palette, capture images to be used in photo simulations, and to conduct
informal meetings with several residents in each community to better understand local character and context.

4.2 Survey Development

A digital survey tool was developed in Qualtrics® using images and plant inventory from a visit to each community. The survey tool was designed to elicit resident landscape preferences divided among three landscape areas: front yard, back yard, and waterfront edge. Within each of the three areas, survey participants were presented with graphic renderings showing a range of landscape characteristics and asked to select the image they would most prefer for their home (Figure 3). The base images for graphic rendering were photos from homes located within the study communities to increase visual legibility for the participants. The graphic renderings were presented achromatically (black and white) to abstract from details and encourage the user to respond based on more general elements of form, texture, and spatial characteristics (Nassauer 1983, Peterson et al. 2012).

Figure 3. Example of Graphic Illustrations used in Survey Tool to Elicit Landscape Preferences

In addition to the preferences section, the survey used images of common native and non-native landscape plants to collect responses related to both existing plants and desired plants (Figure 4). The division between native and non-native plant images allowed for additional measurement of each respondent’s capacity to differentiate between the two plant types. Several non-graphic survey questions were also developed to capture current level of satisfaction, willingness-to-pay, types of desired improvements, more detailed characterization of existing conditions and maintenance practices, and basic demographic data. The content of these are reported in the following results section.
Figure 4. HAVE/WANT Graphic Matrix
4.3 Survey Implementation

Based on age-range demographics in the participating communities, as well as feedback from the initial site visit, the survey tool was administered using a mailed, printed survey. The survey distribution method employed a cash incentive strategy based on the Dillman Total Design Survey Method (Hoddintott 1986). A $2 cash incentive was included in the survey mailer to communicate the importance and value of the participants’ time and attention to the survey. Survey packets (N=389) were mailed to residents in the target communities, with a return period of ten weeks. Typical survey response rates average 10-15% (Fryrear 2015). The use of a cash incentive, alongside a visually appealing (color) and easy-to-understand survey, enabled this survey to achieve a 38% response rate (N=196), tripling the average response rate for external mail surveys. After the response window closed, a team of data entry assistants were trained to enter data into the Qualtrics® interface. All surveys were initially reviewed for completeness by the study leader, then data entry assistants entered data directly to the digital Qualtrics® instrument. Upon preliminary review of the returned surveys it became clear that the responses to the ranking questions associated with landscape preferences section reflected a misinterpretation of the ranked response input. The decision was made to remove all four ranking questions from the results due to the confused responses. Assistants were instructed to make note and report any uncertain response to the survey lead. Upon validating all returned surveys, 152 were entered into the original, digital Qualtrics® instrument. The first phase of data analysis was completed using Qualtrics® analytics, and a second level of data analysis was completed to extract and highlight findings most relevant to project objectives.

5 RESULTS

5.1 Satisfaction and Change

Study results found homeowners generally dissatisfied with their current landscapes (-27.3 Net Promoter® Score1) with many respondents noting difficulty maintaining quality turf, controlling invasive plants, and poor drainage around their home. When polled about barriers to improving their landscapes, a large majority of respondents stated a need for additional funding (70%) and personal free time (49%). In addition, very few respondents reported paying for landscape-related services, with 85% of homeowners installing their own new materials and 72% performing their own maintenance. Willingness-to-pay for landscape improvements reflects a high level of Do-It-Yourself (DIY) activities, with 76% of respondents interested in small to medium-sized ($≤2000) projects (Table 1). Reflecting the stated desire for more funding as a barrier to change, less than half of respondents (47%) thought their willingness-to-pay for desired improvements would result in a satisfactory landscape. Many respondents (63%) reported a desire for more vegetation, including turf, with some noting a need for structural improvements to their bulkheads (seawall) and drainage solutions.

Table 1. Willingness to Pay for Landscape Improvements.

<table>
<thead>
<tr>
<th>WTP Range</th>
<th>Percentage</th>
<th>Count</th>
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<tbody>
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<td>&lt;$100</td>
<td>16%</td>
<td>21</td>
</tr>
<tr>
<td>$100 - $499</td>
<td>30%</td>
<td>40</td>
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<td>$500 - $1999</td>
<td>28%</td>
<td>37</td>
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<tr>
<td>$2000 - $4999</td>
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<tr>
<td>$&gt;10000</td>
<td>3%</td>
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</tbody>
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5.2 Landscape Preferences and Values

Although the survey tool separated landscape preferences between front and back yards, the stated preferences were nearly identical between the two areas. On a four-point scale from mostly turf to mostly shrubs and flowers, the large majority of respondents chose the middle-ground preferring some turf with shrubs and flowers, and majority turf with some shrubs and flowers (32% and 43% respectively). Interestingly, waterfront planting preferences were significantly different from the front and back yard preferences with an even spread across the four options (from turf to trees and shrub dominated: 29%, 29%, 25%, and 17%) (Figure 5). Improving the drainage of house-adjacent landscapes was a stated priority, with residents citing a desire to decrease water-related pests and avoid stormwater intrusion into their homes. Similarly, when asked to rank value statements regarding their landscape, respondents indicated a strong preference (85%) for waterfront improvements that address flood and hurricane resilience. This preference for resilient landscapes preceded other common, highly valued characteristics like low-maintenance landscapes and aesthetic appeal.

A primary driver for waterfront property owners was the long view from their home out to tidal creek waters and, when possible, across tidal creek waters into the sound. This desire adds value to low-growing vegetation like turf, however, creates exposure to wind and sun while exacerbating high-velocity stormwater drainage into the creeks.

5.3 Existing and Desired Landscape Plants

Responses from the “want/have” graphic matrix of plant types found clear trends both in existing and desired landscape plant types. More than half of the respondents reported existing loblolly pine (59%), crepe myrtle (70%), dollar weed (60%), and live oak (54%) on their property, with more than a third of respondents reporting existing dogwood (37%), cedar (37%), wax myrtle (37%), magnolia (36%), maple (41%), boxwood (37%), lantana (32%), and camellia (32%). Respondent wants/desires did not poll over 50% for any species, however, more than 30% of respondents reported wanting crepe myrtle, butterfly bush, camellia, lantana, dogwood, palmetto, muhley grass, gallardia, and black-eyed susan. Plants selected for the graphic matrix were based on three criteria: 1) they were observed in the study area.
during site visits; 2) they are common native landscape plants viable in the study areas; or 3) they are commonly available from commercial landscape supply retailers in the region. The plant type graphic matrix (Figure 4) was conspicuously divided evenly into native and non-native invasive plant sections (‘Part One’ and ‘Part Two’) allowing a follow-up question that helped determine the level of plant knowledge respondents had. The survey found the majority of respondents were either 1) unable to distinguish between the two plant categories (74%), or 2) incorrectly identified the distinction (18%).

6 CONCLUSIONS

6.1 Findings & Implications

A key finding was the value respondents placed on the role landscapes serve as buffers from natural hazards related to wind and water. This finding, in unison with low levels of satisfaction related to existing conditions, suggest that education campaigns specifically focused on the role of sustainable landscape practices in protection and buffering from erosion, wind damage, and poor drainage may be met with interest, participation, and investment. Likewise, stated landscape desires and willingness-to-pay attitudes indicate that landscape interventions should focus on sections of the yard that enhance drainage and wind-buffering functions and add structural and compositional variety, without reducing healthy turf or obstructing important viewsheds. Functional and appropriately scaled residential landscape interventions that are transferrable to the tidal creek context include: gutter gardens, streetscape improvements, bioretention swales, and perimeter buffer zones. Based on study findings, the authors recommend that community education and/or design assistance activities be structured to strategically address three essential elements: function, desire, and availability.

Landscape improvements along tidal creek waterfronts should first address flood and hurricane resilience. Design assistance and education related to waterfront edges should promote options other than bulkhead (hard) installations as a means of flood protection. Naturalized (soft) edge transitions with piers or a combination of bulkhead and naturalized edge treatments can improve resiliency and ecologic function without jeopardizing accessibility to the tidal creek (Dugan et al. 2017). Many of the study’s home sites currently have open turf areas between water’s edge and house, thus achieving little to no protection from prevailing winds or summer sun.

6.2 Design Strategies

Strategies for creating understanding and desire for ecologically responsive landscapes must include developing education programs that acknowledge and address the priorities of landowners. Within waterfront and water-adjacent communities, these priorities include framing water views in a manner that strikes a balance between ecologic functions and maintaining valuable viewsheds. Key program elements should address basic stormwater best practices and landscape plantings that provide desired design characteristics such as color and texture across the seasons as well as ecosystem services (i.e., habitat, erosion control, etc.). Thus, landscape improvements should prioritize plant functionality, installation techniques, careful consideration of native/exotic/invasive species, and maintenance practices such as proper and/or reduced application of fertilizers, pesticides and herbicides.

Both communities show a desire for design assistance. This suggests that a set of templates that provide guidance could be influential in educating and incentivizing residents to implement sustainable, resilient, attractive, and affordable improvements.

Collectively, the study indicates a critical need to support community awareness of attractive, available, and adaptable landscape plants. This step is essential because the implementation of high-performing, coastal landscape solutions is reliant on aligning two factors: 1) consumer understanding of and value for ecologically high-performing native plant communities (demand), and 2) locally available nursery stock and knowledgeable contractors (supply). Aligning these factors can be challenging—the retail supply of plant species is market-driven and often limited to selections that neither reflect ecological diversity, nor recognize the ecosystem services provided by native and/or adapted non-native, non-invasive species for coastal environments. Strategies for addressing these issues include: develop demonstration gardens in high-visibility locations to raise awareness of both the functional and aesthetic characteristics of native and/or coastal-adapted ornamentals; deliver cooperative extension training programs for both homeowners and green industry professionals (growers, distributors, designers, and
contractors); and conduct horticultural research trials to test in-situ plant performance and market viability (ease of propagation through end-point sales).

6.3 Transferability

Although this study focused on North Carolina tidal creek communities, the methods employed and findings can inform efforts to improve residential landscapes in many contexts. The research processes used provide important and useful knowledge pertaining to both existing physical conditions and cultural norms, including local residents’ desires for and capacities to enact localized environmental function. This knowledge lays the groundwork for continued efforts across the landscape industry sectors of design services, wholesale and retail growing, contracting and maintenance, and research and education. Working collectively and collaboratively, efforts to engage industry-wide best practices aspire to improve landscape performance across the realms of resiliency, ecological health, community aesthetics, and quality of life. Toward these ends, the information revealed in this study creates pathways for improving the health, safety, and well-being of constructed landscapes and their impact on the ecological diversity and vitality of the larger environmental systems.

7 REFERENCES


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¹ The Net Promoter Score is an index ranging from -100 to 100 that is used as a proxy for gauging the overall satisfaction with a product or service. The metric was originally created by Fred Reicheld and Bain & Company and is primarily used by companies to gauge client or consumer satisfaction.
FROM ASPHALT TO FIELD -
PARKING LOTS AS TRANSITIONAL URBAN LANDSCAPES

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1 ABSTRACT
It is time to reconsider the amount of impervious surface that covers so much of our country and come up with a plant-forward alternative. Much attention has already been devoted toward questioning the amount of area given to cars. Equal thought should be given to the empty lots that dot the urban fabric, those oceans of paving that surround big-box retail developments and sports complexes and are only full a handful of days out of the year. Landscape Architects have the skills, and the creativity, to turn these surface lots from locations back into places that can benefit both city residents and the urban environment. What critical thought and scholarly writing exists on the topic of parking lot design is largely focused on functionality and efficiency. How to move the most cars in and out of the lot in the quickest and safest manner possible. Very little consideration has been given to the aesthetic or environmental implications of parking lot design. Through the study of the history of parking lots in the United States and a critique of today’s current “green” parking lots design strategies, this paper aims to begin a conversation, and transform the discussion, of what parking lots could contribute to the urban landscape. Why keep to the accepted formula of aisles, parking bays and medians. Why stop there? Why can’t parking lots be dynamic parts of the urban fabric - active fields where the median and the bays become one continuous planted whole? These fields will soften the site and decrease the heat island effect during slow retail months and can be mowed down during periods of high traffic. Let the choreography of the planting reflect the choreography of our activities as consumers. The field to fallow ratio illustrates the temporal - planted in the off-season, more parking available during holidays or sports seasons. The landscape becomes the framework for the program, turning a location back into a place while addressing the variabilities of its users and imperviousness in the city fabric.

1.1 Keywords
Parking, Impervious, Pervious, Urban, Contextual, Temporal, Fields
INTRODUCTION

Imagine pulling into a Best Buy and parking in a tall grassy meadow or running into Home Depot and brushing up against Russian Sage. This could be a reality if we treat parking lots like fields - allowing them to lay “fallow” when spaces are in high demand and planting them when business slows down after the rush of the holidays. Although called “parking” lots, the amount of time that they are actually used for parking is minimal. We should either call them something else entirely or rethink the whole design.

Parking lots are a conundrum, on the one hand they are a necessary part of our everyday life - ensuring that we accomplish our daily activities with relative ease and providing a locale for complex social behaviors that extend beyond the physical act of parking. On the other hand, they are typically large swaths of impervious surface that increase the heat island effect, eliminate ecosystems and jeopardize animal corridors, and strip soil of all nutrients and organic content. Eran Ben-Joseph writes about this conundrum in his book, Rethinking A Lot, saying “Parking lots may be utilitarian and practical, unexceptional, and even unpleasant, but their magnitude and sheer frequency of occurrence merit greater attention. The task is first to rediscover their virtues and common good, and second to elevate their design above mediocrity.” (Ben-Joseph 2012: 4)

Aerial photographs of Baltimore, MD, reveal enormous expanses of paved surface lots at big-box retail stores both within the city and in the surrounding counties. These lots contribute to storm water runoff entering the Chesapeake Bay watershed and are generally underused except for peak shopping days between Thanksgiving and Christmas. The parking lots around the Ravens Stadium are equally seasonal in their use and could be reconfigured to provide more green within the heart of the city. Fig. 1. There are many challenges to this proposal and they need to be addressed in order to make progress, but with some creative thinking and the strategic use of an appropriate palette of plants parking lots can become fields and help to soften the urban landscape and heal the impervious nature of the city.

Figure 1. Aerial View of Camden Yards and Ravens Stadium, Baltimore, MD
https://upload.wikimedia.org/wikipedia/commons/8/8b/Camden_Yards_Sports_Complex_satellite_view.png

REGULATIONS

Current design regulations for parking lots are lacking, to say the least. Time-Saver Standards for Landscape Architecture, the long-standing reference book for Landscape Architects, devotes six pages to the site planning and layout of parking lots. Six pages out of a book of over nine hundred. The first sentence under the heading “4.2 General Layout of Parking Areas” states, “A major consideration in the design of any parking lot is simplicity.” (Time-Saver Standards 1998: 342-20) Simplicity is fine, boring and monotonous and completely impervious is not. The Wiley Graphic Standards, a guidebook usually used as a reference for professionals, includes four pages on parking lots in its Student Edition. The first sentence under the heading of Parking Lot Design states, “Parking lots should offer direct and easy access
for people walking between their vehicles and the building entrances.” (Wiley Graphic Standards 2007: 166) Emphasis is placed on pedestrian safety, ease of circulation, and standard dimensions. No discussion is given to aesthetics or the integration of the parking lot with its immediate surroundings. This Student Edition is 436 pages, so less than 1% of a book on urban design and planning policy is dedicated to the design of parking lots, which occupy such a major percentage of our urban land. Design regulations and requirements for off-street parking are more concerned with screening the parking from its neighboring streets and lots, concealing the parking lot rather than engaging its design with the immediate context. Additional requirements include minimal tree coverage, detailed dimensions for setbacks and general recommendations for paving.

To give another example of the uninspired nature of general parking lot design, developers rely on standard formulas when calculating how many spaces should be included for a certain structure. In the early 1980’s the Institute of Transportation Engineers created two handbooks, Trip Generation and Parking Generation, which suggest a number of peak parked vehicles per unit of particular land use: typically, 4 parking spaces per 1,000 gross square feet. This ratio has been used in most transportation models and, as often becomes the case with such standards, has been taken for granted. (Ben-Joseph 2012: 8) Parking lots are often built to accommodate the anticipated crowd of customers on the busiest shopping days of the year - the day after Thanksgiving, being an obvious example. As a result, a typical single-story commercial building requires a minimum of one-half to three-quarters of the site dedicated to parking. Various studies suggest that this results in a serious oversupply of parking, and that even at peak demand only two to three spaces per 1,000 square feet are utilized. (Ben-Joseph 2012: 8) As a result these formulas have had a great influence on how our cities and towns look, feel, and function.

4 HISTORY

How did we get to this point where we have paved over our country? A little background on the history of the parking lot will shed some light on why we find ourselves in this predicament. The domination of parking lots and the vastness of their impervious nature can be traced back to the years following World War I. With the automobile more readily affordable to Americans of all financial means, thanks in part to the Ford Motor Company and General Motors Corporation, there were suddenly many more cars on the road. (Jakle and Sculle 2004: 2) This rise in traffic overwhelmed the city and rural streets and the parking of cars along curbs only added to the congestion. In an attempt to attract frustrated customers, merchants began to provide off-street parking. As described in Lots of Parking, “Commercial buildings were moved back from sidewalks and streets, and business premises were increasingly configured to be seen across parking lots through automobile windshields.” (Jakle and Sculle 2004: 3)

The primary concern of the parking industry – whether merchants, traffic engineers, or planners, was functionality. The whole act of parking received little thought beyond the practical. John A. Jakle and Keith A. Sculle note in their book, Lots of Parking: Land Use in a Car Culture, that “Parking was not expected to contribute to the visual enjoyment of the landscape.” (Jakle and Sculle 2004: 7) But was it meant to reduce the beauty of the landscape as it does currently? Most scholarly writing on parking focuses on the pragmatic issues of safety and efficiency and is less interested in the social or environmental implications of its design; certainly, no real discussion is given to aesthetics. This concern with parking lots as purely facilitative was emphasized by Henry Evans in a 1945 edition of Traffic Engineering where he described the attributes of a “good lot” as being “one that offered a minumum of inconvenience, that is, delay and accident hazard to the motorist. Size and shape, grading and surfacing, lot enclosure, marking of parking stalls, positioning of entrances and exits, layout of aisles for car movement, and illumination.” (Jakle and Sculle 2004: 98) Mark C. Childs provides an exception with his book, Parking Spaces, in which he writes that “the typical design of parking lots as simply mere functional expanse of cheap asphalt and net of white lines is wasteful and destructive.” (Jakle and Sculle 2004: 96)

5 GREEN PRACTICES

Over the past two decades there have been attempts by planners, developers, and landscape architects to adopt a “greener” approach to the design of parking lots within cities and their surrounding suburbs. Design principles including Storm Water Management, Best Management Practices, and Low Impact Development have generated new ways of viewing ecology and the environment as contributors to the design at the conceptual phase and no longer as an afterthought. Strategies such as using pervious paving for the parking bays, wetland plantings and low medians designed to capture rainfall and run-
off from the aisles, and wider medians to accommodate canopy trees that will decrease the heat-island effect are positive initiatives, but they continue to fall short. These “green” designs still include the expected bays, medians and aisles of the Time-Saver Standards and Wiley Graphics descriptions and do not do enough to become dynamic parts of the urban fabric. Why can’t parking lots become active fields where the median and the bays become one continuous planted whole? Pushing the envelope of what a parking lot really can become?

6 PRECEDENTS

Some projects have begun to ask such questions and consider parking in a new way. As with so much that is both environmental- and design-related, European countries seem to have taken the lead in rethinking what a parking lot can be. There are advances in alternative surface materials, such as an ultra-porous concrete that is being tested on the streets of Rotterdam. Rainaway, an Eindhoven-based company, and Tarmac, a UK-based company, are promoting water-permeable tiles. The city of Copenhagen has been recognized as one of the world’s most environmentally sensitive cities. In 2010, Copenhagen adopted a policy requiring green roofs for all new construction with roof slopes of less than 30 degrees. More relevant, however, is the city’s adoption of green parking lots, two examples of which are at the University of Copenhagen, Royal Danish Academy of Fine Arts, and Technical University of Denmark in Lyngby. Fig. 2. (http://buildabetterburb.org/copenhagen-green-city-green-parking) Both university’s showcase landscaped parking lots with permeable pavers that simulate natural hydrologic functions and beautify the entrances to the institutions for visitors, students and faculty.

Figure 2. Parking Lot at the Technical University of Denmark in Lyngby
http://buildabetterburb.org/copenhagen-green-city-green-parking/

Two larger-scale projects provide insight and precedent for the parking “field” proposal and, in this light, are valuable contributors to the field of landscape architecture. Bluewater Shopping & Retail Destination in Kent, England, is the second-largest shopping mall in the United Kingdom. Occupying 240 acres, it is located on the site of a former chalk quarry and a large part of the program was the reclamation of land lost to mining. Bluewater was designed by CivicArts / Eric R. Kuhne and Associates who took their cue from the agrarian countryside surrounding the great estate homes of Kent County. In an interview from 2012 Kuhne states, “The Bluewater car parks were designed as urban orchards based on the reputation of Kent County as the Garden of England and one of the highest fruit producing counties in the UK. We achieved over one tree for every two spaces, covering nearly 6,000 spaces, and heavily landscaped verges surrounding each surface lot.” (http://buildabetterburb.org/qa-with-architect-eric-r-kuhne-about-bluewater-mall-parking-and-landscaping/ accessed February 8, 2018). The siting of the roads follows existing quarry topography, bike paths and walkways connect the parking lots to the open space. Over time, Bluewater’s parking orchards will become a solid canopy of trees shading the cars and revealing the architecture of the mall above the treetops. (http://buildabetterburb.org/qa-with-architect-eric-r-kuhne-about-bluewater-mall-parking-and-landscaping/ accessed February 8, 2018). As Ben-Joseph
writes in Rethinking A Lot, Bluewater has “a parking landscape, where the lawns, lakes, and foliage are carefully meshed with the required areas of tarmac to accommodate cars.” (Ben-Joseph 2012: 124) Now, can we push this idea further and remove the requirement of tarmac?

Another precedent that questions the traditional layout of a parking lot is Fiat’s Lingotto Factory in Turin, Italy. A massive industrial complex, the original building was a third of a mile long and built entirely of concrete and posed a number of challenges to the design team selected for its adaptive reuse in the 1980’s. Not only was its size daunting, but there was the added issue of how to integrate the industrial building with the surrounding urban context. Renzo Piano was selected for his scheme that centered on a strategy of blurring the lines between the building, its surrounding infrastructure (parking lots), and the larger landscape. The design team brought the building into the landscape and the landscape into the building. Piano recognized the parking lots around the buildings as an opportunity to connect the sheer size of the architecture to the more human-scaled fabric of the city. He created a series of parking lot gardens by getting rid of the expected islands and curbs and planting rows of trees in a dense grid. An early description of his design concept states, “The unifying and connecting feature of the whole scheme will be nature. Nature re-conquers the spaces left vacant by industry and railways, thus healing the wounds inflicted between the area and its surroundings.” (Domus 675, p. 38)

Despite these two forward-thinking projects, surface parking lots are very rarely creatively designed, and have won very few design competitions or professional awards. Since 1990 the only parking lot design to win an award from the American Society of Landscape Architects was by Michael Van Valkenburg Associates, Inc. The project, titled “12,000 Factory Workers Meet Ecology in the Parking Lot”, was for the Herman Miller furniture manufacturing and assembly plant in Cherokee County, Georgia, and incorporates ecological design principles to mitigate storm water runoff while providing spaces for more than 500 cars and 120 semitrailers. (Ben-Joseph 2012: 4) A decade earlier, in the mid-1980’s a competition was held for the design of a municipal parking lot for about 300 cars. The competition, sponsored by the City of Columbus, Ohio, and the Irwin-Sweeney-Miller Foundation, was intended to unveil new approaches addressing function and aesthetics in parking lot design, while exposing the lack of energy typically afforded such projects. The winning entry was by Eric R. Kuhne & Associates (of Bluewater Shopping and Retail) who transformed the parking lot into a park inspired by European urban plazas. In typical fashion, nothing ever transpired in either built form, or planning policy, and we find ourselves in a similar discussion over 30 years later.

7 INCREMENTAL CHANGES

One could argue that the relationship between parking lot and park is a metaphor for the more general relationship between the city and nature. Just as the disregard of natural processes in the city results in high cost and infrastructural damage, so, too, does disregard of ecology in a parking lot result in future costs and increased flooding. Anne Spirn writes about the symbiotic relationship of the City and Nature in her book, The Granite Garden, where she maintains that the cost of disregarding nature extends not only to the physical wellness of the city, but also to the quality of life of its inhabitants. (Spirn 1984: 10) Spirn continues by stating that change does not need to include major overhauls of infrastructure in order to make progress, but that these changes can instead be made up of small individual projects. She writes, “Incremental change through small projects is often more manageable, more feasible, less daunting, and more adaptable to local needs and values…. Solutions need not be comprehensive, but the understanding of the problem must be.” (Spirn 1984: 10) Landscape Architect, Margie Ruddick, in her book Wild by Design, takes this notion a bit further describing the “Reinvention” of a site as including a variety of actions including, Cleaning up, Reframing, Deconstructing, Rewiring, Transforming, and Re-programming. (Ruddick 2016: 46) This process of reinvention can be viewed as a method of incremental change and can be applied to the design of the parking lot in order to create something that is better integrated with the life of the community, and with its immediate context. Ruddick writes, “In reinventing sites, we are often like surgeons, taking whole parts of the body apart but leaving enough intact to keep the patient alive.” (Ruddick 2016: 46) This paper recognizes the parking lot’s function and purpose in our society but proposes a transformation, or rewiring of its parts, so that it is more environmentally friendly, more visually aesthetic, and better connected to its surroundings.

Long ago parking lots ceased existing as places and became instead vast spaces for the storage of automobiles. The book, Lots of Parking, poses the question of how parking impacts the human habitat as landscape. (Jakle and Sculle 2004: 15) Noting that places “have symbolic meaning as well as physical
substance,” its authors suggest that places exist in the landscape as messages waiting to be read in different ways by potential users. (Jakle and Sculle 2004: 15) Therefore, parking lots have the potential to symbolize a variety of meaning, and it is in the act of incremental change that we can hope to accomplish a transformation of standard parking lots from spaces back into places that contribute, favorably, to one’s experience of their surroundings. Beginning with smaller parking “gardens” might help facilitate this transformation at the larger, big-box, scale further down the road. An example of such an incremental change includes the Parking Garden at Olympic College in Bremerton, WA. Designed by SvR Design Company in 2011, this project was the first part of an overall master plan that focused on the development of a series of campus open spaces linked by a hierarchy of pedestrian, bicycle and vehicular circulation systems. This newly constructed student parking lot includes LID technologies, such as weirs, perforated curbs, and rain gardens in the medians. http://www.svrdesign.com/olympic-college-parking-garden/3cqtynkegki4mus8uw1w7uh2j1pfif Fig. 3.

Figure 3. Olympic College Parking Garden, Bremerton, WA, by SvR Design Company http://www.svrdesign.com/olympic-college-parking-garden/3cqtynkegki4mus8uw1w7uh2j1pfif

A smaller, but no less lovely example of this notion of parking “garden” can be seen at the Hawksbill Greenway Foundation in Luray, VA. With over two miles of walking trails, the Greenway provides its users with a setting from which to enjoy the beauty of Virginia’s Shenandoah Valley in a unique urban context. The parking lot is completely constructed of permeable pavers and succeeds in blending seamlessly into its surroundings, providing its users with a calming entry and exit experience from the park. Fig. 4.

Figure 4. Parking Lot at Hawksbill Greenway Foundation https://hawksbillgreenway.org/welcome/attachment/permeable-paver-parking-lot/
Some malls and big-box retail stores have begun to recognize the overly large expanses of asphalt surrounding them and are addressing this in various ways. It is common to find sheds, outdoor structures, and landscape materials displayed in sections of parking lots outside of Lowes and Home Depot. Christmas tree lots spring up the day after Thanksgiving - complete with lights, fencing, piped music and general holiday cheer. Farmer’s markets appear on weekends from May through October, reflecting the change of seasons as cool season lettuces give way to tomatoes and finally to apples and gourds. Some Wal-Marts even offer overnight parking to campers and recreational vehicles. Recognizing that the outer regions of the lots are unlikely to be occupied, managers reason that the campers constitute a customer base since they can stock up on goods while in the lot. (Ben-Joseph 2012: 28) However, despite this smattering of creativity, parking lots remain largely under-used, contributing impervious surfaces, light pollution, and heat to urban areas for the majority of the year.

As the high-demand for parking lots tends to be seasonal, Black Friday and holiday shopping for big-box retail, and late summer through fall for football stadiums, surface lots could be treated like fields instead of lying empty for months at a time. Parking lots could become dynamic parts of the urban fabric - active fields where the median and the bays become one continuous planted whole. The planting would cycle with the seasons, lending visual interest and vitality to the site. This strategy of planting the entire lot would decrease the heat island effect, provide corridors for wildlife, and minimize stormwater runoff during slow retail months, while being easily mowed down during periods of high traffic. The choreography of the planting reflecting the seasonal choreography of our activities as consumers. Fig. 5.

Figure 5. Rendering of Parking Field, (2018) by Author

Of course, there will be challengers and challenges to this proposal. Some stadiums are used for other events during the off-season, so how would this be accounted for? Perhaps identify certain sections of the parking lot to be designated for special events and create a hierarchy of lot treatment. Maintenance crews might ask how snow removal would be addressed - could the planting be plowed, would this change the strategy of using large parking lots for dumping snow after big storms? An argument could be made that a large expanse of pervious surface (parking “field”) is a better location for dumping piles of snow than the currently accepted practice of dumping snow on asphalt or concrete surfaces. The snow melt would be absorbed directly into the ground, thereby treating the runoff on site. Table 1.
8 PLANTING STRATEGIES

In order to create successful and viable parking fields, the selection of an appropriate planting scheme must be achieved. Some considerations in the plant selection include how long one needs for a meadow or field to take form. Which plants will fulfill the desired aesthetic in the amount of time needed and in the “off” season when the parking lots are not in use? According to expert James Hitchmough in his book, Sowing Beauty, one should select plants well-suited to the climate in which they are planting. In other words, ask how warm are the summers, how cold are the winters, when is the growing season, and what is the typical rainfall during that growing season? The general context of big-box retail lots and stadium parking is such that any watering or irrigation would be minimal to none, so selected plants must be drought-tolerant and hearty. Hitchmough also claims that less-productive soils allow for a greater density of species, which is positive for sites previously covered in asphalt, and therefore presumably lacking in nutrients. (Hitchmough 2017: 37) Two planting typologies fit with both the desired time frame of the parking “field” planting and the heartiness required of such settings: the Summer-cut Grassland and Meadow, and the Prairie.

The Summer-cut Grassland comprises plants that begin their growth in spring, typically peak in their flowering in June or July, and are cut down in early August. This general growth cycle parallels the use cycle of football stadiums and big-box retail stores, which are not typically in high demand during the spring and early summer and are just getting into full swing in late summer with the onset of back-to-school shopping and pre-season games. The act of cutting and removing the plant material is what curbs the invasion of weeds, and invasives like Tree of Heaven, and allows the meadow to perpetuate the following season after the last of the shopping rush has ended. Cool-season species are applicable here, as they grow from winter to summer, and include such species as Agrostis gigantea, Festuca glauca, and Poa annua - often familiar as lawn grasses.

The second planting typology that would work well in a parking “field” strategy is the Prairie. The term prairie derives from the French word for grassland and is applied to a vast range of grasslands found in North America. James Hitchmough describes two classic types of Prairie grasses: tall-grass prairie, which can be found on more productive soils, and short-grass prairie, found on much less productive soils. (Hitchmough 2017: 86) Again, one could reasonably argue that soils found on sites that have been paved over for years are generally compacted, shallow, and have been stripped of vital nutrients, therefore falling squarely into the low-productivity category and ideal for short-prairie grasses. Plants that could provide the framework for the parking “field” or Prairie, are Schizachyrium scoparius, Bouteloua curtipendula, and Sporobolus heterolepis, which are easy to obtain and available as seeds or plants making them...
a practical source for less productive soils. The Prairie is an important model for designed naturalistic vegetation and includes species, like Aster and Solidago, that flower later in the year thereby extending the growing season and adding visual interest to this newly proposed urban landscape. (Hitchmough 2017: 87) Other examples of applicable species with high-design potential found within North American prairie communities include: Aster sericeus, Coreopsis purpuea, Echinacea tennesseensis, Euphorbia corollata, Geum triflorum, Liatris aspera, Liatris scariosa.

9 CONCLUSION

Unless changes are made to the way we think about parking, flooding will persist, or even increase, chemicals will continue to drain into our sewers and watersheds, and the temperatures of our cities will continue to rise. None of these trends can be addressed until a long-established practice is altered. By completely rethinking the layout of the parking lot, replacing acres of impervious surfaces with fully planted “fields” or prairies, we can achieve places that are environmentally sensitive, pleasing to the eye, and spatially effective. These “fields” can be inserted into any context: the cool, dry conditions in the Northeast, the wetter conditions of the Northwest, even the hot, arid, desert environment of the Southwest. A deeper investigation into the appropriate species of plants needed to accomplish a successful sense of place will be required. Regardless of context, these “fields” will treat storm water runoff on site, decrease the heat island effect during the slow retail months and can be mowed down during periods of high use. The choreography of the planting reflects the choreography of our consumer activities. The parking experience becomes an adventure - which areas will be wildflowers and grasses? Which will be mowed and accessible? We should build on the success of Bluewater and the smaller “parking gardens” that are beginning to take root both nationally and internationally, and make this the rule and no longer the exception. Again, the landscape becomes the framework for the program, turning a space back into a place while addressing the needs of its users and the vulnerability of the urban fabric.

10 REFERENCES


RACIAL AND SOCIOECONOMIC DISTRIBUTION OF PUBLIC GREEN RIBBON SCHOOLS

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1 ABSTRACT
This study aims to investigate whether all students, regardless of racial and socioeconomic status, have equal access to the Green Ribbon Schools. Research on the benefits of green school programs are positively correlated with green spaces, particularly with enhanced attention and improved academic performance. The Green Ribbon award honors schools that are environmentally conscious and focus on sustainability. States that nominate more than two schools must have one school that serves at least 40% of students from disadvantaged backgrounds. The purpose of this study is to determine whether the awarded public Green Ribbon Schools are equally distributed among disadvantaged populations. The list of ED Green Ribbon public schools for the years 2013 through 2015 was collected from the Department of Education. Racial/ethnic and socioeconomic data was collected from the Elementary/Secondary Information System. The study found that the majority of awarded public Green Ribbon Schools did not serve at least 40% disadvantaged students. The majority of Green Ribbon Schools (61%) are primarily attended by White students. Just under 50% of Green Ribbon Schools serve at least 40% socioeconomically disadvantaged students. The chi-squared test found that race/ethnicity and socioeconomic status of the students were not equally distributed for the Green Ribbon Schools ($\chi^2 = 30.60$, p$< 0.0005$). This study is important because it shows that disadvantaged populations are less likely to get an education that may allow their students to learn about sustainability. The recognition process of bestowing Green Ribbon awards can become more conscious in reaching schools that serve disadvantaged populations.

1.1 Keywords
School Environments, Environmental Justice, Green Ribbon Schools, Children
2 INTRODUCTION
In September 2011, the Obama administration announced the inception of the Green Ribbon Schools with the first awardees being awarded in 2012. The program began after roughly 80 nonprofit organizations requested that the USDED honor schools for their achievement in sustainable facilities, above average health practices, and effort in environmental education (USDED 1, 2017). As of 2017, a total of 340 Kindergarten through 12th grade schools, 56 districts, and 34 post-secondary schools were honored (USDED 2, 2017). Over the entirety of the program 42 states, and Washington, DC, had at least one school honored. Eight states- Arkansas, Maine, Nevada, South Carolina, South Dakota, Texas, Utah, and Wyoming- have yet to participate in the program.

The United States Department of Education (USDED) runs the Green Ribbon Schools program which awards schools, districts, and institutions of Higher Education that reach high standards of sustainability and environmental education (USDED 1, 2017). The program is based on three fundamental pillars: reduced environmental impact and costs, improved health and wellness, and effective environmental and sustainability education. However, these pillars lack any mention of serving disadvantaged populations, which is a key component of environmental justice, an important part of sustainability and environmental education.

The USDED states that their goals for the program are to increase economic health and stability as well as student achievement. The goals of the program are to help schools to create jobs and save money under the reduced environmental impact and costs Pillar. The USDED aims for this program to increase student engagement and knowledge in STEM fields which is ultimately helpful for college and career preparedness. The goal of the third pillar, effective environmental and sustainability education, is to teach students civic skills in order to help them grow into responsible world citizens.

As a relatively new program, there is much research left to be done regarding Green Ribbon Schools, particularly if the program reaches the goals set out by the USDED and how the program affects the students that attend awarded schools. As a recognition award, there are not many tangible benefits to the schools for participating in the program. Rather, the schools are given a sense of pride in their accomplishment of being denoted as one of the United States’ top institutions in sustainability and become part of the community of fellow Green Ribbon Schools.

The USDED often claims that this program successfully serves disadvantaged populations (USDED 2017; USDED, 2016; USDED, 2015; USDED, 2014; USDED, 2013; USDED, 2012). The goal of this paper was to determine whether the awarded Green Ribbon Schools proportionally serve students of color and of lower socioeconomic status.

2.1 Literature Review
Despite the lack of research on ED Green Ribbon Schools in particular, there is a wide array of research that has been completed on green schools’ and green school programs’ benefits to students. We care about this because the overall goal of our research is to determine whether all students, regardless of racial and socioeconomic status, have equal access to these benefits. The current research that has been completed has demonstrated positive effects correlated with green spaces, particularly with attention, improved academic performance, incorporation of outdoor education, and overall well-being.

Kaplan and Kaplan’s Attention Restoration Theory (1989) found that after a prolonged time devoted to direct attention, people experience fatigue, which causes irritation, a lack of concentration, and agitated behavior. This is particularly relevant to school children, who are required for long periods of time to engage in direct attention. Kaplan and Kaplan found that exposure to natural environments helps people to practice holding attention, allows for reflection, improves concentration, reduces mental fatigue (1989). The ability of green spaces to help with attention has been confirmed in several other studies (Berman, Jonides, & Kaplan, 2008; Mårtensson, Boldemann, Söderström, Blennow, Englund, & Graham, 2009; Taylor & Kuo, 2009; Taylor & Kuo, 2004). In a comparison of natural vs urban environments, two experiments were presented by Berman, Jonides, & Kaplan (2008) which showed that both taking a walk in nature or viewing pictures of nature can help to improve directed-attention abilities. In Taylor & Kuo’s national study (2004), it was found that green outdoor activities reduced symptoms of ADHD significantly more than activities in other settings. Their findings were consistent even taking into consideration possible other confounding variables like age, gender, socioeconomic status, and region. Thus, exposure to green spaces again is seen to help with attention issues, even in cases of diagnosed Attention-Deficit/Hyperactivity Disorder.
Recent studies have indicated a positive correlation between increased green space on school grounds and improved academic performance. In 2014, Wu et al. conducted a study on the association between green space on school grounds and cognitive function, as measured by academic performance. The conclusion of this study was that there was a positive correlation between the students’ exposure to green spaces on their school grounds and higher academic performance. The positive correlation between increased green space on school grounds and improved academic performance is also demonstrated by a study done by Matsuoka (2010). In Matsuoka’s 2010 study, data from high school students in Michigan were analyzed to see if there was a correlation between availability of nearby nature and the students’ academic achievement and behavior. It was found that students with greater access to nature and who were able to spend more time outside had higher standardized test scores, higher graduation rates, and were more likely to plan on attending four-year colleges. In a study done by Kweon et al. (2016), it was found that the students in schools with more trees received a higher percentage of proficient or advanced scores in Mathematics and Reading standardized tests even after controlling for school size, student teacher ratio, and free lunch enrollment. Not all landscapes had the same positive effects; “featureless landscapes” such as large lawns or athletic fields had negative, rather than positive, impacts on academic performance. With the insights provided by recent studies on the positive correlation between increased green space on school grounds and improved academic performance, it can be assumed that a benefit of Green Ribbon Schools would be an improvement in academic performance as well.

Green schools and green school programs incorporate outdoor education in order to reap the benefits associated with green spaces. Kweon, Ellis, & Storie (2016) provided several case studies on how green schools and green school programs have begun to incorporate outdoor education into their curriculum; they document the benefits associated with these school’s incorporation of outdoor education. The schools used in this case study incorporate outdoor education through various means including: teaching students how the school’s storm water and wastewater treatments work, education on ecosystems through direct observation of the school’s landscapes, and teaching students basic plant science through running their own vegetable gardens and including students in the process of growing and harvesting the produce.

The benefits of green space on school grounds do not stop at merely academic benefits, green schools and green school program also are correlated with overall wellbeing. A study on the association between outdoor environments of day care centers and the children’s health concluded that outdoor environments do influence health and wellbeing (Söderström, Boldemann, Sahlin, Mårtensson, Raustorp, & Blennow, 2013). Day care centers with “high-quality outdoor environments” were associated with health benefits such as: leaner bodies, longer sleep at night, better overall well-being, and higher mid-morning saliva cortisol levels.

The research done on the benefits of green spaces and on green schools’ and green school programs’ benefits for students can be applied to potential benefits of ED Green Ribbon Schools. It is important to consider the benefits that could be gained by students attending ED Green Ribbon Schools because the goal of this paper is to determine whether those benefits are equally accessible, regardless of racial and socioeconomic status. Students should not be restricted because they belong to a disadvantaged population. They should have equal access to improved attention, academic performance, overall well-being, and a chance to learn about the environment through the incorporation of outdoor education.

3 METHODS

In this section we will discuss data collection for the Green Ribbon Schools and the associated demographics. The data analysis was conducted via Excel and a statistical program, “R.”

3.1 Data Collection

To determine if the Green Ribbon Awards were disproportionately awarded to non-disadvantaged populations, a database was created of the Green Ribbon Schools and variables associated with advantaged and disadvantaged populations: racial/ethnic and socioeconomic distributions. A disadvantaged school was defined as one which serves at least 40% students from a disadvantaged background. This definition is based on the criteria of the U.S. Department of Education for when a state nominates more than two schools or districts (“Green Ribbon School,” 2016). While the Green Ribbon program awards both individual schools and districts, this study focused solely on individual schools. Data
were collected for the awarded schools from 2012 to 2014; the number of awarded schools per year and per state are shown in Table 1 and Figure 1. 35 states have at least one school that has been awarded Green Ribbon Award, while 15 states do not.

3.2 School Demographics
Racial/ethnic distributions and socioeconomic distributions were used as indicators of advantage. The Elementary/Secondary Information System (ELSi) was used to synthesize the information on the Green Ribbon Schools. ELSi is a database of public and private schools in the United States provided by the National Center for Education Statistics (NCES). The data provided in ELSi was taken from two sources- the Common Core of Data (CCD) for public schools and the Private School Survey (PSS) for private schools. The CCD is a survey that is conducted by the Department of Education while the PSS is conducted by the Bureau of the Census.

After compiling preliminary data on the awarded schools, it was clear that there was not sufficient data available to analyze private school data. As the two surveys have different metrics it would not be appropriate to combine the datasets. Many private schools also did not provide data about their schools to the PSS; thus, only public school information was evaluated.

3.3 Data Analysis
The compiled Green Ribbon School information was analyzed for trends, quantitative information, and for a chi-squared test for independence. The number of students of each race/ethnicity had to be converted to percent of each race/ethnicity per school. From there Excel was used to determine the descriptive statistics such as mean, median, range, etc. Graphs of both racial/ethnic distributions and socioeconomic distributions were created to visualize and analyze the trends in the data.

In order to perform a chi-squared test for independence, the program “R” was used. R is an open source computational system that allows for accurate statistical computing. R was used to analyze the interaction between race/ethnicity and socioeconomic status. A chi-squared test was used to determine if a significant association exists between two variables. If an association was present, it could be concluded that race/ethnicity and socioeconomic status were related for Green Ribbon Schools. The typical chi-squared test requires certain assumptions to be met such as no expected values less than one and less than 20% of the expected values can be less than five. The data analyzed in this paper did not meet either of those assumptions given the wide variance in race/ethnicity and socioeconomic status. Monte Carlo principles were used to run our chi-squared test in R since they allow data that does not meet the assumptions of a normal chi-squared test.

4 Results
This section will discuss the racial/ethnical distribution, socioeconomic distribution, and the interaction between the racial/ethnical and socioeconomic distribution. The results show that the majority of awarded public Green Ribbon Schools did not serve at least 40 percent disadvantaged students.

4.1 Racial/Ethnical Distribution
While breaking down the racial and ethnical distribution of the schools, this paper focused on the three main represented races and ethnicities: White, African American, and Hispanic. The majority of Green Ribbon Schools (61%) are primarily attended by White students. Figure 1 shows that, on average, the Green Ribbon Schools only have 15.5% Hispanic students and 13.7% African American students. It should be noted that there is a large range represented in the data as seen in Table 1. The lowest percent of each race/ethnicity is 0% and the highest percentages are all above 80%. In fact, percentage of Hispanic students has the smallest range, even at the quite large range of 0 to 82% (Table 1). Figure 2 shows the distribution of the schools according to their percentage of students of each race/ethnicity. The overall trend shows that the majority of schools have less than 10% Hispanic and African American students and more than 90% White students. As percentage of students goes up, the number of schools goes up for White students and down for both Hispanic and African American students.
4.2 Socioeconomic Status

The majority of Green Ribbon Schools (51%) are not financially disadvantaged. Financial disadvantage is based on the percent of students who qualify for the federal Free and Reduced Lunch Program. For the purpose of analysis in this paper, the schools were determined to serve primarily financially disadvantaged students if >40% of the schools’ students qualified for either free or reduced lunch prices. We chose 40% as the threshold because the U.S. Department of Education Green Ribbon Schools mandates that if a state wants to nominate more than two schools or districts, “at least one must serve at least 40 percent of students from a disadvantaged background (2016).” Figure 3 shows the percentage of schools by whether they are classified as not financially disadvantaged, 0-40%, or are classified as financially disadvantaged, >40%. By this definition, only 49% of the Green Ribbon Schools served primarily financially disadvantaged students. Figure 4 shows the distribution of schools by percentage of students who qualify for either free or reduced lunch. The most schools fall between 20-30% of students qualifying for either free or reduced lunch.

4.3 Interaction between Race/Ethnicity and Socioeconomic Status

The statistics program R was used to analyze whether the intersection of Race/Ethnicity and Socioeconomic Status is merely due to chance. When the socioeconomic disadvantage of a school was determined by whether more than 40% of students qualified for Free and Reduced Lunch Prices, the p-value of the chi-squared test was <0.0005. This determined that Race/Ethnicity and Socioeconomic status are related factors, and it is not just due to chance that the majority of schools are White and Not Disadvantaged.

5 Conclusion

This study’s goal was to determine whether the majority of awarded public Green Ribbon Schools did or did not serve at least 40 percent disadvantaged students in order to find out if there is equal access to students of disadvantaged populations. There have been many studies discussing the benefits of green schools and green school programs, so we wanted to know if the government awarded ED Green Ribbon Schools, which presumably have these benefits, were accessible to students, regardless of race/ethnicity and/or socioeconomic status. This study found that the ED Green Ribbon Schools currently are not equally accessed by disadvantaged populations as advantaged populations, with the majority of ED Green Ribbon Schools (61%) primarily serving White students and not even 50% of ED Green Ribbon Schools serving a minimum of 40% socioeconomically disadvantaged students.

This study is important because in order for a problem to be solved, the problem must first be recognized. The positive effects of green schools and green school programs such as enhanced attention, improved academic performance, fosters outdoor education, and overall well-being, should be accessible regardless of race/ethnicity and/or socioeconomic status. With this knowledge, the recognition process of bestowing Green Ribbon awards can become more conscious in reaching out to schools that serve more disadvantaged populations. By acknowledging that the current ED Green Ribbon School program does not do enough to ensure the access of these benefits to disadvantaged populations, the Department of Education can begin to work toward a more inclusive program.

5.1 Figures and tables

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Number of Schools</th>
<th>Number of Schools with Missing Data</th>
</tr>
</thead>
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<td>2012</td>
<td>60</td>
<td>1</td>
</tr>
<tr>
<td>2013</td>
<td>54</td>
<td>3</td>
</tr>
<tr>
<td>2014</td>
<td>39</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>153</td>
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</table>
Table 2. Quantitative Data for Race/Ethnicity Percentages.

<table>
<thead>
<tr>
<th></th>
<th>%Hispanic</th>
<th>%African American</th>
<th>%White</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>15.56</td>
<td>13.68</td>
<td>61.43</td>
</tr>
<tr>
<td>Median</td>
<td>6.77</td>
<td>3.85</td>
<td>69.5</td>
</tr>
<tr>
<td>Mode</td>
<td>0</td>
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<td>0</td>
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<tr>
<td>Standard Deviation</td>
<td>19.34</td>
<td>21.65</td>
<td>30.05</td>
</tr>
<tr>
<td>Range</td>
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<td>99.74</td>
<td>99.44</td>
</tr>
<tr>
<td>Minimum</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Maximum</td>
<td>82.11</td>
<td>99.74</td>
<td>99.44</td>
</tr>
</tbody>
</table>

Table 3. Quantitative Data for Free and Reduced Lunch Prices.

<table>
<thead>
<tr>
<th>FRLP%</th>
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</thead>
<tbody>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Standard Error</td>
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<tr>
<td>Median</td>
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<tr>
<td>Mode</td>
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<td>Standard Deviation</td>
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<tr>
<td>Range</td>
</tr>
<tr>
<td>Minimum</td>
</tr>
<tr>
<td>Maximum</td>
</tr>
</tbody>
</table>

Table 4. \( \chi^2 \) Test for Distribution of Race/Ethnicity and Socioeconomic Factors (\( \chi^2 =30.60, \text{df}=7, \text{p-value}= <0.0005 \)).

<table>
<thead>
<tr>
<th>Socio-economic</th>
<th>Majority Race/Ethic</th>
<th>White Count (%)</th>
<th>African American Count (%)</th>
<th>Hispanic Count (%)</th>
<th>No Racial Majority Count (%)</th>
<th>Total Count (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Count (%)</td>
<td>Count (%)</td>
<td>Count (%)</td>
<td>Count (%)</td>
<td>Count (%)</td>
</tr>
<tr>
<td>Disadvantaged</td>
<td></td>
<td>36(46.75)</td>
<td>13(16.88)</td>
<td>10(12.99)</td>
<td>18(23.38)</td>
<td>77(100)</td>
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<tr>
<td>Not Disadvantaged</td>
<td></td>
<td>58(86.57)</td>
<td>0(0)</td>
<td>0(0)</td>
<td>9(13.43)</td>
<td>67(100)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>94(65.28)</td>
<td>13(9.03)</td>
<td>10(6.94)</td>
<td>27(18.75)</td>
<td>144(100)</td>
</tr>
</tbody>
</table>

Figure 1. Number of public schools per state including the schools with insufficient data
Figure 2. Average Percent of Students based on Race/Ethnicity (n=146)

Figure 3. Frequency of Percentage of Students of Each Race/Ethnicity (n=146)
Figure 4. Percentage of Students that Qualify for Free or Reduced Lunch Prices (n=138).

Figure 5. Frequency of Percentage of Students that Qualify for Free or Reduced Lunch Price (n=138).
REFERENCES
CELA MEDIA STATEMENT

Title of Paper or Research:  
RACIAL AND SOCIOECONOMIC DISTRIBUTION OF PUBLIC GREEN RIBBON SCHOOLS

Authors:  
Johnson, Elizabeth and Kweon, Byoung-Suk

Institution or Professional Affiliation:  
University of Maryland

Media Statement:  
This study’s goal was to find out if the Department of Education’s Green Ribbon Schools Award program serves all populations of students equally. We found that the majority of Green Ribbon Schools are primarily attended by non-socioeconomically disadvantaged White students. This finding shows that disadvantaged populations are less likely to attend a Green Ribbon School and may miss an opportunity to learn about sustainability and its benefits while attending school. It is critical for all children to have healthy and sustainable school environments for them to learn and succeed.
RESEARCH
AND METHODS

Edited by Bin Jiang & Chuo Li
FIELDWORK HYBRIDS: LEARNING FROM OTHER DISCIPLINES HOW TO READ, RECORD AND REVEAL THE LANDSCAPE

RAGSDALE, JOSEPH
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1 ABSTRACT
Various disciplines use the fieldwork heuristic ranging from biology, through the observation of certain animal species in their natural setting, to anthropology, through observation of social settings or cultural groups. The practice requires more than simply being out in the field, however. Fieldwork requires immersion in a particular setting, observation of the subject matter, and recording of observations in a systematic manner. The purpose of this study is to learn from other discipline’s fieldwork methodologies in order to derive new techniques for researching and interpreting the landscape. This paper reports on the development and use of fieldwork hybrids as an analytical methodology to understand, document and visualize the landscape. The presentation discusses three examples of fieldwork hybrids, two academic exercises and one professional development project. Drawing from the environmental and social sciences fieldwork methodologies, the hybrids include problem definition, site immersion, observation and recording, findings analysis and presentations of results/findings. In looking at fieldwork methodology used by other disciplines, landscape architecture has the potential to build on existing analytical and visualization techniques and expand into new territories of reading, recording and revealing the landscape.

1.1 Keywords
Fieldwork, Hybrid Methods, Landscape Analysis, Site Representation
2 INTRODUCTION

For various disciplines, the landscape serves as either the setting or the subject of study. Geography examines the physical features of the landscape or how humans are impacted by those features. Ethnography is the study of cultures and communities from the point of view of the group in an in-situ or site-based setting. Environmental Science combines interdisciplinary perspectives to study the environment and propose solutions to environmental problems. These fields of study bring traditions, practices and methodologies to observe, record and develop findings related to the landscape. Within both academic and professional realms, landscape architecture often uses the knowledge created by these related disciplines to inform the study and practice of the field. For example, information about soils, plants and human factors often stems from related disciplinary fields in the natural and social sciences. Are there other ways to learn from these disciplines in order to enrich landscape architecture? The purpose of this study is to learn from other discipline’s fieldwork methodologies in order to develop expanded techniques for investigating, analyzing and understanding the landscape. This paper posits that landscape architecture might look to fieldwork methods and techniques used in the natural and social sciences in order to inform and inspire our own methods and techniques of studying the landscape. In particular, this paper explores how the methods and techniques of fieldwork, ‘the immersion by a researcher in a setting, group or area of study in order to conduct inquiry’ (Wolcott, 2005), might inform landscape architecture for reading, recording and revealing the landscape.

The primary research question of this study asks is if new approaches to site inventory and analysis can be formed by sampling fieldwork methods from allied disciplines? This paper reports on the development of three fieldwork hybrids, two undergraduate academic exercises and one ongoing research project, drawn from the environmental and social sciences. Having grown from the author’s design research and evolved into instructional tools, the hybrids are utilized as a research endeavor, an analytic tool, and an opportunity to connect with the landscape. The hybrid methods discussed draw from three commonalities found across fieldwork practices - the immersion of the researcher into the study site, an emphasis on observation, and approaches to recording and reporting data. These methods have the potential to build on existing analytical and visualization methods.

2.1 Site Analysis Traditions and New Directions

Author and landscape architect Thomas Russ, notes that “site analysis is the most important step in the successful site design process” but often discounted and undervalued (Russ, 2009, p. 47). In the text Site Analysis, A Contextual Approach to Sustainable Land Planning and Site Design, author James LaGro defines site analysis as, “a diagnostic process that identifies the opportunities and constraints for a specific land use program” and integral to this process is the prior need to conduct site inventory in order to “provide the physical, biological and cultural data needed for this program-driven analysis” (LaGro, 2008, p. 169). This process of collecting and critically evaluating information about the landscape directs further decision making including a site’s suitability, program, capacity, development opportunities and non-development constraints. Site analysis is closely linked with the activities of site planning, the action Kevin Lynch describes as “the art of arranging structures on the land and shaping the spaces between.” (Lynch, 1984, p. 1). Many authors trace the development of site analysis methodologies from the early 20th century and connect the practices of overlay mapping and diagramming through the work of Charles Elliott, Ian McHarg and Kevin Lynch. (Collins, 2001; Herrington, 2010; LaGro, 2008; White, 1983). The landscape architecture profession confirms connections with the activities of inventory and analysis through the inclusion of education requirements for accredited institutions (LAAB, 2016) and licensure (CLARB, 2017). Current methods rely on acquiring and reviewing objective, data-rich resources such as soil, geologic, engineering and hydrologic reports, aerial photography, and policies guiding site development (Russ, 2009).

While site analysis and inventory practices are essential to the landscape architecture profession, for many studying the landscape, current conventions are not fully sufficient to understand a site’s potential in the design process. Christophe Girot, discusses his intuitive and perceptual connections to a particular site, noting that “each time a landscape project begins there should follow an extended period in which one may simply discover what already exists” and designers should “come to grips with their intuitions and experiences of place, allowing these impressions to direct the unfolding of the project.” (Girot, 1999). Seeking to expand traditions and drive new directions, essay collections such as James Corner’s Recovering Landscape or Carol Burns’ Site Matters have offered needed conversation and resources for educators and practitioners. In these collections, theorists like Elizabeth Meyer expose a diverse and expansive set of considerations of site in the
design processes of landscape designers and architects including Downing, Olmsted Sr. and Jr., Jensen and Eckbo among others (Meyer, 2005).

Educators have also sought to expand current analytical practices and develop new methodologies. Caroline Lavoie promotes sketching on site as a ‘form of information gathering and understanding the landscape setting’ (Lavoie, 2005, p. 13) while Katherine Jenkins details analytic methods that ‘promote direct engagement in the field while piloting empirical tools that record open-air encounters’ (Jenkins, 2018, p. 6). In review of Council of Educators in Landscape Architecture (CELA) Annual Meeting Proceedings from 2012-2017 and Landscape Research Record (LRR) publications from 2013-2017, a keyword search for ‘site inventory’ and ‘site analysis’ results in multiple references to both the traditional and boundary-pushing approaches. For example, Watts, D. and Torres note opportunities to integrate new ‘off-site’ technologies for conventional inventory approaches (Watts, D., 2014) while Smith, Erdman and Billig discuss the recording of perceptions through on-site drawing linked to the design process (Smith, 2016). Other works emphasize traditional and innovative approaches to data collection. Lowe and Voos propose an immersive and ‘site-specific’ methodology to data collection (Lowe, 2014) while Lickwar et al. note the importance of being in the landscape or in the author’s words “confront[ing] the world directly in all its messiness and agonism” in the design process (Lickwar, 2016). While the more objective and analytical forms of site analysis are not in direct confrontation with the more personal and intuitive approaches, the differences can be challenging for the educator and student of landscape architecture. On the one hand, professional curriculums require a certain set of skills and knowledge, yet contemporary approaches seek innovation and new opportunities.

2.2 Fieldwork Practices

In Fieldwork: Definition, History, Ethics, Lickwar et al. asks “What can landscape architecture learn from other ‘fieldwork disciplines’ such as geography, anthropology, and the natural sciences?” (Lickwar, 2016). In considering the landscape as an opportunity for discovery and/or design, the immediate response to the question is ‘much.’ Fieldwork can be described as the immersion by the researcher in a setting, group or area of study in order to conduct inquiry (Wolcott, 2005). While supplementary information is gleaned through literature reviews and background collection, primary data collection occurs outside a controlled laboratory environment. Various disciplines use the fieldwork heuristic ranging from biology, through the observation of certain animal species in their natural setting, to anthropology, through observation of social settings or cultural groups (McCall, 2006).

Practices vary across disciplines but share three notable commonalities – immersion in a particular setting, observation of the subject matter, and recording of observations in a systemic manner. Both McCall and Wolcott describe fieldwork as conducting primary research through immersion ‘in the field’ or ‘outside the controlled settings of a library or laboratory’ (McCall, 2006; Wolcott, 2005). Various anthologies of fieldwork in both the natural and social sciences document the rigorous observation and recording techniques (Jackson, 1987; McCall, 2006; Watts, S., 1996). Results and conclusions are reached based upon information gathered and documented while being in the field. Traditions and methods can be traced to Victorian-era natural history excursions as European cultures sought scientific knowledge from across the globe (Camerini, 1997). Expeditions by natural historians such as Charles Darwin, depended on field study, observation and material collection for the discovery of new knowledge. Contemporary fieldwork methods build on these traditions, but have roots in the social sciences, particularly Anthropology. During the late 19th and early 20th centuries, researchers in Europe and America expanded research on human populations to rely less on references, theoretical speculation and isolated interviews and more on immersion into a particular setting or population for direct observation and methodical recording (McCall, 2006). Another commonality among disciplinary approaches is the adaptability and malleability of methods. Fieldwork is commonly described as complex, as a set of procedures and not a single method, as requiring adaptability over rigidity, and as deeply personal (Jackson, 1987; LaReau, 1996; MacClancy, 2011; Wolcott, 2005). Noted Anthropologist Harry Wolcott explores fieldwork as an “activity incorporating elements of both art and science” where scientific research methods combine with artistic sensibility to both observe and portray a subject group.

Fieldwork practices and traditions also have connections with design and design-related fields. Within the field of cultural landscape studies, methods rely heavily on an ability to ‘read’ the stories embedded in the landscape leading to understanding about the people and their relationship with the land (Lewis, 2003). These efforts stem directly from the writing of J.B. Jackson, who does not profess a particular technique or method of study of the landscape, only describes the goal of the effort as “a rich and beautiful book is always open before us. We have but to learn to read it.” (Jackson, J.B., 1951). Connections with field-based study and

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practice can also be seen in American land art practices of the late 1960s, particularly in artist Robert Smithson. Smithson, an oft-inspirational figure for landscape architecture, ventured into over-looked, industrial and barren landscapes, initially to observe and document the landscape, and later to create art. Scholar and artist, Emily Scott argues that Robert Smithson embarked on fieldwork-like journeys as a creative-critical act seeking spaces in which to stage a particular set of critiques. Additional connections between the design fields and fieldwork include the 1968 research study by Robert Venturi and Denise Scott Brown’s Learning from Las Vegas. Methods merged scientific observation and recording techniques drawn from the discipline of sociology with graphic representation experiments to both understand and reveal urban form (Chapman, 2009). Landscape architecture’s more direct connection with fieldwork can also be noted in sociologist and urbanist William H. Whyte’s 1980 study The Social Life of Small Urban Plazas. In this field-based study, Whyte adapts the technology of time-lapse photography with the observation of urban spaces to test a hypothesis on how people use a particular landscape. This work, in print and film, is a foundation of many landscape architecture curriculums.

In review of fieldwork traditions of other disciplines, connections with site analysis are readily apparent. Both methods require an initial time to frame the study and approach, visit the field (or site), observe specifics of place, and record information. These practices are followed by a period of evaluation or analysis of the data in order to produce findings or conclusions. Within the realm of instruction on methods and techniques, similarities can also be found. Students in landscape architecture conducting site analysis and students in disciplines using fieldwork are expected to know best practices and methods, but curriculum rarely has adequate room for focused efforts or faculty don’t have time to fully teach the subject (Jackson, 1986; Lickwar, 2016). Like site analysis, best practices and mastery of approaches are best learned through learn-by-doing approaches and experiences (Jackson, 1986; Lareau, 1996; McCall, 2006). Considering the many apparent, face-value similarities between fieldwork and site analysis, learning from related disciplines has the potential to generate new directions in landscape architectural practice.

3 HYBRID METHODS

The three approaches presented in this paper strive to incorporate fieldwork techniques from the arts and design fields, social sciences and natural sciences to better inform the comprehension, documentation and visualization of the landscape. The approaches also form hybrids between fieldwork and site analysis techniques with the purposes of developing a deeper understanding of site and context, learning from and about the landscape and informing the design process. The hybrid methods build on fieldwork’s reliance on immersion, observation and recording of the subject, qualities prevalent across disciplinary approaches (Jackson, 1987; McCall, 2006; Watts, S., 1996; Wolcott, 2005).

Within fieldwork, immersion refers to more than being ‘in the field.’ Immersion requires time and commitment. For social anthropologists, immersion is critical to participate in the setting, observe over a length of time and be present for “an illuminating serendipity: the unexpected event which can make us revise our understanding of local life” (MacClancy, 2011, p. 18). Immersion in the research setting or group allows for a greater personal attachment and opportunity for a deeper level of understanding (Wolcott, 2005). Immersion also allows for the researcher to move from an outsider position, to what is characterized as a ‘participant-observer’ thus reinforcing an understanding of the research subject through participation with the group (Jackson, 1987). Observation is more than simple looking or seeing. Observation is thinking critically about what we see and inquiring about the reasons for what we see. In Essential Environmental Science, authors Simon Watts and Lyndsay Halliwell note that observation requires much work before setting out “because only then will you know: (a) what you are supposed to see; (b) whether what you are seeing is what you are supposed to see; and finally (c) reasons for things that you may have recognized” (Watts, S., 1996, p. 2). Recording is a critical skill in fieldwork across disciplines. Techniques and data vary from project to project but often include quantitative values and qualitative descriptions. Recording aids in the process of understanding and functions as an archive of the researcher’s observations (Blommaert, 2010). The list of techniques of recording noted in fieldwork manuals is long and similar to site inventory techniques - notes, photography, interviews, cataloging, coding, recording, and diagramming (Wolcott, 2005, Blommaert, 2010).

Fieldwork literature and manuals also note several techniques for data analysis, synthesis and developing research conclusions. This paper does not discuss specific analytic methods or how fieldwork influenced design efforts. The hybrids utilize visualization techniques to portray observations and findings. Results are interpretive of the place and landscape, with the intention to set up a future design action. Fieldwork across disciplines is similarly interpretive. Blommaert notes that ethnographic fieldwork is
“interpretive research in a situated, real environment, based on interaction between the researcher and the subject(s), hence, fundamentally subjective in nature, aimed at demonstrating complexity, and yielding hypotheses that can be replicated and tested in similar, not identical, circumstances” (Blommaert, 2010, p. 17).

3.1 Fieldwork Hybrids - The Palette

This hybrid method combines rigorous fieldwork observation and recording techniques with the use of the palette. The term palette is often synonymous with an artist’s hand-held paint board, although in this instance, palette refers to the spectrum of attributes of the landscape. As an opening exercise within site-scale design projects, a short prompt directs students “through careful observation, record and reveal unique qualities and characteristics the site and landscape context landscape using photography (digital or print) or other static medium.” Students must produce a multi-image display that captures their individual observations of place. Offered over the years to various course levels from 2nd through 5th year capstone, the purpose of the method is to push critical inquiry of the landscape while tapping into the familiarity of readily-available technology (digital and cell phone cameras). The hybrid is designed to allow for seeing and recording in a meaningful way for those that might not be confident in drawing or sketching, know data analysis software such as GIS, or have practiced site inventory and analysis skills. The hybrid encourages being in the landscape, careful examination and rigorous documentation.

Figure 1. Student work emphasizing observed materials and atmospheric qualities, ground plane materials for a campus landscape (left), figured sky recordings for an urban environment (right).

Palettes by Tyler Reed (2015) and Patrick Kelty (2017)

The short assignment prompt is supported by a discussion on the scope of the site and landscape context, the process and value of observation, preliminary identification of qualities and characteristics of the site, methods of recording, the potentials and pitfalls of the palette, and opportunities for representation. Emphasis is placed on considering the exercise as a kind of research conducted through being in the landscape or field. Students are introduced to the concept of fieldwork “as a particular kind of systematic research practice based on naturalistic observation,” “an archive that documents our communities and cultures,” and “a methodology of knowledge creation” (Fox, 2006, p. 347). This conceptual understanding of the method is supported by practices of observation and rigorous recording. Observation is promoted as requiring both forethought and continuous consideration of “what to look at, what to look for, and the never-ending tension between taking a closer look at something versus taking a broader look at everything” (Wolcott, 2006, p. 89).
After observation and recording, students spend additional time analyzing and formatting images. Narratives are not revealed through a few photos swiped on a mobile device or placing images on a poster. Like the outcomes of site analysis informing site planning decisions, the outcomes of this fieldwork hybrid are intended to inform and inspire future design directions. Students are encouraged during this analytic phase to consider design implications and how the represented palette can lead to and inform design directions. Students investing in the process, show strong appreciation and understanding of a particular quality or set of characteristics observed in the landscape (Figure 1). New understandings of the landscape are revealed through in-depth studies of materials, temporal qualities or observed qualities. Results show students connected to and invested in a process of careful observation and recording with the intent of producing a new way of understanding the landscape.

3.2 Fieldwork Hybrids - The Transect

This hybrid takes advantage of the transect, an observation and data collection method utilized in natural science fieldwork. The transect (trans meaning through and sect meaning cut) allows a researcher to observe and record a set of field observations sampled along a line crossing the study area (Watts, S., 1996). Transect sampling is utilized to study large areas that can’t be fully explored or to reveal relationships between ecological zones or communities. 19th century naturalist and explorer, Alexander von Humboldt, popularized the transect in fieldwork excursions to the Americas to observe and record the biological diversity, revealing findings in large, annotated cross section drawings of the landscape (Braae, 2013). The transect requires a researcher to carefully plot a path of travel or section through the site, develop a sampling method and record observations along the section. The transect has been utilized by the design fields for both analysis and design of the landscape. Ellen Brae, Lisa Diedrich and Gini Lee have utilized the transect and von Humboldt's methods to both map and narrate the landscape (Braae, 2013, Diedrich 2014). Within the design fields, transect planning is based on the fieldwork method and proposes that zoning policy should reflect a range of urban habitats and environments from rural to urban along a continuum (Duany, 2002).

![Figure 2. City-scale transect observations along rail line in San Luis Obispo, recording major spatial configurations in relationship to topographic modifications. Work by Raisa Capella de Almeida (2016)](image)

This hybrid method is deployed in studio courses with large landscape contexts, such as university campuses or urban environments. The assignment prompt directs students to plot a transect, or path of travel, across the landscape and record observations about a set of conditions. Recordings are taken at pre-defined intervals and strive to capture similar information at each stop. The project’s learning goals include having students experience, record and reveal the landscape from new perspectives and techniques; to make visible distinct parts, systems and sites of the landscape context; and to discover what site data, research and information is required to conduct future design efforts. Supporting presentations discuss fieldwork and design approaches utilizing the transect. Discussions emphasize the necessity for defining the project scope and focus. Prior to getting in the field, each student must answer: what are you looking for? what do you want to reveal? where will you look for it? what are the boundaries and limits of the landscape? what is your path of travel? how will you record information?
Students spend additional time organizing and analyzing results and formatting outcomes upon completing observation and recording. As an open-ended project, results often reveal highly personal connections with the landscape, such as favorite paths of travel or notable places. Other results, showcase relationships including activities/functions, spatial structure, natural and social histories and observed qualities of place (Figure 2). Operating at the largest of scales, students sometimes struggle with the applicability to future design efforts. In these efforts, transects are framed as becoming oriented to the landscape context for future design studies. Within smaller contexts, the transect can allow for greater understanding of issues such as connections among topography, stormwater features and campus layout (Figure 3).

Figure 3. Campus-scale transect observations record storm water and drainage features in relationship to topography and campus structure. Work by Kevin Jo (2017) and Misty Wada (2017).

3.3 Fieldwork Hybrids - Immersive Observation and Recording

A third hybrid method relies on immersion and the use of a participant-observation methodology to understand, observe, record and reveal a cultural landscape. As noted earlier, immersion into the setting is a cornerstone of fieldwork, particularly social science fieldwork (McCall, 2006). Participant-observation methods rely on the researcher taking part in daily interactions with the study subject thus providing greater exposure and the opportunity for in-depth observations and recordings. McCall notes participant observation ‘in a broader sense, as naming not a single method but a necessarily multimethod, mixed-method mode of research in which both participation and observation figure prominently’ (McCall, 2006, p. 4). Immersive, participant-observation methods offer great potential for the research of complex landscape architectural issues, like the field of cultural landscape studies that rely on observation and recording where primary source material is not readily available.

The author’s research investigation, Source + Surface: Diptychs of Extraction and Production was the result of immersion in the study site of Rome, Italy, as a Fellow at the American Academy in Rome. The research was conceived as a broad search for revealing insights into the source landscapes of the monuments and architectural works of the city center. The research posits that for every constructed surface in Rome, there lies an equally excavated and transformed site outside the city center. When a literature review noted limited resources into the source landscapes, the research methodology turned to an iterative process of being in the field, obsessive observation, exploration of the landscape, mapping and documentation. As Gillian Rose notes “fieldwork is all about looking [and] the visual is central to claims to geographical knowledge: a president of the Association of American Geographers (John Fraser Hart) has argued that ‘good regional geography, and I suspect most good geography of any stripe, begins by looking”’ (Rose, 2008, p. 171). By relying on observation and daily interaction with the materials, connections could be proposed, then through further book research, verified or expanded. For example, regular observations of the Servian Walls, noted the use of varied stone materials in different construction configurations. Successive research, verified the material nomenclature and potential locations of origin. A return to the field, produced potential source quarries through a process of exploration, observation and verification.
As the project developed, daily interaction and observation with the sites and landscapes solidified an understanding of the landscape and knowledge creation. The process was not linear, however, but continued to constantly probe the research subject in an iterative manner as described by Blommaert (Blommaert, 2010). Long-term immersion allowed for continually asking critical questions what am I looking for? (problem setting), what is already known? (background data collection), where might I look for answers? (inquiry), where do I go? (fieldworks, exploration and immersion), what do I see? (inventory), how do I record? (observations and data collection), what does it mean? (analysis), and how do I report findings? (creative responses). Observations and data collection included a mixed-method approach, including: macro and panoramic photography, study modelling, sketching and mapping, measured drawing, and material sampling (Figure 4). Fieldwork studies were summarized through the creation of visual images, models and diagrammatic relationships. Through immersion, observation, making and reflections the study grew to reveal a relationship between the source and surface landscapes, between extractive spaces and constructed surfaces, between landscape and city. Revealing the connections between the 'source' extractive landscape outside the city and the 'surface' constructive landscape within the city walls, became the emphasis of the study. The relationships and connections between landscapes are revealed through the use of the diptych - an ancient and adapted art technique which scholars point to the artist’s establishment of purposeful relationships between the images and to the intention of connecting the viewer with the images (Hand, 2006). Diptychs forge connections between sites of extraction (abandoned quarries, forgotten communities and unique cultural and ecological landscapes) with sites of production (buildings, facades, temple bases, roads and walls) (Figure 5). Fieldwork methods produced a deeper understanding of the landscape, a solidified connection between the landscape with the city, a strong influence of the geologic conditions on urban form and a narrative of material use and landscape transformation in the development of the Eternal City.

4 DISCUSSION

4.1 Challenges

Several challenges are noted in the development of fieldwork hybrids. Practices are varied and often evolving instead of lockstep. Although the themes of immersion, observation and recording are prevalent across practices, the literature points to varying methods and techniques among disciplines. Developing, piloting and implementing hybrid methods takes time, focus and a commitment to ongoing refinement of best practices. Student assessment of the hybrid method exercises as well as author reflection on hybrid practices confirms the need to carefully consider when and how to sample from other disciplines. Like design, however, fieldwork is iterative and offers many opportunities for both professional development and continued refinement of best practices. Literature sources also often include advice and opinion for those interested in the subject. Anthropologist and education researcher, Harry Wolcott provides advice for who should and should not conduct fieldwork: “Fieldwork is not well suited for individuals who thrive on authority and expertise and feel they must know everything about whatever subject they touch. Nor is it comforting for anyone obsessed with
maintaining control. But fieldwork is wonderfully suited for those who find satisfaction as lifelong learners, ever appreciative of how much others know and have experienced, rather than in need of parading their own knowledge before audiences.” (Wolcott, 2005, p. 225). In the introduction of Fieldwork, author Bruce Jackson notes on the first page that “useful fieldwork isn’t easy” and on the concluding page “I’ve never had what I’d call a perfect field experience” (Jackson, 1987). Approaches and acceptance may be more amenable to certain learner types based on these words from notable sources.

Figure 5. A large-format, photomontage diptych records a connection between the travertine source quarry landscapes near Bagni di Tivoli (left) and surface uses in the city center at the Colosseo Quadrato/Palace of Italian Civilization, EUR (right). Photos by author (2004).

A reflection on the construction of fieldwork hybrids for landscape architecture education and research method for ongoing fieldwork also offers more practical challenges for consideration. Fieldwork takes time and commitment. In order to gain a deep understanding of place through immersion and observation, students and practitioners will be required to spend significant time on the study site. Time can be particularly challenging to find within a given academic term or to be compensated for within professional practice. Within the education environment, students may also doubt practices with which they are uncomfortable or don’t maintain a clear understanding of how the approach may apply to future efforts. Student reflections on the methods have included statements such as ‘I’m not a photographer or researcher. I am a designer.’ or ‘I wasn’t interested in looking very hard at things I was going to change on the site.’ A final practical challenge can be found in moving from recording to analysis. Being on-site, looking and recording can be engaging and an inventory can be produced. Moving from recording to analysis, from recording to determining meaning, significance or impact requires much critical thinking.

4.2 Opportunities

Fieldwork practices and the hybrid methods presented, offer tremendous potential for the instruction, research and practice of landscape architecture and to address concerns about conventional methods noted previously (Burns, 2005; Corner, 2005; Meyer, 2005). Hybrid methods can also address concerns noted with the profession’s complaisance with and reliance on digital resources and techniques for analytical decision making during the design process (Jenkins, 2018; Lavoie, 2005). Within the classroom, hybrid methods provide additional time in the landscape and an opportunity to hone observation skills. Direct observation and recording in the field has the opportunity to move site inventory and analysis from a checklist of required review items or examination of externally acquired data sets towards a more discerning and directed approach to
understanding the landscape. Inventory and analysis can become a physical act conducted within the study site and not reliant on a detached examination of digital data sets. Inventorial facts and diagrams of sun patterns, wind directions and locations of noise and wind could be replaced with critical inquiry of the site in order to better inform the design process. Students could be challenged to both think about and respond to questions about what site or landscape is, what could or should be observed, what potential can be found through a detailed examination of place and how could complex issues be better represented? Fieldwork hybrids also offer tangible and intangible opportunities for those studying the landscape through the discipline of landscape architecture. Fieldwork methods including immersion, observation and recording methods both offer and require the pursuit of an understanding of place (Blommaert, 2010; Jackson, 1987; MacClancy, 2011; Wolcott, 2006). Pursuing hybrid methods has the potential to refine research processes, develop broader conclusions and experiment with the representation of results. Cultural landscape studies, for example, might further develop or expand approaches for observation skills, data collection and reporting of findings by drawing from fieldwork disciplines. Within practice, detailed representation of site issues could increase client and community awareness and value of the landscape. A deeper understanding and a portrayal of site and context issues could also lead to greater buy-in of design efforts. The development of scholarship and literature on fieldwork practices can be an additional opportunity for faculty and practitioner professional development. The author is aware of ongoing efforts in this area, for example Thomas Oles’ and Paula Horrigan’s forthcoming book, and looks forward to continued efforts to learn more about the practices and methods.

5 CONCLUSION

While landscape architecture practices continue to evolve, educators and practitioners might consider further investigation into the methods of fieldwork for both research and design endeavors. Science, research and design do not need to stand apart from one another. In fact, within fieldwork disciplines, the approaches to problem setting, process and the creation of results and outcomes share many connections with landscape architecture design process. Exhaustive literature exists for fieldwork practices for anthropology, ethnography, biology and geography. Several resources provide well-documented methods for immersion (McCall, 2005), observation and recording techniques (Jackson, 1987; Watts, S., 1996; Wolcott, 2006). Additional literature documents well known fieldwork investigations and best practices (Lareau, 1996; MacClancy, 2006). These resources should be key for future efforts adapt methods and practices for the profession. New methods and techniques for analysis and inventory can be formed by rigorously sampling fieldwork methods from the environmental and social sciences. The three fieldwork hybrids presented, two academic exercises and one research investigation, initiate new directions for inventory and analysis research methods in landscape architecture. The palette fieldwork hybrid strengthens connections with the landscape through careful examination and rigorous documentation. The transect fieldwork hybrid solidifies awareness of landscape contexts. The immersive observation and recording hybrid articulates the need for critical inquiry and deep understanding of the landscape. The hybrids reinforce an emphasis of fieldwork on immersion with the study subject, focused observation and meticulous recording. As Elizabeth Meyer notes, ‘site concerns challenge the modern divide between rational site analysis and intuitive, creative conceptual design’ (Meyer, 2005). Fieldwork hybrids provide a framework for reading, recording and revealing the landscape and look to contribute to methods and practices leading to deeper understanding of the design potential of the landscape.
6 REFERENCES


Title of Paper or Research:
FIELDWORK HYBRIDS: LEARNING FROM OTHER DISCIPLINES HOW TO READ, RECORD AND REVEAL THE LANDSCAPE

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Media Statement:
Landscape architecture has the potential to build on existing analytical and visualization techniques and expand into new territories of reading, recording and revealing the landscape. This paper discusses three examples of fieldwork hybrids, two academic exercises and one professional development project. Drawing from the environmental and social sciences fieldwork methodologies, the hybrids include problem definition, site immersion, observation and recording, findings analysis and presentations of results/findings.

Graphic Abstract:

Fieldwork studies reveal a connection the travertine source quarry landscapes near Bagni di Tivoli (left) and surface uses in the city center at the Colosseo Quadrato/Palace of Italian Civilization, EUR (right). Photomontage diptych by author (2004).
USING INDIVIDUAL AND GROUP COMMUNITY-BASED METHODS TO DOCUMENT CULTURAL LANDSCAPES ELEMENTS

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1 ABSTRACT
Community-based studies encourage people to speak out, lending their voices and memories to studies that seek to document community awareness and perceptions of local landscapes. Sanoff (2000) states that “residents are more aware of the realities of their own environments than outside professionals”. This is a reflective critique of a community-based approach used to document the cultural landscape elements of Findikli in Rize province located near the Black Sea in the northeast of Turkey. The critique reveals advantages and limitations to research methodologies that researchers should consider as they design their community-based studies. This paper reviews six methods used in the study to document people’s awareness and perceptions of their current and past physical and social landscapes. The methods include: discussion, survey, oral history interview, photo survey, photo-voice recording and spatial mapping. Group sizes ranged from individual to small groups with 2 or 3 participants, and large groups of 4 to 8 participants. The critique presents and reviews the opportunities such as ability to recall, flexibility to work with participants and challenges such as language barriers, time limitations to collect quality and quantity of data encountered with the different methods based on group size. This paper offers researchers a practical perspective on factors to consider when implementing community-based methods.

1.1 Keywords
Cultural Landscape, Cultural Heritage Documentation, Community Participation Research Methods
2 INTRODUCTION
This paper evaluates the effectiveness of community participation methods in documenting cultural landscape elements and it provides a practical perspective on factors to consider when implementing community-based methods for researchers in their studies of cultural landscapes.

Community-based methods implemented in this study include: discussion, survey, oral history interview, photo survey, photo-voice recording and mapping. This combination of methods allows collection of qualitative and quantitative data as well as factual and perceptual information of cultural landscape elements in a district. All methods were conducted in different group sizes: individual, small group (2 or 3) and large group (4 to 8). The research methods study showed that different group sizes created opportunities to collect high quality and quantity of information whereas they created limitations to collection of high quality and quantity of information in different methods. This paper demonstrates the effectiveness of community-based methods in collecting high quality and quantity of information about local cultural landscapes by using either a single method or multiple methods.

2.1 Literature review of community participation methods
Community-based methods are used to obtain more information about a community and its affiliations. Fagerholm and Käyhkö (2009) pointed out that in developing countries local scale social landscape values are missing when natural resources are under the pressure of new developments (p.44). The way to learn local scale landscape values is possible with community based methods. There are various ways to engage people (individuals or groups) in community projects. The specific characteristics of a particular study, such as its project goals, objectives, and time frame, determine the most effective means of engaging communities in that project.

Community-based methods are good for documenting cultural landscape elements. Community participation methods provide information regarding landscape meanings in the eyes of a community as well as landscape values and significance with which they are imbued. Sanoff (2000) emphasized that community participation is necessary because local people “are more aware of the realities of their own environments than outside professionals. They have a sense of what will work and what will not work” also of what is valued more or less (p.7). Community participation methods encourage people to speak out, lending their voices to studies that seek to understand their communities. In this regard, to obtain data on cultural landscapes past and present, local people must be directly participating.

A range of community participation methods are necessary to reveal information such as local demographics, people’s landscape perception, and meanings. A combination of discussion, survey, oral history interview, photo survey, photo-voice recording and mapping were selected for the documentation study. For example, community surveys can be designed to collect demographic data such as gender, race, and education levels in the community population (Asah, Lenentine, and Blahna, 2014, p.111). Another example, oral history interviews reveal meanings of the past (Abrams, 2016, p.12). Photo-voice recordings convey people’s feelings, thoughts, and perceptions. (Wang and Burris, 1997, p.369). Many scholars value maps as tools for extracting the geographical, personal, or social meanings of a place (Roberts, 1994, p.135; Boyer, 1996, p. 206; Powell, 2010, p.539). These meanings are derived from the relationships or connections between humans, place and nature. Mapping offers an easy way to read multilayered landscapes and to document both physical and social components of landscapes in cultural landscape studies. Group mapping and discussions also benefit from communal remembering and story-telling.

2.2 Introduction of the large study: understanding of physical and social landscapes of Findikli under the threat of losing culture
This research method critique focuses on methods used to document cultural landscape elements. Findikli, a district of Rize province in northeastern Turkey (see Figure 1), was selected as a case study area as it has been under the threat of losing traditional physical landscapes and cultural knowledge due to rapid landscape change. In order to understand how the cultural landscape has changed because of human engagement with the landscape, both qualitative and quantitative data collection methods were implemented. A comprehensive review of the existing literature and the official archives of Findikli revealed insufficient information about people’s relationships with the landscape such as community perceptions of physical and social landscape change and the spatial organization of dwelling areas. Therefore, community participation methods were conducted in a data collection to reveal information hidden in people’s minds. To gather both factual and perceptual information, community participation methods were conducted in
different group sizes. This critique evaluates the effectiveness of community participation methods in documenting cultural landscape elements by comparing the methods used in different group sizes and their limitations and opportunities to collect high quality and quantity of information. Also, this critique provides a practical insight of community participation methods for researchers in their studies of cultural landscape.

Figure 1. Location of Findikli. Figure by Alisan (2013)

2.3 Case study area

Findikli has three different types of settlement patterns: urban, mixed rural and urban, and rural. The urban structure of Findikli is represented by the downtown area. The mixed rural and urban structure includes eight neighborhood settlements. Twenty-two villages form the rural pattern of Findikli. These are scattered along the valleys close to the river or mountains.

Two ethnic groups reside within Findikli: Lazi (Laz, Lazuri) and Hemshin (Hemsin). Both groups have been living in this area for thousands of years. However, Lazi and Hemshin people share the same physical setting in only a few settlements. Typically, Hemshin villages are located close to the peak of mountains, and Lazi villages are near the coast. This geographic difference affected Lazi and Hemshin daily activities and relations to their environment. For example, while Hemshin people are known for their practice of moving livestock from lowlands to highlands in the summer for grazing (transhumance). The Lazi people are known for cultivating their land for corn, hazelnut, and vegetable, and aquaculture. (Simonian 2007) (see Figure 2) The area is more recently developed for tea production.

Figure 2. Hemshin people practice transhumance (on the left), Lazi people produce tea. Photo on the left by permission of Erkan Aksu, photo on the right by the author

Findikli is defined by its dramatic natural borders, the Black Sea and the Kackar Mountains. The mountains dominate the area and create deep valleys with a network of dense flowing waterways. Findikli is located in a narrow strip of land between the mountains and the sea. Arable lands are very limited. Uneven terrain created by valleys and rivers caused the dispersed settlement patterns in the region (see Figure 3). Agricultural lands are generally located on the steep slopes. The climate makes life harder because there are heavy rains most of the year. The rugged terrain and rain create challenging living conditions for local people, which require survival skills such as energy, strength, and resourcefulness (Hann, 2007, p.342). The ability to work efficiently and cooperatively is valued in the community because of the need to bring in harvests quickly in the face of unpredictable weather conditions.
Overtime geographic locations and different ethnicities created different cultural practices and unique landscape heritage for each group. However, today, the different ethnic groups in Findikli have a shared culture and rituals such as practicing agriculture, playing the traditional instrument *tulum*, and dancing *horon*.

![Figure 3. Dispersed settlements in the topography of Findikli. Photo by permission of Erkan Aksu](image)

3 METHODS USED TO DISCOVER FINDIKLI’S CULTURAL LANDSCAPE ELEMENTS

In general, landscapes are threatened by rapid landscape change due to human activities that cause natural and cultural heritage to be lost (Roberts, 1994). In order to diminish heritage loss, organizational bodies such as The United Nations Educational, Scientific and Cultural Organization (UNESCO) and The International Council on Monuments and Sites (ICOMOS) conduct cultural landscapes studies to document natural and cultural landscape elements. Similarly, Findikli has been under the threat of losing its traditional physical landscape and cultural knowledge due to rapid landscape change caused by newer monoculture agricultural practices. In this regard, a documentation study was designed for cultural landscape research and planned to use community participation methods to collect perceptual and factual data regarding physical and social landscape elements. Six community participation methods were selected: discussion, survey, oral history interview, photo survey, photo-voice recording, and mapping. In order to implement these methods, the site was visited two times for gaining access to community members; to build trust while meeting individuals and groups; to introduce the study to community groups and members; to generate interest within established community networks; to obtain access to range of individuals and community members; and to recruit participants for the research study.

During the first site visit, official archival documents of Findikli were obtained and connections to community networks were established. Between the first and second site visits, a research protocol of community-based methods was presented to the Institutional Review Board (IRB) for review. Final IRB approval initiated the second site visit and plans were made to implement methods and to inform community members about community meeting to be held. Also, an aerial photo map was created for the community mapping activity.

In this research method critique, the conducted methods are introduced in three phases; preparing to meet the community, data collection and data analysis (see Table 1). In the first phase, the design of the research methodology and the prerequisites for methods to be conducted are presented. The second phase included recruitment of participants and implementing methods on-site including group size, limitations and opportunities. The third phase presents findings in this research method critique. Cross relationships between methods and the quality of collected data are presented in the findings.
Table 1 Community participation methods and expected information types to be collected.

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<th>METHODS</th>
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The research methods were designed to collect both objective and subjective data via determined community participation methods. Each method was designed to collect specific types of information such as demographics, spatial organization, land-use, physical and social landscape values and perception of change.

3.1 Phase 1: Preparing to meet the community

Selected community participation methods are discussed in the order they were implemented on-site (see Figure 4). Methods were selected and refined to help determine where to meet with community members and to account for the types of information to be collected. The research methods design included gaining trust and access to the community members as preparation for implementing methods.

3.1.1 Discussion

The purpose of this method was to recruit participants to the study and to gather main topics during discussions with community groups and members. This approach was important to introduce the documentation study to the community and to gain trust among them. Discussions were expected to occur spontaneously in small community gatherings. There was no prerequisite for this method as the initial discussions took place in community gathering places such as coffee houses and association places.

3.1.2 Survey

A survey instrument was used to collect demographic information about the Findikli community; and perceptual information of landscape change and values. The survey was distributed to people with different ethnicities, ages and socio-economic levels.

The paper-based survey was designed to gather information in four categories. The first category included demographic information of the community such as age, gender, socio-economic status and cultural backgrounds. This was important because the Findikli community was formed by different ethnic groups and cultural differences can affect people’s perceptions of their landscape change and value. In the second category, questions about people’s relationships to farms were used to learn how people use(d) their lands and for what purposes including past and present interactions between people and landscapes. Questions in the third category were asked to collect people’s perceptions of environmental and social life change. How and how much physical and social landscapes have changed and when people noticed the change can reveal the impact of these changes in the Findikli community. The last category of questions include people’s perceptions of environmental and social life values. Collecting people’s values relating to the past and present is important to making comparisons of people’s perception of past and present landscape perception.

The survey method was designed to include at least one participant from 30 different settlements around Findikli. The survey questions were developed in response to information about Findikli’s physical and social landscapes and the community fabric as drawn from the literature review and archival research. Preparation of the survey took significant time and effort to make the questions clear and to design self-explanatory tables and questions for different age groups. Due to personal questions in the surveys, they were intended to be filled out by individuals during the community meetings.
3.1.3 Oral History Interview

Oral history interviews were conducted to collect in-depth information regarding perceptions of physical and social landscape changes and values. Stories, memories and experiences can be extracted by asking more questions about the past as well as comparing the past and present. Oral history interviews drew specific details from people’s minds about relationships between people and landscape.

This method was designed to take place in the participants’ homes. Participants were free to talk while walking or sitting at the table, inside or outside. A voice recorder is an essential tool to record what the interviewees said.

3.1.4 Photo Survey

The photo survey method was used to collect factual and perceptual information of landscape changes and values. Photo surveys reveal varying interpretations of the same pictures by individuals or groups. For example, a picture that shows a traditional agricultural practice on the land might remind people of hard work in the past or good old days. In addition to the written survey questionnaire, a photo-survey questionnaire was used to trigger participants’ memories and experiences. Participants were asked to tell what they saw in each photo, how it has changed over time, and what they feel when looking at the photos.

The photo album included past and present pictures of physical and social landscapes of Findikli. Pictures were compiled from archival documents, personal collections from community members, theses and dissertations about Findikli and photos taken during the first site visit. Therefore, the prerequisites for photo survey method were literature review, archival research, and a previous site visit to establish connections with people who had photo collections. Photos have to be clear and big enough for older participants to see details in the pictures. This method was planned to be done immediately after the oral history interview if the interviewee was willing to participate.

3.1.5 Photo-voice recording

The photo-voice recording method was to collect perceptual information of landscape values of landscapes and landscape elements chosen by individual participants. It was important to understand how people described what they saw and the relation between the actual photo and the participant’s interpretation of the photo. Another significant point of this method is whether people rely on the factual information or content to interpret what they see or upon their feelings, thoughts and stories.

The participants were asked to take a picture of what they value most in the landscape. It could be a view of the mountains, or a tool used in the past for agriculture practice. There is no prerequisite for this method except the equipment when implementing the method. This method was planned to be completed after the photo survey if the interviewee was willing to participate. A photo camera and voice recorder were essential equipment for this method.

3.1.6 Mapping

The mapping method collects factual and perceptual information about the spatial organization of physical and social landscape elements, land-use, and social activities that had taken place in the past and present landscapes of Findikli. This method was used to reveal landscape change visually. Also, this method was important as there were not any records in Findikli that show such physical landscapes and spaces as historic and present village settlement patterns, dwelling units, trails and motor vehicle roads that connected districts.

Mapping was designed in two parts. The first part was for individuals who participated in oral history interview study. Participants were asked to draw both their childhood neighborhood and their current neighborhood as cognitive maps. They were asked to write the activities that had taken place on the maps, as well. The second part was designed as a community meeting activity. Participants were asked to gather around an aerial photo of Findikli as a map and to point out the location of things and events they remembered from the past, identify current landscape elements and present activities. Individual mapping activities were intended to be conducted after the photo-voice recording activity. Community mapping was designed to take place during the second community meeting.

A high-quality aerial photo is required for the mapping method. These were obtained from authorized agencies during the first site visit. Equipment for the mapping activity included drawing papers, color pencils, and post-it notes. Also, a voice recorder was an essential tool to record what all participants said.
3.2 Phase 2: Data collection

Data collection in phase two required developing plans to recruit participants for the community participation methods, to implement the various research methods on-site in different group sizes, and anticipate limitations and opportunities that could occur. Data collection was conducted in two site visits. Archival document collection, field visits, and field observations were conducted as a groundwork study during the first site visit, while additional field observations and community-based methods were conducted during the second site visit.

During the first site visit, a groundwork study was conducted to initiate the data collection process. Data was collected in four areas: archival document collection, site visits, field observation, and community-based methods.

Community-based methods and field observations were conducted concurrently during the second site visit. We met and reconnected with people to participate in the community-based research methods. Reconnection with the community members, referred to earlier as discussion, occurred in coffee houses allowing the researchers to generate interest in the study. Community-based methods were designed to be conducted in a certain sequence. The survey method was conducted first to recruit participants for the oral history interviews as well as to learn the general distribution of the community. Oral history interviews were the second method conducted to reveal deeper perceptions of landscape change. These were followed by the photo survey method which illustrate newly shared memories with the photographic examples of physical and social landscape elements. Photo-voice recording was conducted later if there were a missing landscape element in the photo album compilations. Cognitive mapping activities were designed to extract individuals’ perceptions of the spatial organization of social activities in the landscape that were not explained by words or illustrated by pictures. Group mapping was designed for the same purpose as the individual cognitive mapping but from the community’s perception.

3.2.1 Recruitment of participants

Community-based methods required researchers to create and build upon personal connections with community members. We visited the site to gain access to community members, build trust while meeting individuals and groups. Site visits also allow gathering archival information about the study area.

The first site visit was for creating a network in the community by gaining trust and access to them; introducing the study to the community; and conducting archival research by visiting governmental and authorized agencies in local, regional and national level. The second site visit was for generating more interest within the community network; obtaining access to and recruiting a diverse range of participants; and conducting methods.

Relationships were established with members of Findikli Associations, grass-root initiative groups, and headmen of Findikli settlements by visiting them in their places. The documentation study was introduced to members of Findikli Association in community meetings. Researchers attended their events to develop trust with members of the association. Also, we visited governmental agencies to search their archives for old maps, pictures, books, and poems about Findikli.

During the second site visit, we reconnected with people contacted in the first site visit. We visited coffee houses where people usually meet. We had spontaneous discussions about Findikli’s physical and social landscape change. We introduced the documentation study in these small gatherings, as well. By by stating our plan to gather community members to talk about the study and handing out the survey questionnaires. We visited the Findikli Headmen Association to meet each headman of the village and we invited them to the community meeting. The date, time and place for the community meeting was announced on flyers hung at several community meeting points. Also, people heard about the meeting by word of mouth (see figure 4). There was a snowball effect in the Findikli community to recruit participants for the survey. The survey questionnaires were handed out at the meetings and collected a week later. Participants could indicate their willingness to participate in an oral history interview. Willing participants were contacted and meetings scheduled in a place of their choice. All participants chose their family farmstead in their village. Oral history interviews were followed by photo survey, photo-voice recording and individual cognitive mapping with willing participants. Some participants did all methods, some of them did only photo survey, some of them photo survey and photo voice recording. Sample size for all methods were not the same but all methods were conducted.
Figure 4. A flow chart for recruitment of participants and methods. Process of conducting methods was divided into 3 phases. Phase 1 is preparing to meet community, Phase 2 is data collection, and Phase 3 data analysis. Lighter grey refers recruitment participants, darker grey refers methods and white refers researcher preparations. Diagram by the authors.
Some survey participants provided names for the researcher to contact for additional interviews on landscape change and local cultural heritage. Eight participants were recruited via snowballing. The researcher conducted the survey in person with these eight participants during the interview process. Consequently, seventy survey questionnaires were collected at the end of the data collection process (see Figure 5).

### 3.2.2 Implementation methods

All methods except community mapping were designed to be conducted individually. However, ‘on-site experiences necessitated redesigning the sample size for each method. Three group sizes were used during the study:

- **Individual**: participants became a part in the study individually.
- **Small Groups of 2 or 3 participants**: these participants were not recruited intentionally. Some visitors wanted to be part of the study when we were conducting the method individually. They participated in the study voluntarily, spontaneously and signed consent forms.
- **Large Groups of 4 to 8 participants**: participants were recruited by snowball effect. Key people came together for the study. Group mapping participants were recruited via the village headman.

**Discussions** were conducted in small and large groups. This method took place spontaneously in community gathering places with a wide range of residents in Findikli. People were free to join or leave at any time during the discussion session. Discussions were life-based conversations between the researchers and the community. Participants willing shared their memories, experiences and stories about Findikli’s past and present landscapes. Small group discussions went longer than large group discussions as there were less distractions such as frequent change in number of participants. It was also easier to follow the discussions in the smaller groups due to the lower number of participants.

**Surveys** were conducted individually. The 70 participants represented each settlement of Findikli. However, the survey method process took place slightly differently than how it was planned. Survey questionnaires were handed out in the beginning of the meeting but participants requested to turn them in later in the week as the questionnaire was very long. Therefore, a convenient collection point was ...
determined immediately. Survey questionnaires were supposed to be filled out by the participants on their own. However, we noticed that some of the participants left some questions blank. Therefore, we decided to conduct subsequent surveys in person with oral history interviewees to have a chance to make the questions clearer. By doing so, we could gather more information as we explained the questions participants did not understand. We only had a chance to review survey questions again with the participants who were willing to participate in the interviews rather than all participants due to time limitation.

*Oral History Interviews* were conducted in all group sizes. Individual interview participants were recruited via community meetings held for the survey method. Interested people included contact information at the end of the questionnaire. However, since some interviewees wanted to be interviewed in their place, family members or neighbors spontaneously engaged in this activity as well.

*Photo Surveys* were conducted individually and in small groups. Oral history interviews were followed by photo surveys to visually trigger participants’ memories. Initially photo surveys were conducted in the same size groups as the oral history interviews. However, it was hard for all participants to see photos at the same time in the large group size. Also, it was hard for the researchers to collect responses for each photo. Thereafter, photo surveys were conducted individually and in small groups.

*Photo-voice recordings* were conducted only individually. Participants were recruited in the meeting for individual oral history interviews. After the finishing the photo surveys some individuals wanted to participate in the activity. Only 4 interviewees were eager to participate due to such limitations as time, unexpected visitors, and old age restrictions.

*Mapping* was conducted individually and in large groups. The meetings were in a different setting for each group size. Individual cognitive mapping was completed with interviewees who were able to draw spatial relationships. 9 interviewees participated. Participants for the group mappings were recruited via the headman of a settlement with the largest number of participants. The group mapping was designed to engage all interviewees in the activity of mapping on the aerial photo of all settlements of Findikli. However, we noticed when conducting the methods, participants only knew their village’s past landscapes.

### 4 FINDINGS: EFFECTIVENESS OF METHODS

After completing analysis of the data collected, the effectiveness of the community based research methods was evaluated in terms of quality and quantity of data collected, limitations and opportunities of implementation methods and the combination of methods.

#### 4.1 Evaluation of data collection

The study demonstrates the types of information collected using each method and the quality of information gathered. The information includes factual and perceptual information. Factual information is observable and measurable data whereas perceptual data reflects participants’ point of views. Both factual and perceptual data were subcategorized as either quantitative or qualitative data (see Table 2). Table 2 presents a guide for the researchers to determine which methods were found to be more appropriate to collect specific information. For example, the oral history interviews provided quantitative and qualitative land use information; however, quantitative-perceptual information of spatial organization was not derived from oral history interview method.

#### 4.2 Limitations and opportunities of methods and group sizes

Limitations and opportunities related to the implementation of the community based research methods are described below.

- **The effort to prepare questions** includes required time and effort as well as groundwork process before conducting methods.
- **Flexibility is required to work with participants** setting dates, times and locations of meetings for each method and provide accessibility to participants.
- **The researcher needs flexibility in each method** to ask additional questions to get more detailed information.
- **Credible participants** with local knowledge are needed; they are more aware of the area and changes; older residents had more experience in Findikli.
- **Group Size Dynamics** include individual and interpersonal dynamics as well as their interactions with the researcher. Participants’ behaviors and reactions to the questions vary with group size.
Table 2: Detailed classification of information types.

<table>
<thead>
<tr>
<th>METHODS</th>
<th>FACTUAL INFORMATION</th>
<th>PERCEPTUAL INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantitative</td>
<td>Qualitative</td>
</tr>
<tr>
<td>DISCUSSION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical and Social Landscape Change (only in large group)</td>
<td>Land-Use</td>
<td>Physical and Social Landscape Change (only in small group)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SURVEY</td>
<td>Demographics</td>
<td>Land-Use</td>
</tr>
<tr>
<td></td>
<td>Land-Use</td>
<td>Physical and Social Landscape Elements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical and Social Landscape Change</td>
</tr>
<tr>
<td>ORAL HISTORY INTERVIEW</td>
<td>Demographics</td>
<td>Spatial Organization</td>
</tr>
<tr>
<td></td>
<td>Spatial Organization</td>
<td>Land-Use</td>
</tr>
<tr>
<td></td>
<td>Land-Use</td>
<td>Physical and Social Landscape Elements</td>
</tr>
<tr>
<td></td>
<td>Physical and Social Landscape Elements</td>
<td>Physical and Social Landscape Change</td>
</tr>
<tr>
<td>PHOTOSURVEY</td>
<td>Spatial Organization</td>
<td>Demographics</td>
</tr>
<tr>
<td></td>
<td>Land-Use</td>
<td>Land-Use</td>
</tr>
<tr>
<td></td>
<td>(only individual)</td>
<td>Physical and Social Landscape Elements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical and Social Landscape Change</td>
</tr>
<tr>
<td>PHOTO-VOICE RECORDING</td>
<td>Spatial Organization</td>
<td>Physical and Social Landscape Elements</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical and Social Landscape Change</td>
</tr>
<tr>
<td>MAPPING</td>
<td>Spatial Organization</td>
<td>Demographics</td>
</tr>
<tr>
<td></td>
<td>Physical and Social Landscape Elements</td>
<td>Physical and Social Landscape Elements</td>
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<tr>
<td></td>
<td>Physical and Social Landscape Change</td>
<td>Physical and Social Landscape Elements (only in large group)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Physical and Social Landscape Elements (only in large group)</td>
</tr>
</tbody>
</table>
Activities are needed to enhance participants' abilities to remember past experiences, memories, stories and physical landscape.

Language Barriers can include language as well as specialized terms. Participants can switch to their native language creating an understanding barrier for the researcher.

The implementation duration varies for each method and group size.

It takes additional effort to record, transcribe and analyze collected data.

Richness of Content includes gathered type of information, quantity and quality of information, quantitative or qualitative data. If the method covers all it has a rich content.

We defined parameters in different phases for comparison of the effectiveness of the community-based methods implementation. In the preparation phase the parameter was the effort to prepare survey questions. During the data collection phase the parameters included: flexibility to work with participants, flexibility to conduct the method, credible participants, group size dynamics, ability to recall past, language barrier and duration. In the data analysis phase, the effort to record and transcribe and richness of content were the parameters (see Table 3).

Table 3 Ease of use of each method compared to group size.

<table>
<thead>
<tr>
<th>Phases</th>
<th>Parameters</th>
<th>METHODS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Discussion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SG</td>
</tr>
<tr>
<td>PREPARATION</td>
<td>Effort to prepare questions</td>
<td></td>
</tr>
<tr>
<td>DATA COLLECTION</td>
<td>Flexibility to work with participants</td>
<td></td>
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<tr>
<td></td>
<td>Flexibility to conduct the method</td>
<td></td>
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<td></td>
<td>Credible participants</td>
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<td></td>
<td>Group Size Dynamics</td>
<td></td>
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<tr>
<td></td>
<td>Ability to recall past</td>
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<tr>
<td></td>
<td>Language Barrier</td>
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</tr>
<tr>
<td></td>
<td>Duration of Method</td>
<td></td>
</tr>
<tr>
<td>DATA ANALYSIS</td>
<td>Effort to record and transcribe</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Richness of Content</td>
<td></td>
</tr>
</tbody>
</table>

Table 3 shows the comparison of each methods in difficulty level of parameters. The difficulty level varies between methods and group sizes. The colors represent the difficulty level from lowest (green) to highest (red). Blank cells are non-applicable for the related parameters. Based on the table, we interpreted that even though there were practical difficulties during the data collection, rich content of information was collected. For example, the survey had a very high difficulty level in preparation phase and high difficulty level in data collection phase but we gathered information with rich content. On the other hand, the discussion method did not have a preparation phase and data collection phase was usually of low difficulty in both group sizes. But the data collected did not have richness of content. Oral history interview had low difficulty averages in first two phases. The effort to record and transcribe was the most challenging part, not a surprise in our experience, but this challenge did not prevent rich content collection.
In specific parameters, we found that smaller group discussion required less duration than large groups. Participants were more focused on the discussion in a small group. In survey method, the duration was expected to be complete during the community meeting. However, elderly participants needed eyeglasses to fill out survey questionnaires so they needed additional time and a later collection date. Group size dynamics in each method were more challenging in small and large groups compared to individual interactions.

Evaluation of the methods showed that using a combination of the community-based methods: discussion, survey, oral history interview, photo survey, photo-voice recording and mapping- has the power to produce effectiveness in documenting cultural landscapes. The limitations for a particular method can be offset by another method. For instance, researchers need to be prepared to spend more time and effort in preparing questions for the survey unlike a less structured oral history interview. Table 4 shows that even though a method has practical difficulties during data collection, rich content can be collected. Surveys have a very high difficulty level during the preparation phase and data collection but data analysis is in low difficulty level. On the other hand, discussions do not have a significant preparation phase and data collection phase goes usually in low difficulty level in both group sizes. It also results in a low richness of content.

5 CONCLUSION

We aimed to evaluate the effectiveness of community participation methods in documenting cultural landscape elements, and to provide guidance for developing and implementing community-based methods in cultural landscape studies. We implemented six community-based methods including discussion, survey, oral history interview, photo survey, photo-voice recording, and mapping to document physical and social landscape elements and perceptions of change in a geographic district. All methods were used in different group sizes - individual, small group, and large group. Findikli, the district of Rize province in Turkey, was selected as a case study area since it has been experiencing cultural and natural heritage loss due to rapid landscape change.

The combination of methods provided more factual and perceptual information, in content and in quantity as there was a cross relationship between methods. The sequence of method implementation created a snowball effect for recruitment of participants. Interaction between methods, as well as quality of information. For example, discussions initiated participation in the survey. Oral history interviews provided more details survey questions. Surveys provided demographics of participants. Mapping activities and photo surveys illustrated information raised during the interviews and surveys. Photo-voice recordings provided additional photos to document and illustrate what was drawn during cognitive mappings.

Using the combination of methods provides high quality and quantity of information; more diversity in types of information. Sequencing each method from one to another supports and verifies information derived from different methods. By doing so, researchers collect more saturated data. This critique presents the benefits of using a set of methods. However, when the research is time or effort limited, researchers can use this evaluation to determine what method is more appropriate to collect an information in rich of content and how they conduct methods to obtain more information in high quality and quantity. For example, in our experience most of the data were collected by survey, oral history interview, photo survey and mapping and they complemented each other when we had a time limitation especially.

6 REFERENCES


COMPARING DRAFTING SYSTEMS AGAINST THEIR IMPACT ON EFFICIENCY AND EFFECTIVENESS IN THE CREATIVE DESIGN PROCESS

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1 ABSTRACT
BIM software is only a partial solution for landscape architects. Compared with drafting in a landscape architecture specific BIM software, or BIM(L), the design process employed by landscape architects who solely use BIM software is not as efficient nor as effective, and can hinder BIM ideals. Tools specific to landscape architectural design are requirements in making a CAD-based workflow compatible with a creative landscape design process. The purpose of this study is to gain insight on the effectiveness of common workflows in the field. This paper argues that BIM alone is not much better than CAD alone when compared in terms of efficiency, training time, team coordination, and quality of output and creative design, but that BIM(L) is best for all these factors. The “design process” is defined as “Analysis - Concept - Public Outreach - Construction Drawings - Construction Management” and is used as the basis to compare four basic drafting systems: hand drafting with and without technology, CAD, BIM, and BIM(L). Past research is reviewed, along with a survey of the landscape architecture community’s used workflows and their perceived values of each drafting system. The results find that a majority of Landscape Architects are not using BIM(L) methods, and believe they are not required in projects, but most responses think it’s the most efficient option. The conclusions find that there are advantages for BIM(L) workflow after the concept phase, but that there is a reluctance to adopt the most efficient and effective workflow due to perceived barriers of cost and training.

1.1 Keywords
BIM(L), Computer Aided Drafting, Creative Design Process, Efficiency, Professional Tools
INTRODUCING THE STATE OF LANDSCAPE ARCHITECTURE AND BIM

Since its advent in the 1970s and popularization in the 1980s, computer-aided design (CAD) has gained acceptance as the standard to overtake hand drafting. More recently, CAD systems have evolved into building information modeling (BIM) systems. While BIM in fact encompasses a process rather than a particular technology, software is still the prevailing means of achieving this process (The Landscape Institute [TLI], 2016). However, working with software labeled “BIM” is only a partial solution for landscape architects to achieve the goals of the BIM’s process.

This paper does not seek to validate BIM as an effective process. Rather, the intention is to define and evaluate the type of BIM toolset that is effective for landscape architects, as well as the type of BIM toolset that is not, from within the current range of available toolset options. The future ideal BIM, defined by TLI (2016) as “BIM Level 3” [BIMv3] where all design disciplines work within an environment with fully automated connectivity, does not yet exist. Complex site projects can require a full suite of professionals including landscape architects, as well as “architects; civil, structural, mechanical, electrical, plumbing, heating, ventilating, and air conditioning engineers; interior designers; ... and others whose services have ... traditionally been considered "professional" activities, require licensing or registration by the state, or otherwise require the knowledge and application of design principles appropriate to the problem at hand.” (University of Colorado, 1997). Not all professionals in this broad list can use Revit—or any other single available BIM toolset, for that matter—for their work.

We are then left with BIM Level 2 [BIMv2], where several software toolsets are currently available—some better suited to some tasks, professions, or practices than others. Nevertheless, the industry continues to use tools not best suited for the tasks at hand. This practice pulls landscape architects’ focus and efforts of landscape architects away from making creative leaps with the BIMv2 process and overall landscape design, and instead forces them to use their creative energy to work within or manipulate the CAD environment to accomplish otherwise-simple tasks. This “square peg and round hole” situation applies to both simple CAD, and to BIM software designed for non-landscape architectural professionals.

This study focuses on drafting (used synonymously here and throughout with “drawing” or “communicating” for the purposes of method comparison) as a key component used throughout the creative design process. The creative design process is used here as the collection of tasks needed to arrive at the completed and successful design. In professional practice, this can span from the conceptual phase through to construction. In this paper, the “creative design process” is defined as the whole of the following key tasks: “Analysis - Concept - Public Outreach - Construction Drawings - Construction Management”.

This study seeks to compare both efficiency and effectiveness in the creative design process because of a common concern that BIM software can stifle creativity, or effectiveness of the design.

“BIM” has become a much more frequent requirement of professional Landscape Architectural project requirements. A practitioner with the highest available BIM capability (BIMv2) would be seen to be meeting these requirements at a higher capability and so would be more successful at obtaining a project with that requirement. Many professionals still use non-BIM drafting systems, so these will be compared against BIMv2.

This task of communicating via documents and tools is a prominent need in both the “Design and Construction”, and “Handover and Aftercare” processes within any given BIMv2 project. Comparisons are needed for all methods currently available to and actively used by landscape architects today to determine an ideal toolset workflow for achieving BIMv2 principles.

2.1 Drafting systems and BIM

A “drafting system”, as used within this paper, is a method used to communicate the design intent. It can be software such as a CAD system, or a manual technique such as hand drafting or model building. BIMv2 involves much more than the use of one method or system to achieve its goals. Rather, it compromises a process of beginning a landscape design with the end in mind and incorporating the maintenance aspect early. However, software is still a significant means for achieving BIMv2. Descriptions of software that are BIMv2-compliant include their ability to traverse 2D and 3D, along with the inclusion of data specific to the objects within the overall model (TLS, 2016). The benefits of using BIMv2 tools culminates in peak efficiency for the design process and the resulting design, ultimately keeping design costs low (World Landscape Architecture, 2017).

BIMv2 research has already focused heavily on the architectural process, where analyses have explored how the design process changes between CAD and BIM for architecture [BIM(A)]. Simply
introducing a new tool for BIM(A) has been shown to change the design process itself. The visual feedback systems of a BIM(A) software alert designers immediately to how their designs are behaving, which in turn helps them develop new strategies quickly. (Salman, Laing & Conniff, 2014).

A BIMv2 process requires an understanding of the other design team members’ needs in the support of their work. Arguably, this understanding should extend to the team’s comprehension of what a landscape architect needs in order to meet the standards of a BIMv2 process. While BIMv2 is more than a technology, requirements for information inclusion mean that technology is the primary means of communicating a design’s intent (Poirer, Forgues & Staub-French, 2017).

BIM as a process has been defined thus far into levels 0 through 4, BIM level 0 [BIMv0] being simple line drawings (CAD, hand drafting), BIM level 1 [BIMv1] being segmented 2D and 3D information within the same discipline, BIMv2 being some connectivity between 2D and 3D with industry-specific tools and connected data, and BIMv3 being a fully integrated system where all data for the life of the project is connected for real-time sharing (TLI, 2016). As previously noted, the available tools are at BIMv2. Benefits of BIMv2 include identifying and removing clashes before the costly construction phase. In reality, not every team member will be able to work in a single software, and effort needs to be taken to coordinate compatible file formats (Green, 2017). Consequently, it’s necessary to compare the benefits of clash-detection vs. error checking and automation within a single discipline among the available software for landscape architects.

BIMv2 can be a strong system to help guide and shape an ideal design process, but in the industry today too much emphasis is put on BIM as a single-software solution and landscape architects who try to achieve BIMv2 end up using an architect’s software – BIM(A). This paper intends to explore these systems and their current impact on landscape architects.

Since it’s common for Landscape Architects to use different drafting systems for different tasks throughout the creative design process, this research intends to explore what is used for and what is most efficient and effective for each task, Analysis - Concept - Public Outreach - Construction Drawings - Construction Management.

3 METHODOLOGY FOR COMPARING DRAFTING/COMMUNICATION SYSTEMS

3.1 Research on Drafting Systems, BIM, and the Landscape Architectural Design Process

Since the 1980s, the design industry has looked increasingly to CAD tools as a means to achieving greater results in the design process. As CAD has evolved into BIM, so have the expectations from CAD to BIM. CAD adoption since 2000 has grown steadily as the primary toolset used by landscape architects.

The concurrent globalization of information and communication has made more data readily available over the Web, and that information has steadily been assimilated into BIMv2 technologies. Complex toolsets like Revit are a prime example of the power this data can hold. An architect using Revit has access to a vast database of materials and manufacturer testing parameters. The success of BIM(A) tools and BIM for Engineering has propelled BIMv2 processes into the spotlight of the public and politics. In reality, BIMv2 requirements and expectations are outstripping its actual ability.

In particular, BIMv2 for landscape architects is in a precarious position. The expectations for BIM are for it to be level 3, where all drawings and information are fully automated and reported in real time on a Web-based platform. Some BIMv2 project contract requirements have incorporated these expectations, forcing landscape architects to work in a platform meant for architecture, such as Revit. While it is possible for a landscape architect to use a tool designed for an architect, the entire process becomes “clunky” outside of the building. Architecture is primarily rectilinear, while landscape architecture is much more organic (Barth, 2016). Topography is a struggle, and while the “wall” tool is suggested for curbs in the available site add-on tools for Revit, even guides for this tool show that an L-shaped curb island is not possible with the wall tool (Autodesk Help, 2017).

There are several design methods that are commonplace in the field of landscape architecture today. They fall broadly within the categories of hand drafting with and without technology, CAD (2D or 3D), BIM(A) (used in this paper more broadly to represent any non-landscape-architecture BIMv2 toolset), and BIM(L). The following paragraphs will define these terms for the purposes of the research in Section 3. A further explanation of the reasoning behind the BIM(L) and BIM(A) terms is explored in section 4.2.
Hand drafting with and without technology is a highly respected and widely used method among landscape architects. Improvements in technology have allowed hand drafting to migrate from pen and paper to stylus, tablet and mouse. Hand drafting or drawing remains an important tool in the BIM v2 kit, because with the integration of some technology, hand drafting or drawing can be easily integrated with other communication and drafting methods.

CAD is designated as a simple drafting method at the BIMv0 or BIMv1 level. Lines are just lines and although those practicing exclusively CAD methods might use both 2D and 3D, those drawings would not be linked in any way to each other. CAD can graphically show much of the same end result as BIM(A) or BIM(L) methods, but does not allow for any error checking, clash detection or automated processes. CAD can be customized and linked with small-scale macro processes that start to trend toward BIMv2 capability. The transition from CAD to BIM(A) to BIM(L) is a sliding scale, as opposed to a hard line.

BIM(A) and BIM(L) toolsets are fundamentally the same from a BIM standpoint—both are BIMv2 methods. A BIM(L) technology would provide tools designed specifically for common landscape architecture tasks. Conversely, BIM(A) technology as defined for this paper is a toolset that landscape architects may use but is developed for another allied design profession. For BIM(L), capabilities can include and already-established means to identify plant species within the data tied to the technology, or tools to assign data based on manufacturers that a landscape architect would specify. BIM(L) tools might cover organic grading, landscape details, or pedestrian circulation, as opposed to a BIM(A) tool platform, where landscape architect may be able to manipulate a toolset meant for another profession’s purposes. Again, the line here is grey, but it is typically simple to identify which side of the line on which a software falls in the BIM(A) to BIM(L) spectrum. While this paper will not cover comparing various BIM(L) technology, BIM(L) is usually an add-on or additional toolset pack to plug into another BIM(A) or CAD software. In this paper, using that base BIM(A) software alone is considered BIM(A), and it would not be considered BIM(L) without the plug-in or add-on tools for landscape architects.

Landscape architecture can be a varied and specialized profession. Professionals and even educational programs can focus on wildly different types of projects, from regional planning to small artistic installations to ecological restoration (Gazvoda, D. 2002). The life of a project is commonly laid out broadly in five major processes: inventory and analysis, concept development, public engagement, construction documentation, and construction management. These are the process terms that will serve as the focus of comparison in this paper.

3.2 The Trends and Popular Opinion in the Industry

An open survey was created to gather data on tools used in landscape architecture today, as well as how these tools are used throughout the creative design process. The survey was created and hosted with Google forms tools and distributed through social media on LinkedIn, Twitter, Facebook, and on the subreddit /LandscapeArchitecture. The survey was closed February 2018 (Google Forms Document, 2018). Most respondents were obtained after the subreddit post was added, as this proved to be a more effective method of reaching interested Landscape Architects.

Questions were mostly mandatory multiple choice with some optional long-form answers to allow the respondents to clarify answers, summarize thoughts, and give feedback. Questions to establish demographics included professional designation; years of experience; work in academic, private, and/or public sectors; age; gender; and continent.

The first set of questions established the actual tools, techniques, methods, and software used by respondents. An extensive list was supplied with an open “other” option. Next, respondents were asked how much time they spend on specific common tasks. They were then asked which techniques they use to accomplish those tasks, ranging from hand drafting unaided by technology, to BIMv2 enabled software, differentiating between software with and without tools specific to landscape architecture. Examples of software that fit each category were provided to give clarity to the category. Finally respondents were asked questions of self-reflection on their own workflow and on workflows available to landscape architects. They were then asked how they perceive the impact of different processes on the profession, efficiency, and the creative design process. Responses were anonymous.

The questions were simplified to refer to CAD processes with and without landscape-specific tools. For the purposes of discussion, we’ll call these CAD and BIM(A) vs. BIM(L).
4 FINDINGS

4.1 Results of the Survey

A total of 30 responses were collected and compared (Google Sheet Document, 2018). Most respondents described themselves as active landscape architects, interns, technologists or designers. Six respondents clarified themselves as students or educators. There was an even distribution of experience, ranging from 0 to 20 years of experience, with most respondents being 30 to 39 years of age. Most respondents resided in North America, with Asia, Australia represented by 10%. Responses came from private, academic, and public sectors, with many respondents reporting experience in more than one sector.

Notably, only 90% of respondents reported that they use hand drafting, in comparison with the number of those using Autodesk and SketchUp (93% to 87%). Yet 100% of respondents reported using Photoshop and the Adobe Suite, suggesting a shift to hand drawing with technology instead of paper. Rhino was used by 27% of respondents, and 17% reported using various photorealistic rendering software. Some respondents may use more than one. Landscape-architecture-specific tools were used by 7, but only 4 of those respondents listed that tool as being among their top-3 used tools. GIS tools were used by 13, and Revit was used by 6. The responses to the individual tools used are summarized into the following overall methods and displayed in Figure 1: hand drafting with and without technology, CAD, BIM(A), and BIM(L). This figure is included as an overall look at the drafting systems being compared.

![Breakdown of Respondents Using Each Method](image)

**Figure 1. Breakdown of Respondents Using Each Method (2018).** Diagram by the author

The comparison of use of each method throughout the design process is summarized in Figure 2. This figure breaks down “Hand Drafting with and without technology” into more specific methods since there were a significant number of respondents using these in the Inventory and Analysis phases. Technology was used much more toward the end of a project, with 73% preferring to use hand drafting or other sketching means. This trend does not switch until the public engagement phase into the majority using non-sketching means, where presentation graphics come into the design process.
When asked to self-reflect on their workflow for the landscape design process, 70% said they don’t think or don’t know whether it’s the most efficient available. On the question of why they haven’t achieved their ideal workflow, the highest response at 50% was that respondents felt they did not have enough time to research or learn new methods or software, equaling the 3 other concerns of software cost, simple inexperience, and the fact that the technology doesn’t exist yet combined at 15%, 20% and 15% respectively.

When asked which method is best for an efficient landscape design process, 47% responded as BIM(L), 30% responded CAD/BIM(A), and 23% said hand drafting (almost all involving technology to embellish). However, 43% also said that BIM(L) is the most difficult method to learn/train. Only 13% said that BIM(L) is best to collaborate with other disciplines, with most preferring CAD/BIM(A) at 53%.

CAD and BIM(A) methods are seen to impede the creative design process more than BIM(L). When asked which process is best to communicate creative design intent, 66% of respondents reported that hand drafting is best, with most of those respondents asserting that embellishing with software is even better than hand alone.

Respondents were asked whether hand drafting, CAD/BIM(A), and BIM(L) are required for the landscape design process. A majority believed CAD/BIM(A) to be required, but notably there were more unsure responses to BIM(L), indicating that this is more of an unknown subject in the profession. By this point in the survey, more respondents were starting to suggest that hand drafting is not required at all in the landscape design process, although as indicated at the beginning of the survey, many of those respondents still use it anyway.

Respondents were asked whether landscape architecture and design students are learning the right methods/software to enter the profession. The answers were nearly evenly split between yes, no, and unsure, and the question generated the greatest number of long-form answers to clarify. Strong opinions were given on whether students learn the right tools, and whether that even matters. Many said they themselves had not learned enough technology in school, citing how different firms use such different tools. As stipulated in a notable (anonymous) comment, “Students have the time to explore new and novel methods that aren’t constrained by hourly billing and profit margins. The issue is whether firms students end
up working for are stifling this creativity and workflow innovation.” This brings to bear the question: What can firms do that simultaneously respects the profit margins that allow them to work, and permit effective creativity, in order to ultimately give value to the landscape design process while moving forward with new BIMv2 design requirements?

4.2 Discussion

BIMv2, as a method of delivering a project, is growing into a requirement for the field of landscape architecture. Much research has proposed the merits of a BIMv2 workflow, but also on the pitfalls of landscape architects having to use tools that were not designed for them. Based on the results of this survey, the majority of landscape architects are not fully embracing BIMv2 tools, and far fewer are venturing into BIM(L) options using tools specifically designed for the profession of landscape architecture. This data suggests that the pressure on landscape architects to use BIMv2 is also pushing them into using BIM(A) tools that are not necessarily designed for them.

According to the responses, the primary barrier to landscape architects increasing efficiency and effectiveness in the creative design process is time. This could entail time to research new methods, or time to learn new methods. Many reported that technology impedes the creative design intent, but notably 5 of 7 BIM(L) users felt BIM(L) did not impede creative design. Most respondents pointed to BIM(A) and CAD-only methods instead as the greatest obstructions to effective communication, which suggests that many respondents who deemed BIM(L) as impeding effective creativity had not actually used that technology, and may have been fearing the unknown.

By contrast, BIM(L) was perceived as the most efficient method for the entire landscape design process above BIM(A) and CAD. This perception brings to light another common concern about becoming more efficient: upfront cost. If those not using the technology fear it to impede creativity, they may see that upfront cost as not worth the efficiency boost. With this comparison of perceptions, the aversions to BIM, and above that BIM(L), are largely unfounded.

The following ideas suggest a few means through which to break down the barriers to a BIM(L) workflow. First, it needs to be established that the use of common software is not a requirement for an efficient creative design process. Landscape architects are told that common software is needed but is not a requirement for all other professions. Ideal BIMv2 workflows have means of error checking, which, for landscape architectural designs, BIM(L) toolsets have but BIM(A) toolsets lack. This fact needs to be communicated effectively to other allied professionals. “SIM” and “LIM” have been put forth as possible acronyms, but any allied professional coming across either term would not understand them immediately, and thus the terms are not commonplace except among landscape architects. Creating a means of identifying all BIMv2 tools by the profession for which those tools are created would help allied professionals accept BIM(L) software within their BIMv2 workflow.

True BIM can only be defined as BIMv3. At the current technology stage of BIMv2, the available tools are segmented into disciplines. It does not make sense for the industry to continue to pretend that BIMv3 is currently possible, and consequently, force tools to be used in ways they aren’t meant to be used—especially when there are tools available that accomplish landscape architecture tasks more easily. For landscape architects especially, manipulating tools meant for other disciplines to fit their needs only gives a benefit of easier collaboration with the architect—at the cost of effectively communicating the design intent and efficiency of work.

This segmentation needs to be recognized and acknowledged within the labels bestowed upon available tools. If software contains tools that accomplish primary tasks for a discipline, this fact needs to be acknowledged in its BIMv2 designation, as no currently available software can truly claim to contain tools specific to every design discipline. The commonly known and used drawing identifiers (A for Architectural, C for Civil, E for Electrical, I for Interiors, IR for Irrigation, L for Landscape, M for Mechanical, etc.) are ideal for this task. Software containing BIMv2 tools for landscape architects would be designated BIM(L). Architectural would be BIM(A), Civil would be BIM(C), and Electrical BIM(E). Each discipline’s professional body itself could set parameters for the requirements needed to attain a BIMv2 designation for that discipline’s core needs. This defined designation of BIMv2 would not only help landscape architects easily find out which software meets a contract’s BIMv2 standards, but also help guide the software industry closer to BIMv3 status as various applications gain multiple BIMv2 designations, such as a BIM(A)(L) software or a BIM(C)(L) software. This method, even if only adopted initially by landscape architects, would be simple for allied professionals to understand, accept, and eventually adopt.
4.3 Conclusions and Further Research

The landscape architecture field is reluctant to adopt a BIMv2 workflow. This hesitance stems from an aversion to the available tools for achieving BIMv2. Most landscape architects surveyed were only adopting BIMv1 tools at best, with many opting for BIMv0. While users of BIM(L) tools reported that the tools facilitated collaboration, didn’t impede creativity and were efficient, many more respondents adopted BIM(A) or CAD tools instead.

Further research is necessary to qualify the perceived efficiencies and effectiveness from the survey responses. The survey did attempt to offer a means to qualify or contrast the responses given by tying actual time spent on specific tasks to the process used. The responses received on time spent were of questionable accuracy and could not be compared, however, since many respondents do not work on the entire design process throughout the life of a project. Also, those using BIM(A) and BIM(L) tools tended to report much longer lengths of time spent on each design process (example: construction drawings), likely because they are able to take on more complex, larger projects. A more effective comparison for efficiency might be a case study analysis for two projects of similar scope by a single firm before and after transitioning between CAD and BIM(A) or BIM(L). A better comparison for tools that allow for creativity might be a study of award-winning designs compared with the tools and methods used to create them.

5 REFERENCES


METHODOLOGICAL REVIEW OF SUSTAINABLE LANDSCAPE EDUCATION RESEARCH

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1       ABSTRACT
The purpose of this study is to explore research possibilities with corresponding research methods for the future sustainable landscape education. Sustainable landscape education is an indispensable part of education working towards sustainability. However, we found limited numbers of current studies exploring sustainable landscape education. Thus, potential research elements of sustainable landscape education were summarized in the paper to help the researchers to organize their research ideas. And a methodological review is needed to help the researchers see the successes and weaknesses of the existing studies, and choose the suitable research methodology and approaches for their topics. A methodological review was carried out in the paper on the open access publications since 2000 that focused on sustainable landscape education and the relevant areas, such as Education for Sustainability, sustainable design education, and general design education. The reviewed materials were divided into two broad categories including theoretical research and empirical research, which further divided into three subcategories of qualitative research, quantitative research, and mixed method research. Several significant findings were presented as follows. To focus on the development of a new course, project, workshop or curriculum based on sustainable theories, the researchers can choose either theoretical research method or empirical research method, including the qualitative method or mixed methods. To focus on fundamental research about sustainable landscape education, the researchers can utilize either the quantitative method or mixed methods. Conducting fundamental studies on sustainable landscape education and using a fully integrated mixed-method study are the most challengeable and urgent.

1.1       Keywords
Sustainable Landscape Education, Research Methods, Methodological Review
INTRODUCTION
Sustainability and sustainable development have become a global concern in the recent years. On the one hand, the growing and changing nature of landscapes decide that landscape architecture is the possible medium of sustainability and resilience, which brings the increasing attention to sustainable landscape practice and education. As an essential field contributing to sustainability, landscape architecture needs to lead the changes of sustainable development. On the other hand, achieving sustainability is greatly associated with the leadership of education. As Paul Rowland said, "A sustainable society can only be attained through the combined efforts of all of society. That is why it is so important that higher education institutions take the lead in ensuring that all their graduates - the leaders, the teachers, the professionals, and a significant part of the workforce - have an understand of the challenges we face and the tools and dispositions to address those challenges to create a healthy, just, and sustainable world" (Johnston, 2013, p. x). Sustainable landscape education is an indispensable part of education working towards sustainability.

2.1 Sustainability
Our Common Future, also known as the Brundtland Report, a report describing the outcomes of the United Nations World Commission on Environment and Development put forth the most well-known concept of sustainability (Pearce, Ahn & Hamiglobal, 2018, p. 39). "Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of needs, in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs." (Brundtland & Khalid, 1987, p. 43). Although that sustainability is hard to define in absolute terms, a possible definition will be used as follows for this paper. In general, sustainability means the capacity to be kept in existence or maintained indefinitely, in particular, the capacity to maintain the ability of social systems, economic systems, and environmental systems to support human life and well-being (Portney, 2015, p. 9).

2.2 Education for Sustainability
United Nations (UN) proposed sustainable development as a possible solution to global environmental problems and emphasized that education would benefit its progression (Brundtland, 1987). Education for Sustainability (EFS) is similar to Education for Sustainable Development (ESD), which is currently defined by United Nations Educational, Scientific and Cultural Organization (UNESCO) as follows. "ESD is a learning process (or approach to teaching) based on the ideals and principles that underlie sustainability and is concerned with all levels and types of learning to provide quality education and foster sustainable human development - learning to know, learning to be, learning to live together, learning to do and learning to transform oneself and society" (UNESCO, 2017).

In summary, it is important to carry out high-quality studies covering the field of sustainable landscape education for two reasons. First, sustainable landscape education directly impacts the graduates going into design practice and further influence the progress of sustainable development. Second, sustainable landscape education research can promote the development of sustainable design education and boost the exploration of Education for Sustainability.

To design more appropriate landscape architecture education programs to lead the changes in Education for Sustainability, research possibilities of sustainable landscape education need to be explored to inspire more creative studies and advance our knowledge of the area.

3 SUSTAINABLE LANDSCAPE EDUCATION: RESEARCH POSSIBILITIES
To figure out the studies that can be developed to help design sustainable landscape programs, we need to identify the potential research elements. Through reviewing the studies in the field of sustainable design education, Education for Sustainability, and general design education, we summarized the possible research elements, including potential research content, population, timing, and methods (Table 1).

Potential research content. Inside the landscape architecture programs, sustainable education research can be carried out for the program set up, program vision/mission statement, curriculum, course, workshop, etc. Courses in landscape architecture can be mainly categorized as the design studio, construction/technology, history/theory, and electives. The course type should be taken into account for
landscape education research design. For example, a research design focused on exploring the pedagogy of technology course will be very different from one focused on studio teaching.

Outside the landscape architecture programs, due to the multidisciplinary collaborative characteristic of Education for Sustainability, studies and changes at the university level can be an excellent chance to unite the strengths of different disciplinary. We can consider studies on majors or minors in sustainability, summer program grounded in sustainability, sustainability as the first-year experience, the certificate program in sustainability, etc. (Johnston, 2013, p. 14). Outreaching to local communities for sustainable education at the community level can also inspire interesting research designs. Studies focused on better engaging the landscape architecture programs at an upper level of Education for Sustainability and with broader audiences in local communities will create new changes inside the landscape architecture programs and possibly promote them.

### Table 1. Identification of research elements for sustainable landscape education research.

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<tr>
<td>Inside the program: program set up, mission statement, curriculum, course, workshop, etc.</td>
<td>Teachers Students (undergraduate; graduate) Designers Community members</td>
<td>Before the transition During the transition After the transition</td>
<td>Theoretical research Empirical research</td>
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<tr>
<td>Outside the program: major or minor, summer program, first-year experience activity, certificate program, community education, etc. (Johnston, 2013)</td>
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</table>

Potential research population. The sustainable landscape education research can focus on teachers, students, designers, or community members according to various research content. When choosing the students as the research population, we need to be careful with the research decision on choosing either the undergraduate students or graduate students since their curriculum can be very different. A possible framework to evaluate learning outcomes of the students and community members will include awareness, knowledge, attitudes, skills, and participation (Johnston, 2013, p. 47).

Potential research timing. Promoting the landscape architecture programs means we would like to make changes. The timing of conducting studies to help with the transition can be before, during or after the transition. Before the transition, studies can be undertaken to explore the possible changing directions and instructions. During the transition, studies can be used to watch the process of change and suggest the adjustments. After the transition, studies can be used to evaluate the outcomes and provide new changing instructions.

Potential research methods. From previous research in the related areas, both theoretical research and empirical research has been applied. More details about the specific research methods will be discussed later in this paper.

When we choose and combine the suitable elements, we end up with a new research possibility and design. Summarizing the research elements of sustainable design education is giving us a tool pool to inspire new studies.

### 4 LIMITED CURRENT SUSTAINABLE LANDSCAPE EDUCATION RESEARCH

Theoretically, choosing and combining the suitable research elements we discussed above can lead to new research possibility and design in sustainable landscape education. The more different combination of research elements being found means the more saturated this area is covered by researchers. However, we found limited numbers of current studies exploring the field of sustainable landscape education. The reasons for insufficient sustainable landscape education research may come from three aspects.
First, the difficulties of finding the research gaps lead to the insufficient sustainable landscape education research. Current studies suggested narrow focuses which led to the fragmented research situation. The existing studies mainly focused on developing and testing a new sustainable landscape course, project, or workshop based on different pedagogy and theories. Also, very few fundamental studies were conducted to try to gain a general view of the sustainable design education field. These two situations make it hard for interested researchers to capture the big picture of current research and find the research gaps, which also caused the difficulties in conducting studies in this area.

Second, the difficulties of choosing the research methods and performing solid studies endanger the validity of existing studies and the possibilities of future research. On the one hand, corresponding research methods for different type of research topics have not be developed in the field of sustainable landscape education research. For example, the design studio is a significant kind of the landscape architecture teaching form. The products coming from the design studio can be very diverse and different from regular teaching products in other disciplines. We can see various methods were still in the exploration phase in the previous research to evaluate the sustainable landscape design studio. This is a common methodological difficulty in design education research. On the other hand, it seems like the systematic methodological training of research is missing from the landscape architecture field, which caused some flaws in the existing studies.

Third, some practical obstacles might cause the insufficient research situation. Former research showed several barriers to put Education for Sustainability into action, including lacking funding, lacking the training to assist staff, lacking integration in curriculum across disciplines, etc. (Thomas & Nicita, 2002, p. 485-486). These obstacles might apply to sustainable landscape education practice and research as well. This reason is predicted from past studies in the related areas, but it needs more research to confirm.

To solve the first kind of difficulties, we believe that the summary of the research elements for sustainable landscape education research (Table 1) can help the researchers to organize their research ideas.

However, for the second kind of difficulties, there hasn't been a systematic methodological review on sustainable landscape education research, or even on the Education for Sustainability, sustainable design education research area. This paper will focus on conducting a systematic methodological review on sustainable landscape education research and the related fields. We think a methodological review can help the researchers see the successes and weaknesses of the existing research, and choose the suitable research methodology and approaches for their topics.

To help with the future studies focusing on sustainable landscape education, we raise the research questions as follows. 1) What are the different types of research methods that used to explore sustainable landscape education and the relevant areas? 2) What successes are seen in the existing research with different research methods? 3) What weaknesses are seen as salient in the current research with different research methods? 4) What are the possible research methods for exploring sustainable landscape education in the future?

5  METHODOLOGY

A methodological review was carried out to explore the research questions. Study range included the open access publications since 2000 that focused on sustainable landscape education and the relevant areas, such as Education for Sustainability, sustainable design education, and general design education. According to the research methods, the reviewed materials will be divided into two broad categories including theoretical research and empirical research. This paper will focus more on the empirical research since it provides the way to examine the results of theoretical research. Empirical research category is divided into three subcategories as qualitative research, quantitative research, and mixed method research. In particular, the typical topics and the approaches used for those topics that will be reviewed in each category. The successes and weaknesses of each method and approach will be explored.

6  RESULTS

6.1  Theoretical research

Theoretical research is commonly used in the sustainable landscape education research and the related areas. In particular, researchers are interested in the development of a new course, project, workshop or curriculum based on theories. For example, Hayles and Holdsworth (2008) tried to embed sustainability into the core curriculum at RMIT University, Australia by developing module audits and action
learning workshop. Ahn, Kwon, Pearce, and Wells (2009) developed a course in sustainable construction for students in the USA and focused on the systematic course development approach divided into three stages including preparation, development, and improvement.

The other kind of the research focus using theoretical research is the discussion of putting an advanced pedagogy or problem-solving strategy into sustainable landscape education research and the related areas. For example, Turner (2009) proposed Advanced Systematic Inventive Thinking (ASIT) system as a strategy for sustainable design and education in Australia by using examples in the literature. Vodeb (2015) discussed to use the socially responsive communication design pedagogy to redirect the conditions of communication design education in Australia.

Through the review, we found that by using theoretical research, researchers can focus on the discussion of the theories or pedagogies related to the design education and sustainability, and the development process of the practical usage. That is the successful part of this type of research. However, the weakness of theoretical research in the sustainable landscape education research area is that the effectiveness of the newly developed course, curriculum or pedagogy is hard to tell without using empirical design to examine.

6.2 Empirical research

In the sustainable landscape education research and the related areas, empirical research includes three primary types of qualitative research, quantitative research, and mixed method research.

Qualitative research. Qualitative research is widely used in the sustainable landscape education research and the related areas as a way to explore the effectiveness of the newly developed sustainable course, curriculum or pedagogy. Thus, it is typically associated with case study as a specific approach to imply the freshly developed sustainable course, curriculum or pedagogy in a realistic setting and evaluate the effectiveness. This is the first feature of using qualitative research in the sustainable landscape education research and the related areas. Second, due to the unique learning outcomes and learning process of the design majors, the specific approaches researchers used are more diverse than qualitative research in other fields. The diverse approaches include exploring the blogging, drawings, documentary materials, interviews, focus groups, observations, field notes, participant diaries, video, audio (Lawson, 2010; McMahon & Bhamra, 2016; Nikezić & Marković, 2015). We can see that traditional qualitative approaches like interviews and focus groups are included. Moreover, drawings and other products coming from the design process and final presentations are utilized. So does some new forms of approaches associated with this new digital era like blogging. Some typical exemplars are selected and summarized in Table 2. Third, another feature is associated with multi-methods. That means most of the previous studies analyzed more than one kind of different research materials.

Utilizing qualitative research in sustainable landscape education research and the related areas can help explore the effectiveness of the newly developed sustainable course, curriculum or pedagogy based on theories. This is one of the successes of using qualitative research in the related fields. The other success is that qualitative research can make the most usage out of the unique learning outcomes and learning process of the design majors. Diverse qualitative approaches not only help to better explore the topics in sustainable landscape education research and the related areas, and also show more possibilities in the methodology fields. However, the methodological weaknesses come from the combination of qualitative research and the characteristics of the design major as well. From the exemplars, we can see that how to deal with the relationship between different research materials become the biggest challenge. The results coming from analyzing different research materials, as well as the interactions between the analysis of different research materials should be equally paid attention to.

<table>
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<tr>
<th>Exemplar</th>
<th>Area (Topic)</th>
<th>Approaches</th>
<th>Methodological successes</th>
<th>Methodological weakness</th>
<th>Conclusions helpful for future research</th>
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<tr>
<td>McMahon &amp; Bhamra (2016)</td>
<td>Sustainable design education (Visualizing collaborative)</td>
<td>Case study, including using focus groups, observations, blogging, field</td>
<td>This study tried to include the voices from all participating parties</td>
<td>The description on how the analysis of different kind of qualitative data</td>
<td>The visual timelines can be useful to map the sustainable educational</td>
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</table>
experiences for sustainable design education) with notes and participant diaries from two projects in Ireland, Netherlands, and USA. (planners, facilitators and designers). connect to each other is not very clear. experience of participants and facilitators.

Sustainable design education (Place-Based education in the architectural design studio) Case study, including analyzing and reviewing student work from an architectural design studio in Serbia. This study associated students' design concepts and the review of student works with sustainability implementation. Examining an interaction between the analysis of student work and the review system may bring the research to a deep view. The study proved that “place-based education” is helpful to promote the responsibility for sustainable development in architectural teaching. 

Sustainable design education (Changing pedagogic codes in landscape architecture class learning sustainable development) Case study, including analyzing student drawing from a landscape architecture course in Australia. The study used a creative visualizing code modalities to analyze the students' drawing. This study claimed to have a multi-method design including drawings, interviews and documentary materials, but only focused on drawing in the paper. The study suggested allowing students to choose the knowledge to be learned is beneficial for learning, which is not specific for Education for Sustainability.

Quantitative research. Quantitative research is rarely utilized in the sustainable landscape education research and the related areas. There are only two previous studies used quantitative research in the related areas found in the literature. From the exemplars in Table 3, we can see that the quantitative research is associated with fundamental studies in the related areas, which means the researchers used quantitative research are more interested in examining the common opinions and knowledge of the topics on a large group of people. Different weaknesses have been seen in the two studies. The study from Christie, Miller, Cooke and White (2013) had a high response rate covering 6% of the entire university teaching workforce of Australia. However, the instrument had a narrow focus on frequency of using teaching methods for Education for Sustainability. The study from Thomas and Nicita (2002) had a very small sample size. Except for those, the common weakness of the two studies is that they both didn't conduct a pilot study to improve their instrument. The successes of these two studies are that they both came up with a lot of interesting conclusions, which can be further tested in the future research or served as a foundation for future instrument development in the sustainable landscape education research and the related areas.

Table 3. Summary of key features of quantitative research in related fields.

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<tr>
<th>Exemplar</th>
<th>Area (Topic)</th>
<th>Approaches</th>
<th>Methodological successes</th>
<th>Methodological weakness</th>
<th>Conclusions helpful for future research</th>
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<tr>
<td>Nikezić &amp; Marković (2015)</td>
<td>Sustainable design education (Place-Based education in the architectural design studio)</td>
<td>Case study, including analyzing and reviewing student work from an architectural design studio in Serbia</td>
<td>This study associated students' design concepts and the review of student works with sustainability implementation</td>
<td>Examining an interaction between the analysis of student work and the review system may bring the research to a deep view</td>
<td>The study proved that “place-based education” is helpful to promote the responsibility for sustainable development in architectural teaching.</td>
</tr>
<tr>
<td>Lawson (2010)</td>
<td>Sustainable design education (Changing pedagogic codes in landscape architecture class learning sustainable development)</td>
<td>Case study, including analyzing student drawing from a landscape architecture course in Australia</td>
<td>The study used a creative visualizing code modalities to analyze the students' drawing</td>
<td>This study claimed to have a multi-method design including drawings, interviews and documentary materials, but only focused on drawing in the paper</td>
<td>The study suggested allowing students to choose the knowledge to be learned is beneficial for learning, which is not specific for Education for Sustainability.</td>
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Table 3. Summary of key features of quantitative research in related fields.
Mixed methods research. By examining the research methods used in the literature, we found that mixed methods were rarely used in the research published in peer-reviewed journal articles. Instead, mixed methods were more widely used in doctoral dissertations aiming for fundamental research (Hakky, 2016; Bohannon, 2014; Koo, 2012; Smith, 2010). We think this phenomenon relates to the challenges of conducting mixed methods, particularly the following three. First, mixed methods research is relatively new to the researchers. Second, mixed methods research is time- and resource-consuming. Third, mixed methods studies are quite challenging to describe in one journal article adequately. Since doctoral students are more likely to be exposed to mixed methods research and tend to have more time to complete a more detailed and in-depth study, a mixed methods methodology is a more appropriate option for them. There is one kind of exception to use mixed methods in the peer-reviewed journal articles, which is associated with evaluation. Similar with using qualitative research, we found some scholars used mixed methods to evaluate sustainable design workshop and pedagogy (Albert, von Haaren, Vargas-Moreno & Steinitz, 2015; Ayer, Messner & Anumba, 2016).

Due to the above reason, we selected three exemplary dissertations and an exemplary article (Table 4, Table 5). Specifically, we tried to use the key components of the mixed-method models to compare the mixing and methodological approaches reported by the researchers, which is unique for mixed methods.

Mixing is "the linking, merging, or embedding of qualitative and quantitative strands of a mixed methods study" (Creamer, 2017, p. 245). From the key components in Table 4, first, we can see that the primary purposes of mixed methods in design education were triangulation and enhancement. Triangulation means the researchers in these fields are trying to "enhance validity by using different kinds of data to measure the same phenomenon" (Creamer, 2017, p. 29). Enhancement means the researchers in these fields are seeking "for wider and deeper understanding" (Creamer, 2017, p. 29). Second, we can tell that different researchers have different priorities depending on how they would like to address their research questions. Third, most researchers conducted sequential and multiphase research to use the former phase of data collection and data analysis to lead to the next phase’s sampling procedure.

<table>
<thead>
<tr>
<th>Exemplar</th>
<th>Area (Topic)</th>
<th>Approaches</th>
<th>Rationale</th>
<th>Priority</th>
<th>Timing</th>
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<tbody>
<tr>
<td>Christie, Miller, Cooke &amp; White (2013)</td>
<td>Education for Sustainability (Environmental sustainability in higher education)</td>
<td>An online questionnaire to faculties in Australia</td>
<td>Fundamental research covered 6% of the entire university teaching workforce of Australia across different disciplines.</td>
<td>The research had a narrow focus on frequency of using teaching methods for Education for Sustainability.</td>
<td>Critical thinking, lectures, tutorials, discussions and team work are the most commonly used teaching methods for Education for Sustainability in Australia.</td>
</tr>
<tr>
<td>Thomas &amp; Nicita (2002)</td>
<td>Education for Sustainability (Sustainability education and Australian universities)</td>
<td>An questionnaire to faculties in Australia</td>
<td>The survey instrument contained a lot of open ended questions, which brought more values to the small sample size answers.</td>
<td>The study had very small sample size, leading to the questionable reliability and validity.</td>
<td>The study suggested several obstacles for Education for Sustainability in Australia, including lacking funding, lacking the training to assist staff, lacking integration in curriculum across disciplines.</td>
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Table 5. Summary of mixing feature and methodological evaluation of mixed methods research in related fields.

<table>
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<tr>
<th>Exemplar</th>
<th>Mixing features by stage</th>
<th>Methodological successes</th>
<th>Methodological weakness</th>
<th>Conclusions helpful for future research</th>
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<tbody>
<tr>
<td>Hakky (2016)</td>
<td>Design: qualitative and quantitative research questions</td>
<td>Quantitative and qualitative strands confirmed the similar findings when the researcher tried to compare the results; nested sampling; the interview protocol was developed based on the findings of the survey.</td>
<td>The study was not fully mixed and there was not enough emphasis on the value-added.</td>
<td>Faculty members are likely to accept Design for Sustainable Behavior integrating into interior design area.</td>
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<tr>
<td></td>
<td>Data collection: nested sampling; the interview protocol was developed based on the findings of the survey</td>
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<td>Data analysis: no mixing</td>
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<td>Meta-inference: conclusions from comparison of the qualitative and quantitative results</td>
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<td>Author</td>
<td>Study Title</td>
<td>Methodology Details</td>
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<td>Albert, von Haaren, Vargas-Moreno &amp; Steinitz (2015)</td>
<td>Design: qualitative and quantitative research questions</td>
<td>The study successfully used mixed methods to perform an evaluation for a sustainable pedagogy.</td>
<td>The sustainable landscape workshop advanced students' understanding and skills for collaborative, scenario-based landscape planning.</td>
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<tr>
<td></td>
<td>Data collection: nested sampling</td>
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<td></td>
<td>Data analysis: no mixing</td>
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<td></td>
<td>Meta-inference: conclusions from combinations of the qualitative and quantitative results</td>
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<tr>
<td>Bohannon (2014)</td>
<td>Design: qualitative and quantitative research questions</td>
<td>The study was not fully mixed and there was not enough emphasis on the value-added.</td>
<td>Barriers for transforming community engagement work into scholarship included a lack of theoretical grounding and insufficient methodological training. Participating faculty believed that community engagement was largely valued at the university level but less at the departmental level.</td>
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<tr>
<td></td>
<td>Data collection: nested sampling; the interview protocol was developed based on the findings of the survey</td>
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<tr>
<td></td>
<td>Data analysis: no mixing</td>
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<td></td>
<td>Meta-inference: conclusions from combinations of the qualitative and quantitative results</td>
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<tr>
<td>Smith (2010)</td>
<td>Design: qualitative and quantitative research questions</td>
<td>The study was not fully mixed and there was not enough emphasis on the value-added.</td>
<td>The study revealed that the studio environment played a minor role in the influence of student interests; student curiosities were affected more by travel, internships, family, and non-studio courses.</td>
<td></td>
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<tr>
<td></td>
<td>Data collection: nested sampling</td>
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<td>Data analysis: no mixing</td>
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<td></td>
<td>Meta-inference: no mixing</td>
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</table>

From the approaches in Table 4, we can see that website information collection, survey, and in-depth interview were the most commonly reported methodology approaches. To clarify, website information collection was dealing with research focuses on the mission statement, course requirement, credit hours, etc. (Hakky, 2016). Surveys reported in the studies were mostly focusing on the general state of the education in specific fields, including definitions and attitudes, while the interviews were mainly exploring the definitions, attitudes, perceptions, and thinking about barriers and challenges (Hakky, 2016; Bohannon, 2014; Smith, 2010).

From the mixing features in Table 5, we can see to what extent the mixed methods research are mixed in four stages - design, data collection, data analysis, and inference. First, most researchers developed both qualitative and quantitative research questions which involved mixing in the design stage. Second, most researchers used nested sampling, which means they selected the follow-up interview participants from whom showed their interests for being interviewed in the survey. That represents mixing in the data collection stage. Another sign of mixing is that some of the researchers used their findings of the survey to help them develop an interview protocol. Third, mixing reported in the inference stage were the research conclusions coming from either comparison or combinations of the qualitative and quantitative findings.
The methodological successes of using mixed methods reported in the reviewed research are as follows. First, the successful part is reported that quantitative and qualitative strands confirmed the similar findings when the researcher tried to compare the results (Hakky, 2016). Second, survey became an efficient way to help the researchers sample the participants for the follow-up interview (Hakky, 2016; Bohannon, 2014; Smith, 2010). Third, the findings of the survey helped the development of interview protocol (Hakky, 2016; Bohannon, 2014). For example, Bohannon (2014) raised an interview question directly related to the survey result: "61% of surveyed faculty indicated that community engagement provides opportunities for scholarly work and publication. Does this seem about right to you? What do you think is the relationship between community engagement and scholarship?" (p. 190) Fourth, as reported, the survey provided an overall understanding of the topic, and follow-up interview provided "a more in-depth understanding of the results from the first phase of the study" (Bohannon, 2014, p. 164).

The methodological weaknesses of using mixed methods we see as salient to address are as follows. First, none of the studies that claimed to use mixed methods were fully integrated, which means none of them intentionally mixed the qualitative and quantitative strands of their studies throughout each of the design, data collection, data analysis, and inference stages. The main problem is the mixing in the data analysis stage. Most researchers reported their analysis processes and results in qualitative and quantitative strands separately, even though some of the researchers did the analyses concurrently, which still cannot be considered as mixing since no data transformation had been seen. Second, there is not enough emphasis on the value-added from using mixed methods in the reviewed research. "Value-added is an element of methodological transparency where the insight, inferences, or conclusions that are produced by the use of mixed methods are explicitly identified" (Creamer, 2017, p. 248).

7 DISCUSSION

Through the review, we noticed one interesting phenomenon about the research of sustainable landscape education, sustainable design education and Education for Sustainability. It seems like the researchers and high education facilities in Europe and Australia are more interested in these areas. In the USA, the researchers are more concerned about general design education instead of emphasizing the sustainability. We associated this phenomenon with the history of the movement of Education for Sustainability. After the United Nations started promoting sustainability and introducing the concept of sustainability to universities through its International Environmental Education Programme from 1975 to 1995, many governments showed their support (Christie et al., 2013). Those supports included the Higher Education Funding Council for England's action plan Sustainable development in higher education (HEFCE, 2005); the UK Government report, Securing the future: delivering the UK sustainable development strategy (HM Government, 2005); the Australian Government's National Action Plan for Education for Sustainability (Commonwealth of Australia, 2009). All these reports proved that Australia and Europe are the ones participating in the movement of Education for Sustainability earlier responding to United Nations' promotion. We think that the research heat regarding sustainability is significantly related to earlier government promotion and support. The government funding might play a role in this, but we need more research to prove this prediction. Except for exploring reasons for this phenomenon, we think raising attention to sustainable landscape education and the related areas in the USA is more urgent and essential.

The other phenomenon discovered in this study is that the theoretical research has very close relationship with the empirical research in sustainable landscape education research and the related areas. That is because the theoretical research and empirical research in these areas both focused on the development of a new course, project, workshop or curriculum based on sustainable theories and pedagogy. Although the theoretical research emphasizes on the discussion of the theories and the development process of the practical usage, the empirical research can be seen as the follow-up step of using empirical design to examine them with qualitative multi-methods or mixed methods. In this sense, a lot of the current theoretical studies have potentials to transform into empirical research by taking them one step further. Thus, the topics of the current theoretical studies can be seen as the potential focus of the future empirical research in these areas.

8 CONCLUSIONS

Different from the research situation in Australia and European countries, the sustainable landscape education research in the USA is insufficient. Current studies had narrow focuses on developing and testing a new sustainable landscape course, project, or workshop, which led to the fragmented
research situation. Very few fundamental studies were conducted to try to gain a general view of the sustainable design education field. Thus, researchers are hard to capture the big picture of current research and find the research gaps. To solve this problem, more fundamental studies on sustainable landscape education need to be carried out to understand the general situation of the sustainable landscape education research in the USA and improve the fragmented research situation.

To focus on the development of a new course, project, workshop or curriculum based on sustainable theories and pedagogy, the researchers can choose either theoretical research method or empirical research method for sustainable landscape education research. The choice will depend on if the researchers would like to focus on the developing process or the evaluation. In particular, the corresponding empirical research methods for this kind of study can be either the qualitative method or mixed methods. Due to the unique learning outcomes and learning process of landscape architecture, diverse approaches include exploring the blogging, drawings, documentary materials, interviews, focus groups, observations, field notes, participant diaries, video, and audio can be used (Lawson, 2010; McMahon & Bhamra, 2016; Nikezić & Marković, 2015). Once the multiple kinds of research materials are utilized in the studies, the interactions between the analysis of different research materials should be equally paid attention to just as the results coming from analyzing different research materials.

To focus on fundamental research about sustainable landscape education, the researchers can utilize either the quantitative method or mixed methods. In the quantitative studies, instrument development should be emphasized. Conducting a pilot study to improve the instrument will be a good idea.

In the previous studies, mixed methods were chosen for the rationale of triangulation or enhancement. Sequential and multiphase mixed methods were commonly designed to use the former phase of data collection and data analysis to lead to the next phase's sampling procedure and the development of instrument or protocol. Those are the methodological successes.

Through the review, we find that conducting a fully integrated mixed-method study are the most challenging since the researchers need to intentionally mix the qualitative and quantitative strands of their study throughout each of the design, data collection, data analysis, and inference stages. Especially for the mixing of data analysis and inference stages, no previous example has been seen in the sustainable landscape education research or the related areas. On the one hand, no data transformation was reported in the previous research. To overcome this problem, the researchers should use qualitizing and quantitizing analytical strategies in the data analysis stage to address the mixing. Specifically, the researchers can try to summarize the results from quantitative instruments in narrative form, and transform qualitative data into a quantitative format (Creamer, 2017, p. 247). On the other hand, there is not enough emphasis on the value-added from using mixed methods in the reviewed research. In the future research, the value-added from using mixed methods needs to be paid attention to.

Discussion and conclusions from this study will be helpful for the researchers to find research possibilities with corresponding research methods for the future sustainable landscape education research.

9 REFERENCES


CELA MEDIA STATEMENT

Title of Paper or Research:
METHODOLOGICAL REVIEW OF SUSTAINABLE LANDSCAPE EDUCATION RESEARCH

Authors:
Li, Dan
Kim, Mintai
Bohannon, Cermetrius L.

Institution or Professional Affiliation:
Virginia Polytechnic Institute and State University

Media Statement:
A methodological review was carried out on the open access publications focused on sustainable landscape education and the relevant areas since 2000. Several significant findings are as follows. First, to focus on the development of a new course, project or curriculum based on sustainable theories, researchers can choose either theoretical research method or empirical research method, including the qualitative method or mixed methods. Second, to focus on fundamental research, researchers can utilize the quantitative method or mixed methods. Third, conducting fundamental studies on sustainable landscape education and using a fully integrated mixed-method study are the most challengeable and urgent.
SERVICE LEARNING AND
COMMUNITY ENGAGEMENT

Edited by Malika Bose & Benjamin Spencer
BUILDING A NEW CENTRAL PARK
THROUGH CIVIC ENGAGEMENT AND SERVICE LEARNING:
FALLING RUN GREENSPACE, MORGANTOWN, WEST VIRGINIA

Haas, Vaike
West Virginia University, vaike.haas@mail.wvu.edu

1 ABSTRACT
Service learning, university-community partnerships and volunteers’ civic engagement activities created a new urban forest park, Falling Run Greenspace, from sixty acres of steeply forested university property in downtown Morgantown, West Virginia. Developing the master plan involved a complex process of administrative approvals and committees for engagement of a diverse group of stakeholders. The project catalyzed greenspace partnerships between the University and the community, and promoted civic engagement among students. This paper reports on the collaborative process through which this new park was created. Landscape architecture majors at West Virginia University participated in site analysis and master planning through service learning in class assignments typically over two semesters; community members and students, staff and faculty volunteered to construct trails. The University provided a construction budget for bridges and a universally accessible trail. In 2016, Falling Run was the first Welcome Week trail-building project and attracted 495 incoming freshmen who volunteered to clear brush and build trails. Falling Run’s volunteer structure hinged on a handful of experienced trail crew leaders providing training sessions, and a dedicated volunteer coordinator. Within eighteen months, volunteers built 2.4 miles of trail, utilizing 4,693 worker-hours. A West Virginia Land Trust representative called this project “the most important development for Morgantown green space since the Rail Trail.” With few new large parks being established in central urban areas today, the service learning and volunteer organization strategies used to establish Falling Run provide useful planning insights for universities working within the constraints of limited design and construction budgets, and for landscape architecture programs considering multi-year service learning design-build projects.

1.1 Keywords
Service Learning, Urban Parks, Trail Planning, Appalachia, Volunteers
2 INTRODUCTION

Morgantown, West Virginia lies within the ecologically diverse Appalachian Plateau, which is characterized by a mild climate and broad vegetative diversity resulting from a lack of glaciation and microclimate pockets created by topography. Falling Run Greenspace was originally conceived to complement the existing West Virginia University Core Arboretum, expanding opportunities for outdoor education through its different microclimates. Falling Run’s sheltered cove topography, rich in ferns and with both south- and north-facing slopes, contributes to its potential to support northern hardwood forest and wet prairie meadow demonstration areas – in contrast to Core Arboretum’s exposed, southwest-facing hill slope, which supports mostly mixed oak-hickory and maple-beech forests.

Falling Run valley’s steep side slopes (with an average gradient of around 30%) protected the site from development. By September 2018, volunteers constructed 2.7 miles of trail (with an additional 1.5 miles planned), improving access to the Falling Run stream, characterized by a mostly rural watershed (see Figure 1) – in stark contrast to adjacent watersheds impaired by acid mine drainage and urban stormwater runoff. Falling Run Greenspace’s educational potential from its vegetative diversity and clean watershed offer educational value to both the University and the surrounding community; Falling Run is easily accessed by a short walk from WVU’s main campus and center city residential neighborhoods.

Figure 1. Trails (as built, September 2018) improve access to the Falling Run stream, which has a largely rural watershed of 283-acres (color aerial). Light green denotes WVU farms; Kelly green Falling Run Greenspace, dashed white lines neighborhoods within 0.625 to 0.75 miles of entrances (a 10- to 15-minute walk). Diagram by author

While the Greenspace itself has become an educational resource, its design and implementation through service-learning built ties to the community and benefited students, especially those in landscape architecture, over several semesters. The design and implementation process also strengthened partnerships between university and community greenspace advocates. This paper reports on the collaborative process through which this new park was created.
The paper is organized into several sections. The rest of this section provides a brief background to the study, while Section 3 discusses the study approach. Section 4 is organized around the major study components: outline and evaluation of the structure of the multi-year community-driven design process through which Falling Run Greenspace was established on University property (Section 4.1); a description of the learning outcomes and civic engagement that resulted from service-learning during the design process (Section 4.2); a summary of the volunteer structure for the project (Section 4.3); and a description of community benefits and enhanced partnerships (Section 4.4). The paper concludes with lessons learned (Section 5) and conclusion (Section 6).

2.1 Benefits of Service Learning
Service learning has been found to have benefits for students academically, personally and socially, while promoting civic engagement (Conway, Amel & Gerwien, 2009). Service learning in urban woodlands has been found to improve team skills, build awareness of biodiversity and promote environmental stewardship (Knachmuths, Farmers and Reynolds, 2017; McFall, 2012).

For landscape architecture students, involvement in service learning is likely to have additional specific benefits, important to them in their future professional and civic roles. It offers an opportunity to apply knowledge gained in a classroom setting to the outdoors. According to Beaverford, student involvement in meaningful service projects “provides a venue for design educators to connect students to the humane, political, and practical aspects that are often overlooked in studio education” (2011, p. 533). Winterbottom found “Students are … challenged to work as a team, to plan and communicate design responsively” (2017 film). Design-build work at the University of Washington evoked an emotional response from one project client (filmed in Winterbottom 2017) regarding the long-term benefits for all involved:

“I’ve never seen a group of students – or anybody – work as hard as these kids. My life, and their life, will never be the same because of what they’re doing out there…. That space is going to be healing people long after we’re gone.”
- Cyril Miller, Board President, Veterans and Friends of Puget Sound.

2.2 Community-Driven Design
In addition to expanding outdoor educational opportunities and benefiting students engaged in service-learning, Falling Run Greenspace offers an example of a community-driven design process. This is in stark contrast to a client-driven design process, for which schools of landscape architecture typically prepare their students. While a landscape architect suggested a vision for the space at the request of two university deans, university stakeholders, students, and community members were extensively involved in modifying and implementing that vision.

Community-driven design contrasts with the traditional model of participatory design. Hou and Rio caution against participatory design’s “pitfall of emphasis on the binary interaction between designers and users” (2003, p. 26).

3 STUDY APPROACH
This paper is based upon a case study of the design-build project Falling Run Greenspace in Morgantown, West Virginia. Case studies are increasingly common in landscape architecture research because they offer valuable details and insights about innovation and consequently help to advance the body of knowledge in the field. According to Francis, “A case study is a well-documented and systematic examination of the process, decision-making and outcomes of a project, which is undertaken for the purpose of informing future practice, policy, theory, and/or education.” (2001, p. 16).

This paper’s description of the community-driven design process draws from the concept of ‘biography of landscape’ (Samuels 1979), which has influenced case studies of human-land interactions, cultural geography, ecology, and archaeology. Researchers of landscape biographies are encouraged to explore the landscape’s designers, social context, and temporal transformations, and contributions of planning and design; as well as the “rich interrelationships between the social and natural dimensions of landscapes” (Kolen and Renes 2015, p. 23).

Learning outcomes and benefits to individual landscape architecture students are measured through: student evaluations, interviews with students by campus and local reporters, students'
statements for the Falling Run Master Plan, and anticipated future opportunities for learning created by Falling Run Greenspace. Civic engagement is measured through time-keeping records during various phases of trail construction, which provide additional insights for planning and phasing similar projects. Finally, the benefits to the community are measured in statements of community impact provided by local and university leaders (in press, and in letters of support included in the Falling Run Master Plan).

4 STUDY COMPONENTS

4.1 Morgantown’s planning context and Falling Run’s design process

Despite Morgantown’s steep topography, early city planners imposed a predominantly rectangular street grid, resulting in downtown streets of up to 32% slope. The street grid is broken regularly by difficult-to-develop wooded draws, known locally as hollows (“hollers”), limiting connections to the oldest streets, which tend to flow with an organic alignment around topographic obstacles. The juxtaposition of gridded and organic street networks provides opportunities for greenspace connectivity. The interrupted street grid also contributes to rush-hour gridlock: when a traffic jam occurs, there are few ways around it. According to one former mayor, Morgantown is “a small town with big-city traffic.”

Initially, university decision makers were not sure if it was reasonable, given Falling Run hollow’s steep slopes, to designate the property as greenspace. West Virginia University acquired the property in 2012, after a settlement with a bankrupt developer. “I don’t think it was until about 2013 or 2014 that we really realized what a wonderful asset that we have,” said Narvel Weese, WVU Vice President of Finance (LeRose, 2017). Morgantown’s Mayor Jenny Selin was instrumental in accelerating the development of the Falling Run Greenspace in Spring 2014 by connecting the first visionaries for the project (deans of the Eberly College of Arts and Sciences and Davis College of Agriculture, Natural Resources, and Design) with a landscape architecture faculty member (the author) to analyze the project’s feasibility. The two deans invited the author to analyze the property’s potential as greenspace over Summer 2014.

To facilitate stakeholder engagement but maintain a streamlined planning process, two committees formed for Falling Run’s master planning: a larger WVU Greenspace Committee for stakeholder feedback and a smaller Steering Committee for decision making. In all, 64 people informed the planning of Falling Run, including 13 university administrative units and 18 community partners (see Figure 2). Leadership for the project was provided by:

- the Dean of Davis College of Agriculture, Natural Resources, and Design,
- three successive Deans of the Eberly College of Arts & Sciences,
- the Vice President of Finance, and (after administrative restructuring) by
- the Vice President of Strategic Initiatives.

In Fall 2014, university facilities staff proposed a conceptual design (with trail slopes of up to 34%) that would increase parking at the WVU Organic Farm, assuming commuters would walk 20-minutes to campus through Falling Run. A service-learning exercise demonstrated this would not be viable: in multiple landscape architecture classes over several semesters, students talked to peers about their
commuting patterns to the University's Evansdale campus (one of three WVU campus locations within Morgantown) and found most students willing to walk no more than 0.625 mile. The average commute time (all modes) was 18.5 minutes (see Table 1). Polled travel times include walking to the Personal Rapid Transit (PRT) stations, which connect downtown Morgantown with Main Campus, Evansdale Campus, dorms, and Health Sciences.

Driving was preferred and only 7% of 101 students polled were active commuters (6% walking, 1% skateboarding). This estimate of active commuting rates in Morgantown is consistent with other research: the 2011 American Community Survey found Morgantown having a walking commuter rate of 6.0% (cited by Pedestrian and Bicycle Center, 2018). This student assignment helped to establish walkability and neighborhood connectivity in the vision for Falling Run Greenspace, and to prevent adding paved parking lots at the Organic Farm.

Table 1. For a class assignment, students asked peers (n = 101) about preferred commuting mode and usual travel time, including parking or walking to the Personal Rapid Transit (PRT) rail station, and to identify the closest intersection to commuters’ starting points. Data from students' 2014-2016 mapping exercises, compiled by author.

<table>
<thead>
<tr>
<th>Distance</th>
<th>Active</th>
<th>Drive</th>
<th>Bus</th>
<th>PRT active</th>
<th>Drive</th>
<th>Bus</th>
<th>PRT</th>
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<tbody>
<tr>
<td>&lt;0.625 mi</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>9.3</td>
<td>7.5</td>
<td>-</td>
</tr>
<tr>
<td>0.625-1.25 mi</td>
<td>1</td>
<td>26</td>
<td>3</td>
<td>3</td>
<td>15.0</td>
<td>12.9</td>
<td>21.0</td>
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<tr>
<td>1.25-1.75 mi</td>
<td>0</td>
<td>25</td>
<td>1</td>
<td>29</td>
<td>-</td>
<td>16.9</td>
<td>20.0</td>
</tr>
<tr>
<td>1.75-2.25 mi</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>-</td>
<td>15.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Totals</td>
<td>7</td>
<td>54</td>
<td>5</td>
<td>35</td>
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</table>

By Spring 2015, leadership and funding for the Falling Run Greenspace project were uncertain, but encouragement within the community was clear. Realizing that a site analysis had less potential to catalyze action than a preliminary master plan, the author continued developing a conceptual design, involving students in service learning to help craft a master plan document to advocate for the project. In Spring 2015, landscape architecture students (in a classroom exercise) helped write the vision for the Falling Run Greenspace Master Plan:

Falling Run Greenspace will be an accessible, vibrant urban oasis with the potential to become a central park for the heart of Morgantown, forging a connection between the Organic Farm and Main Campus of West Virginia University. Ultimately, the long-term vision is to provide a connection for bicyclists and pedestrians between east Morgantown's Mileground and central campus.

The author refined the master plan repeatedly through collaborative dialogue and regular meetings with a broad range of policymakers and stakeholders. Organizational change researchers (Stouten, Rousseau and De Cramer 2018: 776) found, “Change agent efficacy derives not only from personal skills but also from the network ties the individual has.” The informal style of engaging stakeholders paralleled the community-driven design model recommended by Hou & Rios, who state (2003: 20):

“communities are developing both approaches that necessitate new relationships between different sectors and forms of decision making that are more collaborative and informal in nature…These changing relationships and conditions reaffirm the understanding of city as both a physical space and an expression of social relations.”

Falling Run’s master plan document added transparency and provided a record of the many planning conversations across administrative units, and was crucial in advocating for the continuation of the project. In Spring 2016, the two Deans agreed to continue to pursue the project and WVU’s Vice President of Finance allocated $140,700 for construction – approved by the University Planning Commission.

Networking relationships, as well as the City’s permission to utilize unbuilt rights of way (“paper streets”), were key to building several of the Falling Run trails, as paper streets connected WVU property to surrounding neighborhoods. In February 2017, the Campus Neighborhoods Revitalization Corporation
voted unanimously to support the development of city paper streets in the Falling Run hollow as trails, supported by the advocacy of the Mayor and City Manager, and the necessary legal agreements between the University and City were prepared. Mayor Jenny Selin expressed support for the Falling Run Master Plan, stating the author “and her students provide practical, well-thought data and landscape plans that help communities use their public space in an elegant way” (Luna, 2017). The Falling Run Master Plan proposed schematic designs for trails and bridges, with limits of disturbances, estimated total construction costs, proposed phasing, restoration strategies, and a planting palette of suitable native species. In late 2015, West Virginia Botanic Gardens launched a $50,000 fundraiser to support their own initial master plan, demonstrating local market cost of a similar effort.

At Falling Run, “The development of the large scale plan, along with community input, was essential in creating a vision and energy around the effort,” according to Judith Wasserman, Director of the School of Design and Community Development (letter, November 2016).

Time-keeping records suggest an ongoing need for a designated ‘change driver’ for similar greenspace master planning projects. As the design lead, the author dedicated 1,414 hours to Falling Run’s master planning and early implementation from April 2014 to May 2017. This was double the time funded by the Deans, but about fifth of the total time dedicated by others during the same interval (see Figure 3). This demonstrates how the time investment of a ‘change driver’ can catalyze civic service, and yet also how “collaboration, community outreach, and coordination… translate into additional time, energy, and cost” (Hou & Rios 2003: 26). Much of the design lead’s time on the project went toward “sustaining the momentum of change implementation” (Whelan-Berry & Somerville 2010: 179). Phasing became an iterative master planning process; volunteer trail building crews worked much faster than the Steering Committee had anticipated, leading to several updates to phasing plans and construction documents required for obtaining permits. A part-time volunteer coordinator and a designated project manager provided construction management, and regular construction meetings continued for the Steering Committee into late 2018.

4.2 Landscape Architecture Student Contributions and Outcomes

Students’ course-based service-learning projects contributing to Falling Run’s master planning were tailored to fit their course curricula; some of the larger analytical tasks (like a tree canopy survey) spanned several cohorts of students. Students were involved in the project in at least two courses over two semesters, from Fall 2014 to Fall 2018, and as third-year undergraduate or as graduate students:

LARC 350: Landscape Architecture Design II
- diagrammed steep slopes, aspect and other site analysis factors (using GIS)

LARC 360: Natural Systems Design and LARC 593c: Environmental Design Studio
- identified scenic views and other key destinations for trail network
- contributed to a survey of tree canopy dominants
- surveyed baseline understory vegetation with plots
- prepared preliminary vegetation restoration plans and invasive species management strategies
- began removing invasive shrubs from the understory
- began restoration planting, reintroducing a broader range native shrubs and trees in canopy gaps
- monitored the stream and ongoing restoration plantings after construction disturbance

LARC 331: Landscape Architectural Construction II / LARC 531: Construction: Materials, Methods and Stormwater Management
- calculated peak stormwater runoff volumes to determine suitable bridge heights and locations
- helped flag trails at Falling Run, measuring slope and making field adjustments
- surveying peers’ commuting patterns (with travel time, and preferred mode)

In all, 112 landscape architecture students contributed an estimated 2,280 hours to Falling Run through course-based service learning in the author’s classes from Spring 2014 – Fall 2018. (This estimate is based on a review of assignments’ value to course grade.) In Fall 2014, nineteen of these students also worked on the GIS site analysis of Falling Run, contributing around 380 hours. Course-based service learning projects for Falling Run were not limited to landscape architecture majors; students in other classes conducted environmental assessments, surveyed park perceptions, and contributed to building trails.
Winterbottom (2002) evaluated success of design-build studios through comparing responses in student evaluation surveys to goals outlined by eight landscape architecture program chairs. That service-learning was effective for learning, in the author’s courses which were most involved in Falling Run, is indicated by responses collected during regular student evaluations. Survey questions varied from year to year, and were designed to evaluate instructors; however, three questions measured course learning outcomes.

In Fall 2015 for LARC 360, 86% of students (n=12) responded to the question “I learned more in this course than in similar courses”, giving a mean rating of 4.56 (where 5 = always, 4 = frequently, 3 = usually, 2 = seldom, 1 = rarely). The question “This course helped me develop new skills / gave me skills that will be directly applicable to my career” earned a mean rating of 4.61 in three courses (LARC 360 and LARC 331, n=64, same scale as above). The results for an overall learning outcomes question, consistently included on student evaluations for lectures and labs, are provided in Table 2. In these courses, on average 29% of the course grade was based on service learning assignments. Results suggest positive learning outcomes in these courses.

### Table 2. Students’ ratings of overall learning (n=237); data from author’s student evaluations.

Percent of course grade based on service-learning is drawn from author’s review of assignments.

<table>
<thead>
<tr>
<th></th>
<th>Fall (LARC 360)</th>
<th>Spring (LARC 331/593c)</th>
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<tbody>
<tr>
<td>response rate</td>
<td>79% 82% 86% 21%* 95%</td>
<td>90% 83% 59% 79% 84%</td>
</tr>
<tr>
<td>mean rating</td>
<td>4.06 4.77 4.59 4.17 3.67</td>
<td>4.47 4.18 4.63 3.95 4.00</td>
</tr>
<tr>
<td>Assignments:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Svc. learning**</td>
<td>0% 35% 24% 33% 29%</td>
<td>22% 32% 36% 30% 34%</td>
</tr>
<tr>
<td>Falling Run</td>
<td>0% 20% 14% 2% 0%</td>
<td>13% 23% 13% 5% 4%</td>
</tr>
</tbody>
</table>

*The low response rate in Fall 2016 was due to switch to electronic evaluations.
** Courses included other service learning projects, in addition to Falling Run.

### 4.3 Volunteer Training and Recruitment

In August 2016, volunteer involvement at Falling Run began with an intense push of 2,103 volunteer hours and 495 (about 10% of) incoming freshman volunteers during Welcome Week (see Table 4). Equipment was donated (tools from Adventure WV and hard hats from Lowe’s). To facilitate access to tools, crews stored equipment on site in a locked trailer borrowed from Adventure WV. University facilities staff cleared and gravel-paved a former access road in July of 2016, to provide vehicular access and a gathering area for up to 200 volunteers at once.

One potential obstacle to implementation identified early by the Steering Committee was the challenge of supervising so many untrained volunteers at the same time. We recruited four experienced trail crew leaders willing to conduct trail crew safety training sessions during Summer 2016, in advance of Welcome Week. These crew leaders in turn trained 48 new crew leaders over multiple training sessions during that summer (see Figure 3) -- communicating how to build trails, and especially how to keep crews safe (safe distances between trail crew members, required safety equipment, and potential hazards). Crew leader training sessions lasted about three hours, during which novice crews built sections of trail at Falling Run to gain comfort with the tools and safety procedures. Crew leaders then discussed these same safety guidelines with their crews before each trail-building shift.

Of the August 2016 trail crew leaders (n=48), 16 participants (33%) were recruited from the landscape architecture program, including fourteen LARC students and two LARC faculty. Only 0.36% of all WVU-Morgantown students were landscape architecture majors in 2016, but LARC majors led 34.8% of Falling Run trail crews in Fall 2016 (see Table 5). The active participation of landscape architecture students shows the efficacy of course-based service learning projects for promoting civic engagement and an interest in leadership. Women students were particularly involved. In Fall 2016, 31 students were female landscape architecture majors, undergraduate or graduate, at WVU-Morgantown (0.10% of the student body), but female LARC majors led 15.2% of Falling Run trail crews from August to November 2016. This
project thus offered important leadership opportunities to women studying landscape architecture.

Many trail crew leaders served on the Greenspace Committee or Steering Committee during the planning process, or were interested members of the community. A substitute teacher for Eastwood Elementary School led eleven trail crews in the first three months, to benefit her own students by improving access to the WVU Organic Farm and Falling Run woods (personal communication, August 2016). During Welcome Week 2016, the design lead, project coordinator, and volunteer coordinator worked to help orient, support and direct trail crews as needed. Crews of three to eleven students worked under crew leaders to clear brush and build trails; most crew leaders led crews during multiple shifts to keep crews small and effectively supervised.

WVU’s Greek Community of sororities and fraternities has its own service requirements, and the Volunteer Coordinator successfully recruited many Greek participants during the school year. By February 2018, crew leaders had led an additional 138 crew shifts, bringing total hours at that time to 4,693 (see Table 4).

Table 4. Volunteer involvement during trail construction at Falling Run Greenspace.
Data from Falling Run Volunteer Coordinator Kate Bolyard (February 2018); used with permission.

<table>
<thead>
<tr>
<th></th>
<th>Crew leaders</th>
<th>Crew members</th>
<th>Running total</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Shifts</td>
<td>Hours</td>
<td>Shifts</td>
</tr>
<tr>
<td>Aug-16</td>
<td>103</td>
<td>618.0</td>
<td>495</td>
</tr>
<tr>
<td>Dec-16</td>
<td>50</td>
<td>151.0</td>
<td>232</td>
</tr>
<tr>
<td>Apr-17</td>
<td>37</td>
<td>111.0</td>
<td>216</td>
</tr>
<tr>
<td>Jul-17</td>
<td>9</td>
<td>20.3</td>
<td>34</td>
</tr>
<tr>
<td>Aug-17</td>
<td>9</td>
<td>31.5</td>
<td>41</td>
</tr>
<tr>
<td>Dec-17</td>
<td>31</td>
<td>94.0</td>
<td>193</td>
</tr>
<tr>
<td>Feb-18</td>
<td>2</td>
<td>41.0</td>
<td>13</td>
</tr>
<tr>
<td>totals:</td>
<td>1066.8</td>
<td>3626.5</td>
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</table>

Over time, crews continued to involve a mixture of students, faculty, staff and community participants, further building university-community partnerships. Trail construction at Falling Run is ongoing; in the first two weeks of the Fall 2018 semester, over 100 volunteers signed up for trail-building shifts (personal communication, second Falling Run Volunteer Coordinator Travis Rawson, September 2018).
Figure 3. Falling Run’s implementation hinged on the leadership of key individuals. Green highlights the landscape architecture program’s involvement during site analysis and master planning, and as volunteer crew leaders during trail construction. Diagram by author.

Table 5. Demographics of crew leadership during trail construction in Fall 2016 at Falling Run. Data for leaders of 158 trail crews, based on Volunteer Coordinator’s rosters (November 2016); used with permission.

<table>
<thead>
<tr>
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<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>male</td>
<td>84</td>
<td>77%</td>
<td>11</td>
<td>73%</td>
<td>13</td>
<td>68%</td>
<td>8</td>
<td>53%</td>
<td>73.4%</td>
</tr>
<tr>
<td>female</td>
<td>25</td>
<td>23%</td>
<td>4</td>
<td>27%</td>
<td>6</td>
<td>32%</td>
<td>7</td>
<td>47%</td>
<td>26.6%</td>
</tr>
<tr>
<td>LARC students</td>
<td>33</td>
<td>30%</td>
<td>4</td>
<td>27%</td>
<td>11</td>
<td>58%</td>
<td>7</td>
<td>47%</td>
<td>34.8%</td>
</tr>
<tr>
<td>LARC female</td>
<td>13</td>
<td>12%</td>
<td>3</td>
<td>20%</td>
<td>3</td>
<td>16%</td>
<td>5</td>
<td>33%</td>
<td>15.2%</td>
</tr>
<tr>
<td>LARC male</td>
<td>20</td>
<td>18%</td>
<td>1</td>
<td>7%</td>
<td>8</td>
<td>42%</td>
<td>2</td>
<td>13%</td>
<td>19.6%</td>
</tr>
<tr>
<td># crews total</td>
<td>109</td>
<td>15</td>
<td>19</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.4 Community Benefits and Enhanced Partnerships

4.4.1 Benefits for Student Volunteers

Previous research suggests that projects like Falling Run would be likely to have several types of positive outcomes for students, whether they were involved in implementation and trail building or the project planning process. Students reflected on the benefits of service learning in press interviews. The development of the Falling Run Greenspace generated 23 news stories after the official opening and ribbon-cutting ceremony in April 2017. One Associated Press article (May 2, 2017) covering the opening ran in thirteen outlets and four states. The involvement of the University’s public relations staff was key in generating the considerable volume of positive press, which attracted public attention to Falling Run Greenspace as a new community asset.

Nine colleges within West Virginia University require service as part of coursework for majors, part of a larger initiative to build a ‘culture of service’ at WVU. West Virginia University encourages service learning in four categories, according to the Academic Service Learning Coordinator Lindsey Rhineheart (2018 bulletin): 1) individual / group service learning projects fit within course objectives; 2) action projects solve a specific community problem; 3) for instructor-led projects, the entire class works with a community partner; 4) for civic engagement, students are involved in community service at a broader scale. Falling Run Greenspace engaged students in service learning at all of these scales, to some extent, but particularly at the broader scales (entire classes, civic engagement).

The Falling Run Volunteer Coordinator Kate Bolyard said in an interview (Connect Bridgeport News 2017): “[Volunteers] will be able to come back 25 years from now and tell their kids that they helped build these trails.” Local TV news captured the pitch of volunteer energy from regular crew leader and landscape architecture student, Morgan Southall (Valente, 2017):

“It’s completely different when you see the trails built out and you see people using it, and they’re bringing their dogs and kids through, and you’re like ‘this is a place and I helped make it, and it’s so cool!’”

In late 2016, I asked the fourteen landscape architecture majors who had volunteered as trail crew leaders in August 2016 to provide a short statement answering two questions, ‘What motivated you to volunteer your time outside class to lead trail crews at Falling Run?’ and ‘What benefits did volunteering at Falling Run provide to you, personally?’ Of this group, five responded, providing statements describing their experience that were included in the Falling Run Greenspace Master Plan; several mention place-making, or connection to the outdoors.

“It’s a really... satisfying experience to be able to be involved in a project where you work through the issues theoretically, and then physically help bring that project to life, and see it have such a positive impact on the local community and environment. This is something that will be here for years and years to come... I helped create this opportunity for people and for the species that call this place home. I had an impact on this environment for the better.”

“Working with freshman students was the most enjoyable experience for me... All of them had an incredible sense of accomplishment in the fact that they played a role in improving the community.... It will be great to see the final outcome of the project and be able to tell people I was involved in the first stages.”

“What motivated me to volunteer was mostly the fact that I love the outdoors... this directly pertained to the kind of work I want to do after I graduate (stormwater management, erosion control, safe circulation, etc).”

“An opportunity to spend more time outdoors motivated me. Volunteering at Falling Run bonded me to that place, I have more connection and personal memories in Falling Run.”

“[Falling Run] has been one of the most rewarding projects I have encountered while in the program at WVU... Being a part of project like this has truly made my time in this program one of a kind.”
Building connections to community and nature are other themes that emerged in other interviews as well. The Director of the School of Design and Community Development Judith Wasserman observed, “This work and commitment goes well beyond the classroom, and stretches far into the community” (letter, November 2016). Project Coordinator Julie Robison stated in an interview for a WVU Davis College Newsletter article (Willey, 2017):

“When all is said and done, this will be a place where you can really go and get away and experience a very pristine nature close to campus. I think that all people need that. They need to be rejuvenated by nature, and this will be a beautiful place for that…”

A graduate student in landscape architecture, Arathy Gowda, made Falling Run the topic of her (2017) capstone project. Gowda interviewed several volunteers among trail crews and found being introduced to West Virginia’s ‘wild and wonderful’ terrain through the directed activity of trail crew participation was sometimes transformative, providing a whole new experience of nature – particularly for international students from dense urban areas. For example, she interviewed a student from Bahrain, who said, before his experience of volunteering:

“I would not go to Falling Run to walk on the trail. My friend asked me to volunteer for trail building, and I agreed. I was not expecting to like being out here. After spending all morning building trail, I feel more connected to this place. I would like to come back.”

The WVU Service Learning Operations Coordinator Leah Cunningham observed that service connected incoming freshman to Morgantown (WVU Today, 2016):

“By doing service, we’re exposing them to the larger Morgantown community very early on, so that they take ownership… they feel they’re not only a West Virginian and a Mountaineer, but they’re a Morgantown resident as well.”

In his statement during Falling Run’s ribbon-cutting ceremony, the student body vice president Blake Humphrey emphasized the project’s contribution to developing a more cohesive university and a collaborative relationship with the community (LeRose 2017):

“One thing that struck me about this is it is a legacy project for WVU… This is going to be something that, not only students, but community members can benefit from… I think that the collaborative aspect of this — the fact of working in teams, coming up with solutions, producing a product — that is really the heart of ONE West Virginia University.”

4.4.2 Recognitions of Service

In researching ‘genuine participation,’ Segalowitz and Chamorra-Koc found “intrinsic motivation, participation self-efficacy and positive group effect can serve as reliable metrics for measuring the quality of participation experience.” (2019, p. 199). One measure of opportunities for ‘genuine participation’ during Falling Run’s design and implementation is awards; several key individuals were recognized for their leadership and service. Landscape architecture student Morgan Southall was recognized with the President’s Volunteer Service Award after leading thirteen trail crews in three months. Another landscape architecture major, Dan Wilson, led eleven crews in six months and was recognized with WVU’s Student Award for Excellence in Civic Engagement. The Falling Run Volunteer Coordinator Kate Bolyard, a master’s student in Health Sciences, was likewise recognized by WVU with the Kenneth Gray Leadership Award for student engagement. The author was recognized by the Davis College School of Design and Community Development Outstanding Service Award twice (2016, 2017), and by the Council of Educators in Landscape Architecture (CELA) Service Learning Award, Junior Level (2017).

4.4.3 Benefits to the Landscape Architecture Program

Program Chair Charlie Yuill called attention to the benefits of service learning for the Landscape Architecture Program, in terms of visibility and engagement (letter, November 2016):
“This visibility has taken many forms, including project specific community engagements working with stakeholder groups, student involvements from throughout the University, and in the case of the Falling Run project multi-college cooperation and collaborations. These engagements have been… acknowledged in various University and Community media outlets… [contributing to] the Program’s continuing commitment to service learning and civic engagement – particularly within the context of the landscape of the Central Appalachians.”

4.4.4 Benefits to Greenspace and Accessibility

Offering Falling Run trail-building as a service opportunity during Welcome Week 2016 assured greenspace a position in WVU’s growing ‘culture of service’. According to the Service and Learning Center, WVU students recorded 10,236 service hours in the Spring 2017 semester. Of these hours, only 6% were at Falling Run Greenspace, demonstrating the scale of students’ service contributions within the community.

The volunteer effort at Falling Run Greenspace inspired WVU’s Core Arboretum director Zach Fowler to engage volunteers more actively; volunteers logged over 1,000 hours at the Arboretum in 2017, mostly during ‘Workday Wednesdays’ (personal communication, December 2017). The WVU Organic Farm adjacent to Falling Run now offers Volunteer Tuesdays. Various organizations have borrowed Falling Run’s trail crew tool trailer (stocked to equip 200 volunteers at once) to construct trails; there were fifteen such trail projects around Morgantown during Welcome Week of 2017. In 2018, Morgantown’s Board of Parks and Recreation (BOPARC) began to consider expanding volunteer opportunities at parks near campus.

As of September 2018, Falling Run’s 2.7 miles of built trail averaged 7.5% slope despite the site’s steep topography. The primary trail was graded in at 5% to meet Americans with Disabilities Act (ADA) standards, providing universal access to the site’s key features (stream and falls). Secondary trails at Falling Run typically feature a 10% maximum longitudinal slope, except where they utilize historic logging roads. In contrast, trails at the 91-acre WVU Core Arboretum present barriers for universal access, with maximum slopes over 22% on the easiest trail connection to the Rail-Trail, and with stretches on Cliff Trail exceeding 59% (Falling Run Master Plan, 2018). Falling Run’s gently sloped trails provide access to recreation and urban woods for people of all mobility levels. West Virginia Land Trust’s Rick Landenberger applauded Falling Run’s inclusivity, calling the work of the author and students “precisely the type of efforts we so desperately need in West Virginia, where safe, easy access to public outdoor recreation is limited” (letter of support, November 2016). Falling Run is significant because few central urban woodland parks are being established today, and few parks in the steep terrain of West Virginia feature accessible trails.

4.4.5 Enhanced University-Community Partnerships

Falling Run is a ‘legacy project’ not only for generating civic engagement, and improving greenway connectivity and universal greenspace access in Morgantown, but also for contributing to the connectivity of key players in Morgantown’s planning. The successful implementation of the project resulted from ‘buy-in’ from key players at critical steps of the master planning process. At Falling Run, this stage epitomized an inclusive community-driven design process; ongoing dialogue with stakeholders informed decisions at multiple stages.

Networking during Falling Run has contributed to several additional community and university greenspace projects. The author and her students in Spring 2018 began working with the Core Arboretum director on an analysis for preliminary master planning at Core Arboretum, which was established in 1948, but has never had a master plan. Landscape architecture students took the lead, conducing site analysis, participating in design charettes with alumni, and interfacing with the public and press. Landscape architecture students’ 2016 course-based contributions to public greenspace planning helped West Virginia Land Trust win over $125,000 for Guyandotte River Trail access points. North of Morgantown, Star City’s riverfront revitalization stakeholder charrettes, public meetings, and grant applications were similarly bolstered by LARC students’ work in 2018.
5 LESSONS LEARNED

Field learning or experiential learning is essential for landscape architecture students. At Falling Run, field learning offered LARC students opportunities to provide feedback and suggest changes to proposed trails and wayfinding, involving them directly in the design process (see Figure 4) – consistent with service learning efforts at other universities (Winterbottom, 2002).

Service-learning based greenspace master planning offers opportunities for leadership that augment students’ learning outcomes. The role of a professor is to guide students in the design process, even if the scale of the project requires multiple semesters and the input of several cohorts of students -- rather than attempt to single-handedly catalyze the larger design process.

Recommendations for similar service-learning projects are as follows:
- Accept a longer time frame for the master planning process. To leverage student effort in design-build work, the design process may need to span multiple semesters.
- Let students benefit from tackling separate portions of a master plan in different classes, to keep service-learning projects closely tied to curricula and course objectives.

Figure 4: Students measuring slope (with a clinometer) while flagging trails at Falling Run in 2016 compared to the nearly the same area as built in Sept. 2018. Photographs by author; students completed a media release.

6 CONCLUSION

Falling Run Greenspace has the potential to become Morgantown’s central park, as well as an educational complement to WVU Core Arboretum. This paper outlined how, for landscape architecture faculty with a background of professional practice, Falling Run's community-driven design and volunteer-based implementation required a different process of practice, inasmuch as the design lead had to serve as the ‘change driver’ to keep the project’s momentum going, as well as to advocate for the vision that change was needed. According to organizational change theorists Whelan-Berry & Somerville (2010: 177), “there are change drivers that facilitate the implementation of change… [and] drivers of the necessity for a change.” The key element throughout Falling Run’s master planning and implementation was effective social mobilization. The community-driven design process used in this project required considerable time for networking, by the landscape architecture faculty design lead for the project. While administration supported 705 faculty hours specifically for the project's master planning from 2014 to 2017, the project’s design and early implementation required more than twice that amount of time. Organizational research has found that successful change requires an effort to “work with social networks and tap their influence” (Stouten, Rousseau and De Cramer 2018, p. 776).

Landscape architecture students developed important field skills through direct experience with planning and restoration work at Falling Run, with assignments involving ecological restoration, stormwater calculations, bridge siting, and analysis of commuting patterns. Students further developed skills in native plant identification, invasive species management, and working with topographic slopes to minimize disturbance. The active participation of Landscape Architecture students as trail crew leaders shows the efficacy of course-based service learning projects for promoting civic engagement. Service-
learning coursework gave landscape architecture students an investment in the greenspace before construction began.

Intense volunteer involvement and student design work further contributed to the cultural sustainability of the project and civic engagement. The mobilization of incoming freshman volunteers in small trail crews during of Welcome Week in August 2016 set a powerful precedent for civic engagement of the WVU student body, initiating the framework for rapid implementation of additional greenspace planning projects in Morgantown.

The sense of ownership fostered by volunteer and student involvement at Falling Run is a legacy for Morgantown and West Virginia University: Falling Run created its own stewards through the energy of thousands of volunteer hours during the project’s first years of implementation, further strengthening university and community relationships. As Shandas and Messer found in Portland (2008, p. 416), “By taking part in stewardship, community members can begin to reestablish the connection between their actions and the health of the environment.”

7 ACKNOWLEDGMENT
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8 REFERENCES
Connect Bridgeport News. (2017). Hundreds of WVU students, faculty and staff build and create 16 biking and hiking trails along Falling Run Stream; Ribbon Cutting April 29. Bridgeport, WV.


COMMUNITY DESIGN CENTERS (CDCs) ON THE UPSURGE: INVESTIGATING PERCEPTIONS AMONGST CDC LEADERS AND ADMINISTRATORS IN TEXAS

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1 ABSTRACT  
For decades, community design centers (CDCs) have specialized in providing professional design and planning assistance to non-profit groups and individuals that lack the funding or resources to otherwise receive such services (ACD 2016). Since the year 2000, the number of these CDCs has nearly tripled in North America, from just under 70, to over 200 organizations, covering ever-expanding disciplinary, and strategic territories (ACSA 2014). The purpose of this research was to explore the recent surge of CDCs in North America, and specifically Texas. This study attempted to elucidate, from the perspective of CDC directors in the state of Texas, what economic, environmental, and social factors underlie such growth. Furthermore, this study sought to answer what roles do landscape architecture, architecture, and urban planning play in the operation of CDCs. This research utilized qualitative methods informed by the “research act” of Gaber and Gaber (2007). Semi-structured interviews were conducted using open-ended questions to build upon respondents’ current knowledge of community design practices. The information obtained was analyzed to draw themes (Taylor and Bogdan 1984) explaining the upsurge of CDCs and to gain insight regarding the continued spread of CDCs and their practices. The findings of this research illustrate an increased economic, environmental, and social need for the services CDCs offer in Texas. The findings suggest an increased humanitarian awareness through service-learning and community-engaged design practice and education, and an open appreciation for multi-disciplinary practices which blend disciplinary boundaries amongst landscape architecture, planning, and architecture, under the unifying identity of urban design.

1.1 Keywords  
Community Design Centers, Administration And Leadership, Multi-Disciplinary Practice, Texas, Project Typologies
2 INTRODUCTION

2.1 Community Design Centers: Then and Now

The advent of community design centers (CDCs) can be synonymously "...linked to the community-based struggles of the 1960s that took place in the context of the civil rights movement, the rise of women's liberation, the anti-war movement, and the challenges of alternative cultures... all of which represented an upheaval of civil society" (Sanoff 2000, 2). Influenced in this manner, CDCs rose up in the 1960s as dedicated providers of planning, design, and development services to low and moderate-income communities (ACD 2016) which were documented and often explored amongst both professional and academic communities alike (Blake 2015; Curry 2004; Dorgan 2012; Sanoff 2003).

Entering the 1980s, however, national politics began to shift and widespread support of CDCs wavered, losing favor to a less government-funded, perceivably more business-led, economic development strategy (Taylor 1998). At this time, "in response to the economic and political pressures of the 1980s some community design centers remained..." (Sanoff 2000, 5) although their numbers eventually tapered.

Within the past few decades though, CDCs have once again experienced a resurgence. Since the year 2000, the number of CDCs in North America has grown from around 70, to over 200 organizations of various structures and capacities (ACSA 2014). Despite this growth, "little is known about the normative underpinnings of CDCs, how successful these centers have been, which factors have contributed to or impeded their success, and how they have responded to the changes in social, political, professional and economic contexts" (Tural 2011, 2).

2.2 Purpose of this Research

The purpose of this research is to document the current state of affairs for Texas CDCs, at a time when their increased presence demands attention (Tam 2011; Tural 2011; Zhou 2011). Specifically, this research sought to determine if economic, environmental, or social factors are underlying this growth. Simultaneously, this research attempted to interpret disciplinary boundaries within CDCs to determine what role, if any, the professions of architecture, landscape architecture, and urban planning play in the spread of CDCs in Texas, and by extension North America.

3 LITERATURE REVIEW

3.1 Community Design Origins

Throughout the urbanization and cultural development of the United States, a rich history of not only physical, but social and political change has followed (Hartshorn 1992; Mehrhoff 1999). In much the same way, through numerous paradigm shifts of planning and design, community design evolved within both the historical and theoretical environment of the 1960s and 70s, "...in the context of a general upheaval of civil society in the USA which included the civil rights movement, the rise of women's liberation, the anti-war movement, the student protest, together with more militant labour demands and the challenge of alternative cultures which were destroying the myth of a conflict-free, post-industrial society, and shaking the basic mechanisms of social control" (Castells 1983, 49).

By its own definition, community design is its own movement, focused on giving that control back, through the creation and management of built environments for people, by the people. Ranging from the neighborhood to regional scale, community design embraces a variety of practices, which can be summarized as addressing the needs of the people, their everyday environments, and highlighting their empowerment and participation to leverage environmental justice (Hester 1990). Motivated by these goals, community designers work towards addressing social, economic, and political issues in relation to the built environment (ACD 2016). In doing this, "the study of cities is a dynamic, multifaceted area of inquiry that combines a number of disciplines, perspectives, time periods, and actors" (Mehrhoff 1999, vii). As a result, the professional roots of community design lie not within a few, but several disciplines: architecture, landscape architecture, city planning, social work and environmental psychology (Hester 1990).
3.2 Community Design Centers

Brought about during the 1960s, community design centers were created in dedication to the provision of planning, design, and development services in low- and moderate-income communities which would normally lack the funding or general accessibility to receive such services (ACD 2016). Since its first inception, however, a number of CDC models have been incorporated throughout North America which either build upon or narrow the scope of such services. An understanding that CDCs can also be differentiated by typology is important, as “the CDC typology sets up the framework for understanding and classifying the plethora of CDCs that have proliferated since the 1990s” (Tam 2012, 7). These typologies include private for-profit CDCs, university-based CDCs, NGO’s and non-profit CDCs, municipal-based CDCs, as well as an assortment of hybrid CDCs which adopt some form of organization from the other typologies (ACD 2016).

With these infrastructures, CDCs of the 1960’s expanded in numbers well into the 1970s before social and political changes inhibited their reach. Yet, the distinct decline of active CDCs in the 1980’s, only brought with it a new era of burgeoning growth in the 1990’s. According to Cary in an Association of Collegiate Schools of Architecture’s (ACSA) survey (2000), over fifty percent of current university-based community design programs were initiated during the 1990s. Accordingly, many authors specifically noted the practice of community design/build education throughout the United States to have grown since the 1990’s as well, although the reasons for this are not completely understood (Goodman 2014; Schuman 2000). As such, considering the current inventory of CDCs across not only North America but the state of Texas, this resurgence would appear worthy of further research. In doing so, "knowing why the practice becomes popular at particular historic moments is key to understanding its utility for the profession and for the communities it claims to serve" (Goodman 2014, 504). With a history of less than fifty years, the CDC model remains open to study and interpretation, and in particular to examining the role of architecture, landscape architecture, and urban planning professions to the development and growth of CDCs (Pitera 2015).

4 METHODOLOGY

This study followed a qualitative research design consisting of several sequential steps. These steps included: establishing research questions, defining a study population and location, data collection, organizing and analyzing data for its observations of reality, identifying data limitations, and presenting the research results (Gaber and Gaber 2007).

As such, spanning across the state, this study population was decidedly limited to Texas for reasons of not only accessibility, but practicality, and potential diversity of both rural and urban perspectives. Once this was determined, the study concentrated on fifteen recognized CDCs which currently exist in the state of Texas (ACD 2016; ACSA 2015). Data for this research was based on semi-structured interviews that allowed the researcher to ask exploratory and descriptive questions (Gaber and Gaber 2007) which sought the input of these CDC leaders and administrators due to their current position and knowledge of CDC operations in their practice. Designed to elicit open-ended responses, a set of secondary interview questions were consequently meant to elaborate upon the original research questions, and were formulated and heavily influenced by findings from the literature review. These interview questions specifically asked:

- How long have you been in your profession, and how long have you served in your current position?
- What is your educational background, and how, if at all, do you feel it may have helped prepare you for this position?
- Can you briefly describe some of your previous work experience which you feel may have prepared you for your current position?
- Can you provide a brief history of why this organization was established?
- Can you briefly describe the organization's scope of work or type of projects it undertakes?
- Who would you say composes the most significant portion of your clientele?
- What percentage (%) of your project portfolio would you say emphasize primarily: economic, environmental, or social issues?
- What percentage (%) of your project portfolio would you categorize as primarily:
architecture, landscape architecture, or urban planning-based services?

- How would you rate or assess the importance of architecture, landscape architecture, and urban planning, as applied to your organization's practices and why?
- What do you feel is causing the recent increase of CDCs across North America?

The interviews were audio recorded. Phone interviews were also scheduled at the participants' convenience and (conducted over speakerphone) and audio recorded. Each of these interviews were later transcribed verbatim into electronic text. Once the transcription process was complete, data obtained from each of the respective interviews were then organized by interview questions and then analyzed through the process of content analysis (Gaber and Gaber 2007). Differences and commonalities were noted and compiled to draw themes for studying the upsurge of CDCs and to gain insight regarding the continued establishment and practices of CDCs in Texas and nationwide.

It is important to note that the conclusions drawn from the interview data were subject to particular limitations and biases, as analysis of the data was based upon certain assumptions that were inherently part of the research process. For instance, the results of the interviews were based upon a sampling of CDC leaders and administrators in Texas who responded to the interview questions based upon their own unique perspectives. These respondents vary not only in their personal and educational backgrounds, but by the particular geographic locations and the human populations that they serve as well. Their responses, therefore, may not fully be representative of the majority of CDCs across Texas nor North America.

5 ANALYSIS AND FINDINGS

5.1 Participants' Profiles

Out of 15 recognized CDCs located throughout the state of Texas, this study interviewed 11 leaders and administrators (7 male, 4 female) representing all but 3 CDC organizations. These participants currently operate under a variety of titles, including, but not limited to: director, co-director, program coordinator, manager, founder, and co-founder. In addition to this, 27% of respondents actually hold these titles concurrently, within multiple CDC organizations. This is important to note, as respondents' views and opinions may ultimately be representative of more than one CDC organization.

5.1.1 Participants by Profession. That said, all participants were asked the same series of questions regarding their professional, educational, and experiential backgrounds. In response, 46% of the participants identified their profession as planning, and 36% stated it to be architecture. Meanwhile, somewhat unexpectedly, 18% of participants actually self-identified themselves as professors. This is of particular interest, as upon further investigation, 46% of the remaining participants currently teach in academic institutions as well. This infers a minimum of 64% of participants have academic connections, as opposed to being strictly a working professional.

5.1.2 Participants by Years of Experience. In terms of professional experience, a relatively diverse sampling seems to be represented as well. With an average number of 25 years experience, 36% of participants fall between 9-12 years, while 36% have over 40 years professional experience. Once compared by profession, however, those numbers seem to skew considerably. By years, those in architecture seem to have the most experience overall, with an average of 39 years in the profession. While planners, on the other hand, had an average of 16 years experience; less than half the average as those in architecture. By professional comparison, this trend holds true similarly in regards to the number of years each participant has held their current CDC position as well. For those in architecture, the average was significantly higher at 13 years in their current position, versus those in planning at 3 years.

5.1.3 Participants by Educational Attainment. In regards to educational attainment, 100% of participants hold a bachelor's degree from their respective fields of study. Of them, nearly 50% obtained their professional degree in architecture (B.Arch). Moreover, out of all participants, 82% also hold master's degrees. Similarly, nearly 50% of those with master's degrees have it in urban planning. Educationally speaking, why is architecture the dominant bachelor's, yet urban planning a dominantly held master's?

From the interviews, two possible answers to this question are revealed. For one, 27% of participants identified their degree in urban planning as complementary to an architectural background, particularly as applied to community design processes. Regarding this topic, participant 1 (P1) explains, “I have this background where I know a fair amount about design... but also, I have the planning background and municipal experience of how cities operate, that all pull together so that I run this interdisciplinary
center with all those things combined." Furthermore, coming to urban planning with a design background offered an advantageous opportunity for participants to bring their design skills and to look at urban issues from not only a policy perspective, but in terms of micro-scale urban design issues (P7). Not the least of which, participant 5 simply states it to be an educational combination which provides both the administrative and design background useful for planning positions (P5).

Besides being professionally practical, however, the other reason 27% of participants cite is of a more personal nature. "I've always taken a sort of environmental slant, sustainability slant - in my personal interests and in work. And pursuing my master's in planning, really was a great way for me to look deeper into issues I cared about - about spaces, and community, and sustainability" (P4). For these participants, there was a desire to work more with the community. Seeking opportunities to do more community engaged work in their careers or profession, some participants found such work architecturally less accessible to come by (P8). In other words, "I just felt that it should be more... as an architect practicing, for me the question was how can I be relevant to the place I live, and how do I have my work not be disconnected from that" (P9). Seeking this sense of purpose and satisfaction, participants expressed an appreciation for architecture school as having prepared them as a designer (P8), "but as far as being able to actually work with people... (laughter) and, you know, consider all of those other things, outside the walls of a building, I think planning school was really essential for that" (P8).

5.1.4 Participants by Work Experience. Still, as one participant gave credit, "I basically learned in the School of Reality" (P2). More to this point, the practical work experience of these participants was also considered. Amongst the most common, approximately 64% of participants described working in the private sector; spanning from entry-level or research positions, to firm principals and founders. These participants shared a variety of ways in which this influenced them in their current position.

For some, this may have been distinguished by the work they did, mostly in regards to the public arena and on public buildings (P8). For others, it was noted for the practical skills that they learned, which included budgeting a project, scoping a timeline, and really just managing a project from beginning to end (P4). Such experiences in the private sector, as being provided with a set of parameters, billing rates, and other very prescriptive information, were cited as being of the most value to participants, as applied to their current CDC position.

Besides this, 36% of participants had experience in other public-sector planning ventures, both long and short term, dealing with transportation related projects, transit oriented development (TODs), traffic congestion, and issues of walkability (P7). By and large though, most common amongst 73% of participants was experience in the classroom. Reminiscent of the first question, this implies teaching may play a special role amongst the participants; significant enough for them to not only mention, but completely define their profession by it.

5.2 Findings: Themes from the Data

Through learning about the participants' backgrounds, the goal is to promote a more insightful and enhanced outlook for analyzing the remainder of the interviews.

5.2.1 Organizations by Purpose. For example, when asked to describe why their organization was established, 45% of participants responded specifically in regards to students' engagement. "We had to find a way to do projects that would be interesting for students and useful for the community" (P2). Here, a very direct connection may be made linking the participants' experience teaching, to that of their organizational mission. Many of these CDCs, at least partially, started off to get the students out of the studio and into the community (P2) and in some instances, were "...established circumstantially, by accident really, as a means of getting graduate students involved in hands-on construction of buildings - to learn more by making buildings at full scale" (P11). These CDCs offer opportunities where students can actually get out into the community and have real world projects and real world clients (P2). In addition, through the processes and services they offer, university interns, for instance, are gaining invaluable real-world experience which they can in turn put into their portfolios, and resumes, and utilize for future employment purposes (P1).

Academically, this goes beyond just student engagement. Research is cited amongst 27% of participants as another primary goal of their existence. For those organizations, their main purpose is to function as a home for research to be discussed, initiated, and distributed to others of common interests.
and mindsets (P4). In such a way, these organizations work to foster, develop, and execute sponsored research projects within their respective academic institute or department (P6).

Also, in the case of some CDCs, their creation was spearheaded by a private group of stakeholders engaged in downtown redevelopment (P10) or in developing design guidelines for downtown (P5). Twenty-seven percent of participants identified private sector development to be a primary concern; "...to provide some professional expertise to help facilitate private-sector issues to do with integration of new development into neighborhoods, like infill development" (P5).

Despite this fact, whether downtown focused or not, community engagement is what was cited as really instrumental here (P10). The overwhelming majority of participants (91%) specifically stated their purpose as just trying to be more of a community resource for design (P8). "I always thought it would be great to have a design-oriented practice that was based in communities" (P9). In such a manner, CDCs may lend themselves to offer a variety of planning, research, and design services that a particular community needs.

5.2.2 Organizations by Scope of Services. Indeed, the scope of services offered by several of these organizations would appear relatively extensive. A total of 73% of participants, through their respective organizations, offer design services, as well as 82% offer planning services. In one aspect, design services may address common, everyday needs by offering private, local businesses assistance with business facade renovations, landscaping, site plans, or even interior design work (P1). Working with neighborhoods, "we help them with visioning different things... sprucing up their neighborhood... landscape improvements to their entryway, or signage design for their entry, or street toppers, or open space improvements" (P1). In terms of planning, however, these services have a broad range of implications, which includes analysis of regional planning activities, regarding projects of over 10,000 sq. miles, to urban design scale projects, and everything in between (P6). As evidenced, by a number of projects both big and small (P7), the scope of these services may include aspects of a more administrative nature as well. Examples of this would include the evaluation of design proposals for historic preservation and design review purposes, as well as for downtown overlays where a particular design criteria is desired or required (P5). Through this sort of design assessment, the disciplines of planning and design combine to produce master plans, comprehensive plans, redevelopment plans, transportation plans, and economic analysis (P7) while attempting to address questions of appropriate building materials and urban design (P6).

This leads into research aspects, which 45% of participants acknowledge as vital to their operations. By collecting data, providing data cleanup services, and further processing that data for analysis, these services are invaluable to give back to a city or community which may use the findings from that research as the basis for future decision-making (P7). In a similar fashion, grant writing for faculty and staff is equally important (P4). Administratively overseeing research opportunities, a number of projects looked at downtown walkability qualities, high speed rail, and quality of life impacts, and lead to further research on affordable housing and a slew of other related topics (P7). In this light, over half the participants also placed an emphasis on affordable housing options, working in some cases "to develop accessory dwelling units (ADUs), which are like a second house, basically, in the backyard of a single family lot. We help homeowners and community organizations develop ADUs as an affordable housing option in the neighborhood" (P8). In many circumstances, this leads into policy work as well. Lobbying and collaborating with different city agencies, CDCs can impact and influence changes in development ordinances, making it more accessible or cheaper to build" (P8). Forty-five percent of respondents similarly cite policy work, oftentimes such work is related to public health, for example, the impacts of infill development on air quality (P3, P8). Such a multitude of activities cover the gamut of services which CDCs are currently offering throughout Texas. As perhaps best expressed by participant 9, "there are times when we can look like an architecture firm... but you'll discover that there are things that we do, that are outside, far, far outside, what would be basic services within the [architecture] manual."

5.2.3 Organizations by Impact Area. In addition, the work that these organizations are doing, may oftentimes go beyond their local jurisdiction. Stretching across the entirety of the state, 45% of participants take on projects in an ongoing capacity, as well as project by project basis. Taking this even further, across state boundaries, 36% take on national endeavors, while 27% of participants cite ongoing or previously completed projects of an international nature. This begs the question, who in fact are these community design centers serving?
5.2.4 **Most Significant Clients by Sector.** When asked who constitutes the most significant portion of their clientele, this inquiry becomes more intriguing. "That's hard because the public is our client. And the public has a broad cross-section" (P9). Understandably, based upon a project's geography, "that context helps to define sort of thresholds of more immediate stakeholders or immediate clients" (P9). Therefore, clients can range anywhere from non-profit organizations, to municipal governments, neighborhood organizations, or even a modest family (P9).

Governmental, institutional, or municipal-based work was most common amongst 45% of participants, who cited projects for public elementary and middle school campuses alongside works with the city parks department (P11). In addition to this, several participants acknowledged Texas cities to be a huge part of their daily clientele (P4). Lastly, "in regards to funding through the center - if you look at it by dollars - the largest stakeholder funder has been the US Department of Housing and Development (HUD), followed by various State of Texas agencies. We've also had funding through other things: the US EDA, the US Department of Defense, the Department of Energy - we do a lot of studies with CITY 6 and COUNTY 6" (P6).

For the remainder of participants, "I'd say it's split pretty evenly between non-profit affordable housing providers, and long-time homeowners who are on a restricted income" (P8). Along with non-profits that are engaged in the community (P10) the private sector would appear equally important amongst participants. "Well, the thing is, not necessarily financially, but we always have ongoing work in regards to downtown redevelopment. That's central to our mission" (P10).

What is perhaps more notable though, was what was learned regarding the value that participants place upon creating projects. Twenty-seven percent of participants remarked "...what we have found is that it's also necessary for us to reach out on our own, to generate the kind of projects that need to be done, rather than just waiting for other non-profits to come to us" (P3). By this, "...in some cases we actually are inventing a project to help us do a level of R&D around a particular segment of work" (P9). At the same time, "there have been other, sometimes entirely opportunistic projects that come along, because it's always difficult to keep a private, non-profit floating" (P3). For this reason, over half the participants (64%) stress the benefit of partnerships, not only for projects, but for overall organizational support and success. "We couldn't do what we're doing if we didn't have the university's assistance and buy-in to the program and support of it. So it's very important that you reach out to your community partners and get them involved because that way it's just a stronger operation over all" (P1). Collaboration, therefore, helps to facilitate projects and build clientele. Once these relationships are formed, "instead of us going to the community to get projects, they call us! They call us and ask for help, for a particular project, or design, or research. And we evaluate their needs and we see if this is something that we can do at CDC 7 and then we get back to them" (P7).

5.2.5 **Project Portfolios by Emphasis.** In such a manner, these organizations' project streams are dependent upon a variety of factors. Firstly involving the client, this may heavily influence and produce project portfolios of a particular nature. Keeping this in mind, the next question is influenced by Scott Campbell's Sustainability Triangle (1996) and seeks to understand what percentage of these organizations' projects emphasize primarily economic, environmental, or social issues. Undoubtedly, in posing this question, there was a notable amount of respondents (36%) who found this question difficult to answer. "That's hard to say... it's so mixed up, it's hard to separate it" (P2). Along with long pauses, "...oh, that's a hard question..." (P4) and "Well, it would be hard to put into percentages..." (P7) were very common initial responses. In this manner, for the majority 64% of these participants, they were emphatic that "every project does all of the above... I mean, they're just part of what we do" (P2). Adding onto this, "I would say most of our projects are a combination of all" (P7) and "one of the things you should understand... every project we should be doing all 3 of those things, simultaneously" (P3). Therefore, what was stated definitively in response to this question, "I can't do it...I can't really separate these. So what I would tell you, is in our work, the economic, environmental, and social issues, all of them come to bear in different weighted emphasis, based on context" (P9).

Correspondingly, 27% of the participants corroborate this notion; acknowledging a certain amount of subjectivity based upon both client and context. "It depends though, as certain clients are more heavy on the environmental piece. Some clients are more heavy on the economic piece. So, it sort of depends on who we work with" (P8). Still, for those participants who responded in terms of percentages, these values tended to vary all across the board.
Interesting in this regard, these spanning percentages would appear strongly divergent, in part, due to the typology and circumstances of the particular organization. As previously determined from the literature review, CDCs may be differentiated by a number of variables, based upon context, mission, organizational structure, budget, its scope of work, as well as position on Campbell's Sustainability Triangle regarding its economic, environmental, and social interests (Campbell 1996; Tam 2012). As evidenced by participants' responses, it would also appear that by taking the average of these percentages, a more-or-less equivalent outcome was the result. Even with a slight economic emphasis, these findings would in fact seem to confirm what participants have stated that "those are obviously very intertwined issues" (P4) and that despite a number of variables, it is in totality by the sum of its parts, that "it can be weighted, but ideally all 3 are always present, in every project" (P9). To this affect, as participant 2 put it, "I mean basically its design, so... everything else is secondary to design."

5.2.6 Project Portfolios by Discipline. This begs the following question as to which of the traditional design disciplines might be most prevalent or represented by their works. Accordingly, participants were asked what percentage (%) of their project portfolio would be categorized as primarily architecture, landscape architecture, or urban planning-based services. Similar to the last question, however, "I try to not have them be so clearly separated" (P9). Rather, 36% of participants emphasized cross-discipline or the interdisciplinary nature of what they do. "What we're seeing right now... is the funding streams, the projects, and the need, aren't really falling into one of these categories. So, I think that what I am seeing in terms of funding opportunities, and just in the opportunities that we are interested in pursuing because they are exciting and bigger projects... are really more and more interdisciplinary in nature, where they want teams from different disciplines coming together to tackle a problem" (P4). This sentiment was echoed by others, in that "our practice language isn't around those disciplines... they're more around storytelling, mapping... and these terms that are about what we are doing, and ideally its cross discipline... it's about having all the skills and talents present, not talking about it as one or the other" (P9).

Still, in terms of percentages of their organizations' project portfolios, several participants shared their insight, and based upon the findings, a variety of practice models are clearly demonstrated. Yet, when calculating the average of these percentages amongst CDC organizations, architecture made up an estimated average of 44% of project portfolios, while urban planning-based projects accounted for about 38% and landscape architecture projects came in at about 18%.

These percentages may possibly indicate a number of things. "If you asked me this question 3 years ago, I would say we were probably 85 to 90% urban planning based services... that's really changed a lot lately (P4). Similarly stated, "when I came here, our projects were almost all of them planning-based. But I'm so glad to see that now, we are bringing projects that are more interdisciplinary" (P7). Based upon input from these participants, and without any previous knowledge of the researcher, those organizations previously offering primarily urban planning-based services, are now (at least here in Texas) expanding into other fields. This revelation, if at all represented through these percentages, would then lend credence to the interdisciplinary nature referenced by a majority of participants. Putting that aside, however, participant 11 remarked of their project portfolio that "100% have a strong urban design component," while participant 10 corroborates "all these form and address the urban design."

5.2.7 Prominence of Disciplines. This statement brings up yet another point of inquiry. Are any of these design disciplines more important than another? As applied to their own organizations' practices, participants provided insight into this question. Insight which unapologetically led down a familiar path. "Again I can't rate one more important than another - it depends on what the situation is" (P9). Once more, "well, I see them all... (laughter) as the same thing. It's like a figure ground, what's more important, the figure or the ground? You know, you don't have one without the other" (P10). Thirty-six percent of participants made similar comments of "... we don't make any real distinctions between those - all of it is design. So whether you are designing a landscape, or a building, or a city, it's the same kind of process of design... I can't really separate those specifically" (P2). Decidedly put, "they're the basis for the lens at which we look at issues and try and address things. So, I wouldn't pick one over another, because again, I think they're very interrelated" (P4).

Not unlike previous questions, cross-discipline or interdisciplinary practices were coveted by 45% of participants as being key to their organizations' practices. "Bringing that kind of expertise in urban design, and architecture... the person we had who was in charge of the office had degrees in both landscape and architecture and also planning, so they were able to bring that combination of skills to the
situations" (P5). This level of expansive knowledge and expertise finds much appreciation by others as well. "When you look at the skill in CDC 9 today, we have architects, landscape architects, planners. We also have individuals related to urban studies, urban geography. We have folks with backgrounds in history, anthropology... and so, it's cross discipline, even beyond the design professions" (P9). From a community design perspective, this makes both logical and practical sense as "each of the various disciplines brings a lens to the work, that can help round out our work activities to be more complete and more responsive to the public's interest. And also to incubate variations of ideas, because they're informed by these kinds of different trainings and backgrounds and interests" (P9). For this reason "I think they are important individually, but the best possible scenario happens when they work together... we come up with outcomes that are more comprehensive and are more ready to be implemented by practitioners" (P7).

Similarly, 27% of participants cite urban design as a unifier. "Urban design puts it all together, and I think that's the most important. It's not helpful to practice landscape nor architecture separate" (P10) because "they all rely on an urban design expertise to integrate specific site design decisions into the larger urban design strategies" (P11).

So it is, considering these responses, that 73% of participants cite either urban design or interdisciplinary practices as most important to their organizational operations. Yet, this overall perspective aside, participants were still able to identify for a variety of reasons why particular disciplines played a unique and essential role in their practices.

From their responses, 36% of participants cited architecture. "So, I think architecture still is a little more prominent, maybe partly because I'm an architect. But we work to try and balance that significantly" (P9). Almost out of obligation, it would appear 18% of participants cited landscape architecture, in combined support of architecture. "The vast majority of our clients are looking for visual representations of projects that they need help with. So it's kind of by default that architecture and landscape architecture skills kind of rise to the top... without the rendering and actual hard design skills of the architecture and landscape architecture interns, we wouldn't be able to run the center. So those are probably the most practical, most important skills" (P1). In further words of sharing, "our work is fundamentally architectural works, but they rely on the integration of landscape architecture in most projects due to the site constraints" (P11).

Another, 36% of participants cited urban planning services to be the most relevant and critical to helping communities define their own needs (P3). For financial reasons, as well, ",...if we simply do it by the dollars (laughter)... the urban planning programs are most important" (P6). In relation to the other disciplines, though, ",...I would say that an undercurrent of all of that is definitely tied to themes that come out of urban planning. So it's almost like the urban planning element is operating in the background, tying everything together. So it's a little bit harder to quantify it... it's not as obvious that we use that skill, but it is still really an important skill" (P1). When asked why, "I think that because the skills that planners bring to the table, really make the other pieces work much better... a lot of the things that we run into with the architectural side of our practice, are really related to city policy and zoning and different regulations around what you are allowed to build, where and how... you need a level of education or experience with the planning field, to be able to interact in that sphere" (P8). So it is supplementary, as well as independently that "I think that design centers would benefit from more people having that planning and policy, and urban design scale knowledge and experience" (P7). Considering what motive, it is because "when you get into this work... you find more and more ripples. And to really get in and understand those ripples, you need to have a perspective that can jump across scales that I think planning really helps with" (P8). Figuratively speaking, participant 6 further interprets "importance" as in relation to oneself, in terms of both scale and influence:

I think that there's a different way, in terms of importance - and I tell my students this - all of them will be asked in their professional lives to choose how they want to spend their influence. How they want to execute and make use of the influence they have as a professional. And you can imagine that as a spectrum between influencing a few people a lot, and influencing a lot of people a little. So if you want to influence a few people a lot, go and design their house. Because they'll spend a lot of time there, they'll raise their kids there, it's where they'll wake up in the morning, it will be part of who they are. If you want to influence a lot of people a little, then you work more planning scale. Where people might not visit or pay attention to everything about a city in a given day, but there are parts of the city that kind of filter out through ambiance and impact their lives.
Deeply rooted and contemplative, this response thoughtfully leads into the heart of this research and to the final question at hand: what are the reasons for the recent increase of CDCs across Texas and North America?

5.2.8 Increased Presence of CDCs. With insight from these leaders and administrators, 55% believed that the need for these services CDCs provide is imperative. "There is a huge need" (P4) and the possible reasons for this are multi-faceted. "The role of municipal governments to not plan and to not have design skill, that's one. So you need to find a way to augment that" (P9). On more of a political level, as participant 3 states, "government has taken a serious turn to the right, both at the federal level and state and local level. And so it leaves people who are the most vulnerable at risk... so there is a greater need" (P3). How this view might compare currently in relation to the rise and fall of CDCs historically, is not at this point verifiable. But certainly "there are things that community groups need that design firms cannot deliver... and in part, they can't deliver because of the way cost structures in firms work. There are many communities that cannot afford to pay for, we'll call it retail design fees" (P6). Economically then, lie several challenges. In response, CDCs may provide services to these groups but "...have cost structures which allow quality work to be done with different kinds of overhead" (P6). Indeed, in order to meet the demand, a number of participants utilize alternative operating and funding processes in their daily practices. Some charge nothing for their services. "By not charging anything for our work... providing a free service to the community... helps people save money... that's how we provide our value" (P1). Others charge at a reduced rate. "We still charge them to pay our GRA's salaries, but that's all we charge. So we provide them with a service that costs them a fraction of what a planning firm would charge them... So because of that, many of our clients are from small cities or towns that they can't afford to hire a planning firm to do the job for them" (P7). Although some organizations receive funding from the state, on a yearly basis, to provide services to the community (P7), others "...subsidize our design fees with grants and donations and other ways to pay ourselves. And we participate in a program with the city that reduces or eliminates all the development fees on their end, so our clients don't pay for like permit fees, or other things like that. So that helps reduce the costs. And then we work with contractors and engineers that help reduce the cost further, so that people can afford to build these units and rent them out at an affordable rate for a certain period of time" (P8).

In mitigating financial barriers, however, these organizations also attempt to address a multitude of environmental and social issues. Depending upon circumstances, the work of CDCs may also serve dual purposes in "being able to supplement people's income with this rental piece, but also develop affordable housing for other families" (P8). Pursuing extensive issues such as homelessness (P10), "what we're trying to do is to construe - help people understand that CDC 3 is not just about housing. It's also then about providing environmental services to the broader community... and we do that by creating energy, by sequestering water, and by allowing the people to walk or ride the bus to work, rather than driving. Those all have consequences for public health as a whole community, not just those of modest means" (P3). These issues are on the table for many CDCs, with simultaneous goals of mitigating gentrification and "making sure our neighborhoods have opportunities for everyone. And that we maintain a diverse body in that neighborhood" (P8).

In addition, 36% of participants also mentioned that the growth of CDCs had something to do with age. "I think that younger people are much more interested in social implications of architecture now, and it's just a good way to channel your energy" (P2). In the words of participant 3, "I think people of your age have an awakened political consciousness and a recognition that design really should be for the public health and welfare... not just design for the rich" (P3). In some ways, by this statement, CDCs "both grow from a critique of postmodernism and elitism in architectural practice" (P11). And so, "it's both increased capacity of the young people and the greater need. I think, that's one of the things that has made the public interest design movement as successful as its been" (P3). Still, "I don't know that this is purely a generational thing. Most of the guys, like me, aren't millenials, right? And we're kind of the old guys now, I would say, in this movement, but we're still not that old" (P9). Echoing this sentiment, "I'm old enough that I was part of the original movement for community design centers... there are also community development corporations and I was involved with one of those in the 1970s" (P3).

In such a way, it would perhaps seem that rather than being specifically age-related, or a generational factor, it is indeed a certain consciousness, an awareness, which is more so the unifying motivation. Collectively, "I also think there is just more of an awareness of how connected we all are, and
how nobody really benefits from people being held down in different ways, in different parts of their community" (P8). Whether professionally or educationally, participants cite a variety of experiences and events which have influenced them in their current position. For instance, "I mentioned that I had been in the Peace Corps, specifically, because I think that was certainly one of the biggest parts of my education. In other words, it gave me some insight at looking back at American culture from a very, very different perspective... it taught me a lot about what our culture is to others abroad. And so it gave me a new way to see it" (P3). Along with having influential professors and engaging in community-based projects (P9, P11), other experiences such as disaster recovery and relief (P2, P8), and the type of exposure where "I remember seeing first-hand, severe poverty, rural poverty" (P9), would seem very influential to the formation of humanitarian awareness. "So, I think that creates a sense of empathy, or at least an approach where empathy is a core value" (P9). A value which many participants undoubtedly employ while working with "home owners who had lost their homes, who were low-income... working in a neighborhood that was majority African American and Vietnamese families" (P8), and with "the Southern Ute Indian Tribe... trying to overcome what the government had done through the Bureau of Indian Affairs" (P9). These are but a few examples participants shared which harkens back to the original tenets of community design, addressing the needs of the people and striving for a more equitably just environment. Requiring qualities of a more insightful and cultural awareness, "...I quickly found out that you don't only need an architecture degree to do that, you also need some humility and relationship-building skills" (P8). Learning from those experiences, "the most valuable part of that work experience was... just sort of knowing your limitations, and respecting other people's experiences, and their own knowledge and their own expertise on what they need, the way they live, and what the priorities should be" (P8). By this, "I think this idea of designing and creating with a community, and amplifying their voice - not talking over them- and amplifying their expertise on the project or the issue at hand, is really, really important" (P4).

Likewise, undertaking private projects of a specific nature may help to raise the profile and awareness of their organizations (P7). One of the ways these CDCs are gaining more awareness is by marketing. "Well publicized programs... put it on the radar screen" (P10) because "you know, when one program is successful, another school looks" (P2). In this manner, universities are pushing it. "Within the university environment, from the upper administration of the university, there's support for and desire for community engagement. So it tacks (resonates) well within the university. You get perks a college or university likes. Alumni like it" (P10).

As such, universities also play a role in the expansion of CDCs across North America. From an academic perspective, providing practice-based, educational opportunities to its students (P1; P9; P11) offers the benefit of gaining experiential knowledge through service to communities. These are community engagement opportunities which, as previously mentioned, potentially drove a number of participants (48%) to obtain their master's degrees in urban planning. Likewise, "the publication of the 1996 Boyer Report (Building Community: A New Future for Architecture Education and Practice) was very influential and recommended the incorporation of hands-on learning and service learning into all architectural programs" (P11). To this extent, the services offered by CDCs are equally considered to be in service to private firms and practices as the eventual recipients of students being both knowledgeable and competitive in the employment arena (P9).

However, "I do think that because universities have engaged design centers within their curriculums, there are a large number of students that come out and they would like to do this. That said, they don't know how to make money - they don't know how to pay themselves doing it" (P9). Needless to say, this does not stop job searchers from aggressively seeking such opportunities. Speaking in further regards to employment, many private firms are now looking into the work of CDCs as well. "I think that new people entering the field... like emerging leaders and generations of people in every field are looking to have more of a social impact or a social cause behind what they spend their time doing. So I think there is just more demand from people graduating from school and people looking for career opportunities to have more of an impact and reason behind what they are doing" (P8). This is an employment demand that firms more and more want to meet. "I think that shows in the fact that not only are there more community design centers, but that these larger architectural practices, specifically, have now a social impact or community engagement piece to their practice. So there's FIRM 1, FIRM 2, FIRM 3... all of these ginormous firms are now trying to compete to provide opportunities to people coming out of school, or people starting to get licensed, and wondering what they want to do for a long time, trying to provide that fulfillment there as well" (P8). Participant 9 affirms this, citing "...a growing interest from firms to want to
participate more in public engaged projects, because their employees want to do it. Right? They want to do something beyond just design... so they're trying to figure out how they can engage projects that are engaging people in communities, because its more meaningful work" (P9). Understanding the market, "one of the reasons they want to focus on that, is that they're losing some of their most talented designers, because they are leaving to go to smaller firms or community organizations that aren't necessarily architecturally-based, because they are seeking those more fulfilling opportunities. And they feel like it is one way that they can retain the talent that they need, to be able to provide that opportunity in the firm" (P8). So it is, that an individual's awareness and desire creates a demand in the job market "and I think CDCs are an absolute reflection of that" (P4).

Similarly, "when you have a successful organization they inspire somebody else to do it. So they kind of accumulate. They grow because they work" (P2). In so much as these organizations actually do work or are considered successful, this in part would seem to inspire confidence. "More communities are now feeling empowered or wanting to have more of their own say about what happens in their areas" (P6). In search of this, "communities, obviously some more than others, are finding ways of finding their voices and identifying resources and people who are willing to work with them, and not for them... and I feel like, for me, in planning and in public engagement... getting out there the with, not for, is a huge distinction" (P4). Accordingly, through mutual learning and communication processes, CDCs are often able "to look at things a little bit differently and to lend a different voice to some issues. To not just be... you know, it's big brother, it's the government, it's some expert in an ivory tower, telling me what to do. But no, I'm at the table and I'm helping decide what happens to my space" (P4). Thus, by building such a rapport, "I think, maybe sometimes people have their own biases against city officials and government and everything. But they are happily working with CDCs - they can trust CDCs" (P7). This is an important distinction to make. "And so I think there is both a push by community members, and a pull by the economics of the situations, that allows CDCs to exist and to expand" (P6).

In some ways, it could be described as the "maturity of place" (P9) which accounts for this expansion. By this term, cities will naturally evolve over time, and shape themselves in accordance to a variety of factors. As a living and breathing organism, these cities have had to adapt "...to deal with more complex issues and find more dynamic ways to be able to deal with those complex issues" (P9). In response, the operations of CDCs "...necessarily keeps changing. And that's because we keep learning new things. And new people get involved - and uninvolved - and the conditions around us keep changing. In other words, urban cities are always incredibly dynamic. And you really... you can try to plan the future, but you never really can" (P3). Here in Texas, "...I also think it has to do with the civil rights movement and the relationship of the civil rights movement to the south, versus to the north, or east or west coast. It's a very different context. So, the idea of social justice, of what we call design justice, is even further removed and so I think we are more able today to engage the work, constructively, and have the resources to do it. Because the places have matured in their sophistication of how they're going to deal with issues. That's what I think" (P9).

6 CONCLUSION

6.1 Overview of Research Findings

Concerning the primary question of this research, a commonly perceived reason for the increase of CDCs across Texas and by extension, North America, is that there is a definite need for their services. Everyday environments in cities and counties throughout Texas exist in less than ideal conditions, suffering from aging infrastructure, and lacking both social and economic opportunities for sustainable redevelopment.

Often falling under the economic, environmental, and social tenets of sustainability, these various needs exist in seeming perpetuity. Although driving the growth of CDCs across the nation, as evidenced by this study, no one tenet proved to be more influential than another in regards to CDC operations. No doubt, based upon the particular goals and objectives of a given CDC, emphasis on particular tenets may exist, but are largely based upon the scope of services being offered. Findings from this research thus tend to confirm the opinion of multiple participants: overall, the economic, environmental and social tenets are held to be "equal."

Acknowledging that CDCs are driven in part by a psychological and physical awareness of these needs, it is then important to consider how this consciousness is developed. Whether it be through past
experiences, both personal and professional, it would seem that through awareness of these issues, an individual desire or determination is instilled. This was again, discussed previously in regards to why participants pursued a master's degree in planning; out of a passion or desire to make a difference. This might explain why 27% of participants were also involved in multiple CDC operations. In many ways, it is this unique individual desire and determination which drives CDCs to be not only started, but consistently operated and supported. Because there is a need for their services, and because individuals are either made aware of their economic, environmental, or social need, they start to care. Care enough that they get individually invested and demand these opportunities in their careers to empower others and even themselves through the processes of community design. "The reason why CDC 9 was established was because, number one, I saw we had a need for this function here, and selfishly, it's the kind of work I wanted to do" (P9).

Therefore, while the increase of CDCs in Texas (as well as in North America), may be commonly believed to be generationally motivated, it is also a movement which cuts across both generational and disciplinary boundaries. Inspired by an ever-present need, professionals in the fields of architecture, landscape architecture, and urban planning, are each called upon by the ethics of their respective professions to respond to this need. More to the point, it is the interdisciplinary actions of these professions in collaboration and totality, which most impacts the operations of CDCs in Texas. Individually, "the practices are... subverted... they're really not meant to be in charge. They're meant to be an enabler" (P9). Yet, in terms of enabling, it would seem an underlying connection between all of these disciplines is teaching. While collectively, the practices are strengthened by each other, particularly in pursuit of urban design issues, it is through teaching and the mutual learning process that 64% of participants ultimately connect that knowledge to others. Provided such a platform, an individual's passion and desire may then influence and be passed on to others. Asked why their organization was started, "actually 2 of my former students decided that what the world - or the world and CITY 3 needed, was a community design center. And so they were the 2 co-founders" (P3). Outside of an individual's experiences, it is in the realm of academia, therefore, with irrelevance to discipline, that the cycle of awareness is potentially continued. No doubt, there are limitations to what an academic institution can do. However, providing an educational and experiential knowledge to individuals may not only empower them with an awareness, but also the potential capability to help address the economic, environmental, and social issues which afflict any given community.

6.2 Relevance to the Professions of Landscape Architecture, Planning, and Architecture

While there is no direct benefit as a result of participation in the interview, participants have contributed to new knowledge about CDCs and why and how they are growing in Texas. These findings correspondingly carry with it several implications for the professions of landscape architecture, planning, and architecture.

To begin, in terms of CDC leaders and administrators in Texas, the results of this study would seem to imply an overall architectural dominance, both in terms of professional experience as well as longevity in their current positions. This authority is continued on academically, as 100% of participants who self-identified their profession as architecture, have teaching experience in their respective field as well. In addition, while 27% of the entire pool of participants concurrently hold titles with multiple CDCs in Texas, the entirety of these participants come from the profession of architecture. Altogether, these pieces of information suggests an elevated level of leadership, expertise, and social entrepreneurship, most common amongst those in architecture. Interesting to note, this is perhaps understandable, as community design practices can be traced historically to the profession of architecture via literature review (Bell 2004, Dorgan 2012). In such a manner, having nurtured the community design movement during its early stages in the 1960s and 70s, the current rise of the public interest design movement since the 1990s could appear to reaffirm this motivation. No doubt, as demonstrated by the results of this study, these strong professional connections are still evident and influential today.

On the other hand, planners still made up the slight majority of participants in this study and accounted for the highest percentage of master's degrees attained. In terms of percentages, planning services were also amongst the most offered across CDC organizations and composed a corresponding amount of these organizations' project portfolios, comparable to that of architecture. Likewise, in comparing the two professions, planning was held in equal esteem to architecture in regards to its
disciplinary relevance and application to daily CDC practices and operations. All this considered, as cited by participants, the profession of urban planning was also credited not only for its stand-alone benefits, but for multi-scalar visioning capabilities, and for its supplementary value to cross-disciplinary collaboration.

In comparison to architecture and urban planning, landscape architecture, it would seem, yielded an overall lower representation amongst not only self-identified professionals, but in terms of educational backgrounds as well. Even more noticeable, project portfolios of these organizations in addition to the discipline’s perceived relevance to CDC practices in Texas show similarly lower percentages for landscape architecture projects, as estimated by the participants of this study.

For this reason, it is important to reassess the current environments in which CDCs operate, and the role that landscape architecture plays within it. Some participants mentioned landscape architecture elements: "we're doing architecture right now with a community group and that includes all the landscape, so..." (P10) maybe it's that "I'd say... landscape architecture is only a part of it, of any project" (P2). Participant 11 discussed the centrality of landscape architecture to their practice though, "all our works have an orientation toward enhancing the stakeholder community through promotion of social gathering, and outdoor education, where appropriate, and by knitting the new gathering space into the existing institutions" (P11). This indicates, there could clearly be implications for landscape architecture, provided those type of projects referred to above are realized. Some CDCs may lack landscape architecture expertise: "I don't really have a lot of experience with landscape... I think that it plays in - sort of as the in-between scale between architecture and planning" (P8); or "we don't really do any landscape, mostly because we don't really have that expertise in-house" (P8). Indeed, as these statements are backed up by corroborating percentages from the research, it appears that a lacking, active presence of landscape architects in CDCs might be held accountable. If so, it is profoundly interesting to consider if the sum of these statements could imply a slightly diminished value of landscape architecture to current CDC practices in Texas.

Therefore, while new knowledge resulting from this research may be of benefit to participants and their respective organizations, this research also has the possibility to promote a deeper understanding of community design practices as they engage the profession of landscape architecture, in addition to urban planning, architecture, and other professions regarding community design and CDCs.

### 6.3 Suggestions for Future Research

Although this research was partly inspired to build upon the knowledge of previous studies (Tam 2012; Tural 2011; Zhou 2011), through the findings of this research, several shortcomings were also identified. Therefore, in order to expand upon the breadth of this research, topics which can be recommended for future research include:

- Assessing the value of social entrepreneurship to CDC practices
- Assessing the impact of new governance arrangements between the public and non-profit sectors (e.g., network governance) upon CDC operations in Texas
- Exploring the role of urban design as promoting cross-disciplinary collaboration
- Investigating quantitative methods for evaluating CDC practices, productivity, and outcomes
- Evaluating opportunities for the role of landscape architecture in the operation and practices of Texas CDCs

Overall, although CDCs have continued to sustain themselves throughout Texas and North America, "they have not been effective chroniclers of their own times and work" (Curry 2004, 69). As such, it is up to others to analyze their practices inclusively and comprehensively for future outcomes. In doing so, each of these general topics could expand upon key components of this research, while simultaneously emphasizing research as a communal undertaking which relies upon the continued work of others for future study (Dandekar 2003).

### 7 REFERENCES


CELÁ MEDIA STATEMENT

Title of Paper or Research:
COMMUNITY DESIGN CENTERS (CDCS) ON THE UPSURGE: INVESTIGATING PERCEPTIONS AMONGST CDC LEADERS AND ADMINISTRATORS IN TEXAS

Authors:
Kevin Rodríguez, Taner R. Özdil, Ivonne Audirac

Institution or Professional Affiliation:
The University of Texas at Arlington

Media Statement:
In-depth interviews with community design center (CDC) leaders in Texas revealed numerous reasons for the spread of CDC practices across the nation. Their combined insights illustrate an increased economic, environmental, and social need for the services CDCs offer in Texas, along with the blending of disciplinary boundaries amongst landscape architecture, planning, and architecture, under the unifying identity of urban design. Their perceptions suggest not only an open appreciation for multi-disciplinary practices, but an increase in humanitarian awareness through service-learning and community-engaged design in both practice and formal education.
SUSTAINABILITY

Edited by Mintai Kim & Sohyun Park
SOCIAL EQUITY THROUGH AN ECO-CULTURAL TRAIL: THE NGÄBE-BUGLÉ MIGRATION UNDER CAPITALISM IN WESTERN PANAMA

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1 ABSTRACT
Panama is a country internationally recognized for the interoceanic canal which plays a unique role in the country’s national economy as well as international commerce. Although the Panama Canal is the biggest source of income and is a key figure for understanding the Panamanian’s history, identity, and economy, this study focuses on the overlooked and ignored western area of Panama. This area is in the shadow of the Canal and the fast-economic growth of Panama City where the canal’s major ports prevail. Therefore, this study looks towards exposing the economic and environmental threats that this region faces, and overall to unveil the social disparities among Latinos and native indigenous peoples, living in the western area of Panama. In so doing, this study aims to uncover a new path of action for designers – to work with the communities and empower them to take actions on environmental injustices, social inequities and the economic burdens imposed by capitalism and global climate challenges. The study analyzes the Provinces of Bocas del Toro, Chiriquí and the “Comarca” (indigenous autonomous territory) Ngäbe-Buglé in the light of the burden of capitalist growth models imposed on the western area of Panama. At this point, the study raises relevant issues of social inequity and show opportunities for interventions with the aim to promote the care of the environment alongside better economic conditions for the most vulnerable groups of this region. This proposal focuses on issues of social equity in the interaction among Latinos and indigenous of this region.

1.1 Keywords:
Social Equity, Capitalism, Indigenous Tourism, Environmental Care.
2 INTRODUCTION

Capitalism can directly or indirectly erode equity in society and consequently negatively impact vulnerable populations. Studies on the effects of capitalism in “developing countries” and with other vulnerable communities, such as Indigenous peoples, have demonstrated how this system can shape and establish a set of conditions limiting their growth, development, and functioning (Ali, 2016; Castells, 1977; Howitt, 2001; Siddiqui, 2012). Thus, capitalism can hurt the very foundation of development and prosperity of the territories in which its interests are focused.

Diverse studies have shown the extent of the impact that extractive capitalist practices can have on the environment of developing countries. Under the umbrella of green development and economic growth, multinational companies and industries manage to exploit resources of powerless communities, harming ecosystems and diminishing biodiversity among others (AIDA, 2009; Aiken & Leigh, 2015; Cansari & Gausset, 2013; Finley-brook & Thomas, 2011; Howitt, 2001; Jaichand & Sampaio, 2015; Siddiqui, 2012). As a consequence, access to basic needs becomes limited for these communities and the unfavorable agrarian policies that free market practices impose on them end up devastating their subsistence economies (Aiken & Leigh, 2015; Ali, 2016; Cansari & Gausset, 2013; Jaichand & Sampaio, 2015; Patnaik, 2003). Finally, the rapid adoption of free market practices presents the possibility of eroding democracy to control the market and support big corporations, hence promoting disparities, generating social fragmentation, displacement, and loss of livelihood and cultural values (AIDA, 2009; Aiken & Leigh, 2015; Ali, 2016; Cansari & Gausset, 2013; Finley-brook & Thomas, 2011; Jaichand & Sampaio, 2015; Patnaik, 2003; Siddiqui, 2012).

As has been previously shown, capitalism can seriously affect small economies and vulnerable populations in developing countries. Panama is no exception. Since the development of the interoceanic canal, the country has been integrated into the world’s capitalist economy and has become almost wholly dependent on the trade and traffic through the canal (Manduley, 1980). Therefore, the economy of Panama – based on the facility for circulation of capital and not in accumulation – allows for unequal distribution of resources. Fast economic growth and stability occur in Panama City, the nation’s capital, where the canal and the International Banking center are located while rural countryside areas are isolated and excluded from these benefits (Manduley, 1980; Siddiqui, 2012; Sigler, 2013). (see Figure 1)

The purpose of this study is to expose the problems generated by capitalism in overlooked areas of Panama and propose a comprehensive design solution to it. In this way, this study also seeks to uncover a path of action for the design that allows solving complex issues integrally.

Figure 1. Map of Panama, highlighting the western region, and the Ngäbe-Buglé internal migration patterns (2017). Diagram by the author
2.1 Study rationale and aims:

Panamanian capitalism, with the vast predominance of the tertiary sector over the others (Castells, 1977; Hornbeck, 2012; Manduley, 1980), imposes environmental, economic, and social burdens on the countryside provinces which largely depend on other sectors of production. This study focuses on western Panama – an agricultural region at risk, due to free trade market rules, the extraction of native resources for sale, and the rapid change of environmental conditions triggered by severe human manipulations of the landscape. Using Think Pad analysis method and interviews described in section 3 this study reveals a chain of events generated by the severe impacts of capitalism in the social dynamics of western Panama. By doing so, this study uncovers the harsh reality that the Ngäbe-Buglé people face and addresses the migratory problems of this group—the most vulnerable group to the effects of capitalism in this region. Therefore, the question raised is how to provide an equitable solution for the social, environmental, and economic problems amongst Ngäbe-Buglé indigenous and Latinos in western Panama?

**Aims:** The overall goal of this study is to address social equity between Latinos and the Ngäbe-Buglé communities in western Panama and to propose a comprehensive solution to it. In doing so, there are three research aims.

1. To expose social, environmental, and economic threats caused by capitalism in western Panama.
2. To unveil social consequences of capitalist practices on western Panama.
3. To propose a comprehensive design solution that can solve local social, economic, and environmental problems of global importance.

2.2 Context area of study description:

**Ethnographic Description:** Western Panama is divided in the provinces of Bocas del Toro, Chiriquí and the Ngäbe-Buglé Comarca (indigenous autonomous territory). This region includes the following ethnicities: Latino-Mestizo/White, Latino-Afro, and Indigenous Ngäbes, Buglés and Briri. They are distributed as shown in Figure 1.

**Location description:** The landscape of western Panama is dominated by a mountain range that runs along the country (see Figures 2 and 4). In the lowest part of the mountain chain, the broken valleys extend toward the coasts at the north and south facing the Atlantic and Pacific oceans. The region has a tropical climate with intense rains and has many rivers within 14 watersheds. The area is suitable for a variety of crops and livestock production and is attractive for the hydroelectric market. The agricultural production capability varies; for example, in Chiriquí and part of Bocas del Toro, there are optimum soils for crop production but in the rocky Ngäbe-Buglé area most of the soil is non-arable with severe limitations that impede their use for commercial production (ANAM, 2010).
Political systems: In this region of Panama there are two governmental systems, 1) Latino system of government (Bocas del Toro and Chiriquí) and 2) Indigenous Comarcal System, presided by the General Ngäbe-Buglé Congress (Ngäbe-Buglé region). In the Comarca both of the systems work together with the supremacy of the Indigenous Comarcal System over the traditions and decisions in that territory (TE, 2010). This is an important characteristic of the region that must be considered in the implementation of policies and execution of projects since indigenous people reject any imposition that threaten their autonomy.

2.3 The importance of this study:

The potential importance of this study relies on three main aspects:

1. It is imperative to raise awareness about the consequences of capitalist practices in western Panama as well as the inequities that the Ngäbe-Buglé families face during their annual migration.
2. It is important to share ThinkPad analysis method, which will be introduced in section 3, as a tool that can be so valuable in early stages of research to consider the social, political, environmental and economic aspects of a problem in different levels of impact.
3. It is useful and valuable to exemplify the results of using such tools that allow designers to examine social, environmental, political and economic aspects of the problems at different scales.

3 METHOD

This study used mixed research methods. Research was divided into the following steps: 1) area of study identification, 2) Think Pad analysis, 3) gap identification, 4) telephone interviews with people from the area, 5) graphic analysis of vulnerabilities and selection of specific area of intervention, and 6) design proposal to address the problem.

3.1 Area of study identification:

Literature and statistical records from INEC (National Institute of Census and Statistics) were analyzed to find possible impacts of capitalism over the countryside of Panama.

3.2 Think Pad Analysis:

The western region of Panama was analyzed through Think Pad to discover hidden issues related to the capital practices in the region and their connections to social issues. Think Pad is an experimental tool developed at Iowa State University by Marwan Ghandour (Architect and Professor) in 2016 for a capstone project of the Master of Design in Sustainable Environments. This is a method of analysis through representation defined for its creator as a “process for “mapping” (not to be confused with map making), is an analytical method to include geographic/spatial representation, charting, diagramming and narrative.” Think Pad consists of a matrix with four different scales and three separate elements or realms.

The different levels and realms of Think Pad are based on theories of “The Production of Space” (Lefebvre, 1991) where Lefebvre states that the space is dynamic and generates as incorporates social actions and interactions. Lefebvre developed a theory that states that the dynamic of the space can be understand through a triad: 1) Spatial practice defined as perceived space (Material realm of Think Pad), 2) Representations of space that he defines as conceived space (Political realm of Think Pad) and, 3) Representational defined as Lived space (Symbolic realm of Think Pad). (Lefebvre, 1991). At the same time, he explains that these dynamics interacts at different scales, these scales are defined in ThinkPad as: Individual, Communal, Systemic and Planetary level.

Think Pad as a tool offers users the opportunity to explore a problem and evaluate findings in different realms and levels. In the current study, Think Pad allowed for a broad analysis of the environmental, economic and social situations of western Panama in multiple realms (material, political, and symbolic) and levels (planetary, systemic, communal and individual). In the current study each topic analyzed through Think Pad was graphically represented to condense complex data. Table 1 illustrates the criteria for each scale, realm and the analyzed topics in for this design proposal.
3.3 Gaps identification:

After studying all the topics presented in Think Pad for each province in the west region, issues related to the Ngābe-Buglé migratory patterns and their relation to the Latino community where identified as issues of most concern to be further investigated.

3.4 Interviews:

Telephone interviews where held with four people from the region to find reliable information about issues related to the temporary migration of the indigenous peoples traveling to the Latino region of Chiriquí.
Participants: The participants included one adult indigenous Ngäbe-Buglé person (who will be referred to as NB) and three non-indigenous social workers in the field of health care (who will be referred to as L1, L2 and L3). The non-Indigenous social workers possess a vast experience working with the Ngäbe-Buglé ethnicity and are knowledgeable about health, social conditions, and environmental conditions, both inside and outside the Comarca.

Procedure: The interviewees were asked to describe issues related to the experience of the Ngäbe-Buglé community when traveling during the annual migrations.

- The indigenous person, NB, was asked to: 1) describe the living conditions of the average indigenous person inside the Comarca, 2) describe the traveling conditions of the indigenous families during their journey to Chiriquí, 3) identify what members of the family were more vulnerable to the risks they faced in each stage of the journey, and 4) describe common experiences that the indigenous people face when interacting with the Latino population.

- The three non-Indigenous social workers, L1, L2 and L3, were asked to: 1) describe common conditions of migrating indigenous people who arrive at health centers during the migration, 2) identify, according their criteria, which members of the indigenous families were more vulnerable to the challenges of the travel and why, and 3) describe the general living conditions of the indigenous people when they get to farm fields in Chiriquí.

3.5 Graphic analysis of vulnerabilities:
A graphic representation of the traveling conditions, risks and vulnerabilities that indigenous people face in each stage of their annual migration was developed based on interviews to identify crucial areas of concern. The first phase of the migration was identified as the most critical (see Figure 4).

3.6 Design proposal:
A creative program of design was developed to respond to the social, environmental and economic issues that indigenous people face in the first stage of the journey taking in account 1) the physical proposal, 2) a program proposal and 3) the system organization.

4 RESULTS AND PROPOSAL:

4.1 Area of Study Identification.
The west region of Panama was selected as focus area of study. This region was selected based on the social, economic and environmental impacts found in the data statistics from INEC and other studies that reveal high levels of poverty, high rate of depopulation, elevated amount of hydroelectric constructions and serious impacts on agriculture (Cansari & Gausset, 2013; Flores, 2017; INEC, 2015; SNE, 2016; UNDP, 2015).

4.2 Think Pad Analysis and Consequences of capitalism in western Panama:
The topics analyzed through Think Pad revealed a chain of events produced by capitalist practices that permeated all levels and realms. Panamanian capitalism generates intertwined environmental and economic problems which cause social conflicts in the labor migration of this region. The analysis of this chain of events is explained through three main aspects as follows (see Figure 3):

Environmental burdens triggered by capitalist economy of extraction of native resources:
The involvement of the west region in the international energy trade market causes environmental disturbances largely due to an excessive amount of hydroelectric projects (Flores, 2017) following the emergence of policies for clean energy production aimed for export (SNE, 2016). Added to that, in 2017, the National Authority of Public Services, announced 31 new concessions for hydroelectric generation in the region (ASEP, 2017). As a consequence, up to 98% of the flow of rivers is used for hydroelectric generation, producing dried up rivers, erosion, sedimentation and impacting the fauna, flora and agriculture (CATIE, 2014; Flores, 2017).

Economic burdens triggered by capitalism: The excessive extraction of native resources indirectly affects the agricultural production of the region, allowing rivers only 2% of the water available for irrigation and other basic needs (CATIE, 2014; Flores, 2017). This lack of water puts the agricultural
production at an extreme risk, provoking uncertainty in the main source of income of the people of the western region. The most affected is the province of Chiriquí, known as the “Panama Bread Basket”, which generates the major percentage of agriculture of the country (CATIE, 2014). But capitalism adds another economic burden to the region through a violent agricultural market that struggles to compete with international imports under unfair conditions of the free trade market.

**Social burdens triggered by capitalism:** The unstable situation of agriculture in Chiriquí results in population decline. People from Chiriquí travel to Panama City searching for better economic opportunities (UNDP, 2015), thus weakening the agricultural labor force of the province. This fact, added to the need of this province to be competitive in the unfair agricultural market, generates the necessity of a cheap labor force to maintain its competitive edge. Latino farmers find that the Ngäbe-Buglé indigenous people are willing to accept the lowest wages (Olguín Martínez, 2006). The deplorable conditions that the Ngäbe-Buglé face in their territory force them to migrate from their lands and accept the crumbs that Chiriquí Latino province offer to them. (see Figures 1, 3 and 4)

### Figure 3. Graphic showing the chain of events happening in the west region of Panama founded through the Think Pad analysis. (2017) Diagram by the author

<table>
<thead>
<tr>
<th>Economic growth model based on the extraction of area resources</th>
<th>Threat to the environment</th>
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<tbody>
<tr>
<td>Hydroelectric projects using 98% of rivers water.</td>
<td>Threat to economy and agriculture</td>
</tr>
<tr>
<td>Unfair free trade market and droughts.</td>
<td>Social disparities</td>
</tr>
<tr>
<td>Ngäbe-Buglé people as cheap labor force.</td>
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</table>

4.3 Gap identification:

Ninety-eight percent of the Ngäbe-Buglé people live in poverty (UNDP, 2015). To escape poverty and the lack of job opportunities inside their own territory, families from the Ngäbe-Buglé community look for temporary jobs outside their land. Olguín Martinez explains the problems faced by the Indigenous community in the west region of Panama as follows:

“The lack of opportunities for income generation within their communities has forced indigenous peoples to emigrate…, moving from a family-oriented economy - within the primary agricultural sector - to a proletarianization, selling their labor force in the worst working conditions ...” (Olguín Martínez, 2006, p.16 – passage translated by the author).

Forty-eight percent of the Ngäbes and thirty-eight percent of the Buglés indigenous people that share the Comarca (indigenous autonomous territory), face the challenges of temporary migration every year. Around the 60% of the migrants go to the high-lands of the Chiriquí province searching for paid labor, particularly in the coffee harvest season that lasts from September to December (BID, et al, 2005; Olguín Martínez, 2006) (see Figures 1 and 4). To get to Chiriquí the Ngäbe-Buglé people need to travel the long and dangerous road that links their community to the Pan-American Highway which takes them to the farm fields in the Latino province of Chiriquí. The migration becomes a problem due to the risks that families go through during this journey.
In the following section, this study uncovers the dangers, risks and vulnerabilities of the Ngäbe-Buglé indigenous people along the journey.

4.4 Interview results:

Four main dangers were revealed through the interviews, including: 1) Conditions within the Comarca and the risks entailed by their crossing, 2) Ethnic confrontation with the Latino community, 3) Interfacing with a capitalist economy, and 4) Conditions in the Chiriquí’s farm fields.

1. **Long walks on roads and pathways in deplorable conditions, inside the Comarca**: A small portion of the access routes to the Comarca are paved, most of them are in poor condition and get very muddy during the winter. Other paths are walking trails to remote mountainous areas.

   In an interview, NB stated: “It can take to some of these families up to a week to reach the main road”. NB remarked, that during their journey, the families who have nobody to host them along the road are faced with no shelter to sleep under during the night, and they face the risk of being attacked by snakes and other animals. L1, who works with the Ngäbe-Buglé people, said: “Some of the women who make this journey are pregnant and risk losing their babies due to the excessive physical effort, lack of shelter, lack of proper sleep, and bad road conditions”. NB expressed that this journey also involves crossing rivers, which put children and adults at risk of drowning during the flood season. Some indigenous people can afford transportation in some part of the route, nevertheless NB said: “fifteen to twenty people are fitted in a wagon of a truck that is not secure, and because of the poor road’s state, accidents become another risk to families that travel”. L1 concluded that: “children and women are the most likely to suffer from heat strokes, fainting, dehydration and respiratory infections because their exposure to extreme conditions of heat or rain.” (see Figure 4)

2. **Confrontation of racial discrimination when facing Latino society**: When indigenous migrants reach the first big towns, Tolé or San Félix, near to the Pan-American highway to take public transportation, they confront the Latino community for the first time. From this point until the farm fields, Latinos dominate the territory. Indigenous people will be mistreated in the buses of public transportation and Latinos will refer to them as “Cholo(a)” pejoratively NB affirmed – in this context, this qualifier can mean ignorant, low quality or uncivilized people. Some Latinos deceive indigenous people offering them underpaid jobs for domestic labors or the riskiest and undesirable jobs, equally underpaid. The women become particularly vulnerable, at risk of abuse by their employers, when they get exposed to the Latino context, NB mentioned. (see Figure 4)

3. **Facing a capitalist economic system different from theirs**: The traditional Ngäbe-Buglé economy, unlike capitalism, is based on subsistence and shared distribution of resources instead of individual accumulation. Torres de Araúz states that agricultural production is the base of the Ngäbe-Buglé economy; “it ranges from the subsistence scale to the location of small surpluses in neighboring non-indigenous peoples” (Torres de Araúz, 1999, p. 272 – passage translated by the author). As Ngäbe-Buglé people mainly grow crops and hunt for consumption and not for profit, managing money is unfamiliar to most of them. However, Ngäbe-Buglé’s economic experience changes when they start depending on Latinos’ goods and market-based economy (Torres de Araúz, 1999). One of the risks to which they are exposed along this travel, is the presence of “cantinas” (Bars) in the Latino region. Bars are uncommon inside the Comarca. L1 and NB stated that once they are exposed bars, many of them, being inexperienced with money, “spend all their money on alcohol”. To NB, the men, as heads of families are the most vulnerable to this problem. Consequently, during the travel they are prone to wasting their money for public transportation: “complete families get stuck in David – a Latino city – until they find help to recover the money to continue traveling”, NB expressed. (see Figure 4)

4. **Precarious living conditions in the agricultural fields where indigenous people go to work**: L3, who works with indigenous people in Chiriquí, declared that the first challenge faced by indigenous people in the new place is the cold climate for which they are unready. This makes them prone to respiratory infections, especially children. L1 clarified that some of the farms provide them with better living conditions, like access to potable water and secure infrastructure to live in. Although, according to L1, “not all the families have the same luck.” Most of them are exposed to terrible conditions of overcrowding in unhealthy environments in on-farm housing. This generates other problems like sexual and physical abuse among themselves. Frequent sexual abuse and promiscuity fosters the spread of diseases among workers. Finally, according to L2, another problem indigenous families face is the exposure to dangerous chemicals in the agricultural fields, without proper safety controls. (see Figure 4)
As has been demonstrated, the interviewees declared that during the journey, indigenous people face many dangers on risky routes and in environments that can put the lives of migrants at risk. As an added burden, when they finally get out from the Comarca, a series of challenges waits for them in an unknown (to indigenous peoples) territory dominated by a Latino population that hires them exploitatively, and only as a cheap labor force. Therefore, awareness of their problems needs to be raised and action must be taken to develop their home economy and improve their migratory conditions.

4.5 Graphic analysis of vulnerabilities and selection of a specific area of intervention

The above declarations reveal the social inequities that the Ngäbe-Buglé families bear along their annual journey. Hence, it is important to improve their economic well-being and their travel condition inside their territory—before they face the aforementioned injustices in foreign areas. It is critical to intervene in the Ngäbe-Buglé migratory situation before they reach the province of Chiriquí—dominated by Latinos—where indigenous people have almost no control over the adversities they face. Thus, the first and most dangerous segment of their travel, is the best target to intervene in the betterment of their living and travel conditions—this is where they have governance, ownership, and decision power (see Figures 1 and 4).

This study proposes a physical and systematic intervention along the primary roads and paths commonly used to migrate, which link the Comarca to San Félix and Tolé. These are towns located at the border of the Latino and indigenous territory. They provide access to the Pan-American Highway and are the first place where indigenous migrants leaving their homeland face discrimination and a capitalist economic system. Hence, these towns are essential to develop initiatives inside the Comarca.

4.6 Design proposal:

Description of the Ngäbe-Buglé Eco-Cultural Trail (NBET) program: This intervention focuses on the first section of the migratory travel, located in the indigenous Ngäbe-Buglé Comarca. Based on the needs and the physical characteristics of the region, this study proposes The Ngäbe-Buglé Eco-Cultural Trail to foster social equity among indigenous people. Specific problems like poor economy, dangerous travel conditions and lack of education about money management were targeted as opportunities for developing solutions. Hence, based on these needs and the social, political, and geographical characteristics of the region, a comprehensive Eco-Cultural Trail program is designed along with a physical prototype to support the program. The following design objectives were developed based on the results of the research:
To provide shelter and better traveling conditions for the Ngäbe-Buglé people in their annual migrations.

To share the value of the region and the importance of this ethnicity among Latinos of the region, foreigners and national tourists.

To provide a buffer for their traditions and ownership of their territory.

To promote the economic development of the area under practices that consider their customs such as their care for the environment.

To encourage the reinvestment of resources in the region.

Components of the NBET program: The Eco-Cultural Trail program proposal has three main components: the trail, an eco-cultural program of tourism, and a program for wise money management. They are described below.

The trail: This is a trail with stations that will serve as shelters for Ngäbe-Buglé families that travel inside the Comarca territory. Stations will also work as tourists rest stops and scenic viewing points. These stations aim to improve the traveling conditions for the Ngäbe-Buglé families in their annual migrations and foster positive interactions between foreigners and the Ngäbe-Buglé community. (see shelters-trail program in Figure 5)
An eco-cultural program of tourism: This part of the program will promote the active involvement, participation, management and ownership of the Ngäbe-Buglé families in the improvement of the economic situation of the region. The program aims to begin with support of NGOs and governmental agencies related to culture, environment and tourism but is projected to be self-sustaining. Thus, the program avoids unstable financing from foreign agencies. This touristic component aims to provide a source of income to the indigenous people and promote their ethnic traditions, care for the environment and empower the community. The program targets specific users in the fields of Indigenous-tourism, Eco-tourism, Ethno-tourism, Biodiversity-tourism, Mountain-tourism and other noninvasive types of tourism. (see target internal user, target foreign user, guides, station specialists and hosts in Figure 5)

A program for wise money management: This is an educational component of the program that will be available for the Ngäbe-Buglé community, particularly for the participants in the Eco-Cultural Trail program. This is to ensure the good management of the income they will receive and to provide to the Ngäbe-Buglé families autonomy and control over the betterment of their living conditions and development of the region. (see money management program in Figure 5)

Systematic organization: As a system, this trail will have four different components that will work as shown in Figure 5:
- Indigenous agencies in charge of the direction and general management of the Eco-Cultural trail program.
- Indigenous families involved as active participants and promoters of the Program.
- NGOs focused on environmental protection and indigenous support.
- Governmental agencies in the fields of social development, environment, culture and tourism, as well as economic and governmental Panamanian support of the program.

Novel Elements of this Proposal:
Double Purpose of One Intervention: The intervention maximizes the benefits of existing routes in the indigenous territory, generating an opportunity for eco-cultural tourism. A series of stations aims to accomplish the purpose to offer shelter for Ngäbe-Buglé families in their journey along these dangerous routes. The shelters also play a role as scenic viewing points and rest stations for tourists, thus, allowing the promotion of the value of Ngäbe-Buglé indigenous people among foreigners.

Indigenous Ownership: The project is based on Ngäbe-Buglé indigenous ownership and participation starting with the design process, through the construction, maintenance, and management of the eco-cultural trail. This project is proposing the involvement of the indigenous, not as passive recipients but as actors in every step of the plan, providing them also with training in money management practices to ensure the good administration of the resources they will get from the services they offer.

5 DISCUSSION
The process presented above uses a multilevel analysis approach (Think Pad) to find problems and shine light on possible solutions to the social inequities in western Panama. Why is it valuable to explore design solutions based on a multilevel analysis approach like the Think Pad method?
In using this method:
1. The nested character of the problem of the region was brought into the light providing a way not to overlook the problems at different scales.
2. The links between the problems were identified.
3. The graphic nature of the method gave clarity to understand how any solution may work.
4. It begins to illuminate at which scale or realm the solution most operate.
5. It allows to objectively examine a problem in a dispassionate way.

There have been many attempts and initiatives to solve the poor conditions in the Ngäbe-Buglé Comarca and it is beyond the scope of this paper to name them all. Future research is needed to comprehensively document them. But from the scope of this study it is clear that interventions become unworthy when solutions 1) are not founded in a comprehensive understanding of the problems and the context, and 2) do not consider how problems are linked to political and economic currents. An example of that is the series of economic aid programs to fight poverty that the Panamanian government has implemented. These should represent a significant benefit for the Ngäbe-Buglé community—that is the poorest in the country (UNDP, 2015). The issue is that these are social programs of financial support through Conditional Cash Transfers. Hence, these monetary solutions do not respond to Ngäbe-Buglé problems since these paternalistic approaches overlook money management education. Such programs do not consider that the indigenous population in Panama have a different conception of money than the
Latino population (Torres de Araúz, 1999). Thus, making these investments is unworthy and not improving the indigenous’ living conditions.

In other cases, the initiatives are never implemented or they are discontinued during the process. This is the case of national and international agencies that have considered eco touristic development and the enhancement of local entrepreneurship, education, women’s empowerment, food sovereignty and sustainable management of resources, among others. Many of these proposals are left to the Comarca authority’s consideration and are never implemented (Jaén, 2008; Mesa Nacional de Desarrollo, 2013). In 2007, an exceptional program was implemented in Costa Rica, which annually receives around 15,000 Ngäbe-Buglé migrants in the coffee harvest season. This program trained Ngäbe-Buglé leaders to teach healthy practices in their communities, achieving high indigenous participation and the empowerment of the population – under the leadership of their own people. Alas, this program depended on the World Bank funding that was temporary.

What are the key factors that other initiatives failed to solve problems in western Panama and what makes this proposal a promising solution?

Many of the previous proposals are focused on one layer of the whole picture, undermining in this way a series of factors that directly impact any performance of the projects. The multilevel analysis approach provided a deep and broader exploration of the Ngäbe-Buglé migratory problems, thus allowing a thorough design proposal such as the Ngäbe-Buglé Eco-Cultural Trail Program. This design proposal:

1. Targets issues at the individual level, like the shelters for the safety of the families during migration.
2. Empowers self-respect of the community through money management programs and cultural exchange.
3. Targets problems at a communal and systemic level like the improvement of the economy of the Ngäbe-Buglé Comarca and promotes care for the environment.
4. Is self-sustained to avoid situations like the Costa Rica example for constant foreign input.
5. It was achieved after understanding how a program like this can fit in global culture driven by capitalism and how it can provide buffers against the invasion of destructive capitalist practices to the indigenous territory.

The last point that must be emphasized is that the Ngäbe-Buglé Eco-Cultural Trail Program raises questions and concerns about the positive or negative impacts of the touristic component of this proposal for the Ngäbe-Buglé community. The Think Pad analysis shines light on this crucial topic. Through the Think Pad analysis, topics like indigenous identity and autonomous governance cannot be overlooked. This analysis of the symbolic realm and political systems of this population shows the importance of providing solutions that promote self-respect and empowerment among the Ngäbe-Buglé community, rather than imposing “solutions” that disturb local livelihoods.

This is significant because many studies have shown the nefarious consequences of touristic practices among indigenous populations that, aiming to improve the economy of the region, have ended in the destruction and displacement of the indigenous populations (Barretto, 2005; Burne & Maris, 1996; Cañada, 2011; Pereiro, 2012, 2016). Nevertheless, studies have also shown that when empowered indigenous groups take ownership of development projects, even when those have a touristic component, tourism may become the source that “revitalizes social organization of Indigenous communities, provides them with new sources of economic and social prosperity, and opens up their communities to the world eager for contact with unique cultural identities” (Pereiro, 2016, p.1129). This is the case of the indigenous people in the Guna Yala Comarca, a coastal fringe with a series of small islands located in eastern Panama and bordered by the Atlantic Ocean. There, the indigenous people developed beach tourism that is a model for sustainable indigenous tourism. The Gunas created an autonomous management system by the Statute of Guna Tourism. This regulates taxes from tourists and cruise ships anchored in their docks, and also provides protection to the economy in their territory. They have developed small traditional Guna Hotels, and the “agents for these types of accommodation are Guna families, companies, or communities, where the majority of agents boast a university education” (Pereiro, 2016, p. 1132). The income provided by the manufacturing of their traditional hand crafts also “ensure the university education” for “some of their children” (Pereiro, 2016, p. 1132)

Thus, based on the understanding of the political, symbolic and economic practices of the region and the examples of projects rooted on indigenous people ownership, this proposal was able to bring an
approach that suggests the value of the indigenous self-governance by giving them total ownership and true participation in every component of the Eco-cultural Trail Program.

6 CONCLUSION

The “Ngäbe-Buglé Eco-cultural Trail Program” emerged in the face of evidence of the economic and social disparities between the capital city of Panama and the countryside. These disparities are consequences of the strong capitalist approach of Panama. This study started with the purpose of uncovering the biggest problems that capitalism imposes over the interior of Panama. This allowed for the identification of opportunities for comprehensive design solutions. Western Panama was targeted as an area of concern in the interior of the country. Consequently, the material, political, and symbolic aspects of the region were analyzed at global, systemic, communal, and individual levels. This study generated a wide range of intertwined problems that revealed the migratory challenges of the indigenous Ngäbe-Buglé community. Major issues of concern have been largely overlooked in previous development programs, thus showing an opportunity for a comprehensive design solution proposal.

Table 2. Agencies and Programs at different Levels and Realms.

<table>
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<tr>
<th>Level</th>
<th>Material</th>
<th>Political</th>
<th>Symbolic</th>
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<tbody>
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<td>Individual</td>
<td>Money Management Program</td>
<td>Shelters-Trail Program</td>
<td>Money Management Program</td>
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<td></td>
<td>•Shelters-Trail Program</td>
<td>•Local Congress</td>
<td>•Money Management Program</td>
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<td></td>
<td>•Shelters-Trail Program</td>
<td>•Local Authorities</td>
<td>•ASMUNG</td>
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<td>Communal</td>
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Under the light of a multilevel analysis — the suggested research proposal is rooted in the promotion of indigenous people empowerment, ownership, and active participation in the betterment of their living conditions. Overall this study responds to the issues of equity in western Panama through research-based design. The multilevel analysis based on Think Pad method has shown that when research-based design considers political, economic, environmental, and social issues in different layers, it enables a single design to address many different problems. Think Pad also allows users to tie the proposal back to every layer of study to corroborate that the proposal is targeting the problems through the involvement of agencies and solution approaches at every level and realm. (see Table 1, Table 2 and Figure 5)

Through this study analysis it has been found that the two greatest failures of precedent solutions for Ngäbe-Buglé indigenous problems have been, on one side, the superficial and paternalistic monetary approaches that worsen their situation, and on the other hand, the lack of awareness of their rejection of foreign proposals that do not consider their active involvement in every stage of the plan. Therefore, the biggest challenge to this proposal is that the Ngäbe-Buglé indigenous people take ownership of it. If this is achieved, the Eco-Cultural Trail Program, as a whole, could provide the indigenous people a sense of self-respect and could empower them to affirm their customs and to revitalize their traditions. It could also reinforce the value of an empowered community that is well organized and politically autonomous, with control over their land, and with total dominion over the management of the income generated through tourism.
Finally, it should be noted that since this study has been primarily focused on solving the migratory problems inside the Comarca Ngäbe-Buglé to prevent a chain of events that derive from leaving their home territory. The rest of the journey is yet to be studied.

7 REFERENCES


CELMA MEDIA STATEMENT

Title of Paper or Research:
SOCIAL EQUITY THROUGH AN ECO-CULTURAL TRAIL: THE NGÄBE-BUGLÉ MIGRATION UNDER CAPITALISM IN WESTERN PANAMA.

Author:
Hatvany Gomez Concepcion

Institution or Professional Affiliation:
Iowa State University

Media Statement
Western Panama was analyzed using Think Pad, an experimental research method that allowed for a multilayer analysis of the social, environmental and economic aspects of the region. This study analyzed the provinces of Bocas del Toro, Chiriquí and the “Comarca” (indigenous autonomous territory) Ngäbe-Buglé in the context of capitalist growth models imposed on them. It reveals the migratory challenges of the Ngäbe-Buglé community as the primary issues. To understand these problems, interviews were held with indigenous people and Latinos from the region revealing specific risks along the journey. These risks were mapped and graphically analyzed, and a design solution was proposed.

Graphic Abstract:
PEIYANG CAMPUS: A SPONGE CITY CASE STUDY

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1 ABSTRACT

“Sponge City” is a term that is currently used in China to refer to the urban design of an area based on stormwater management and restoration of ecological processes. Tianjin University’s Peiyang Park Campus was opened in 2015 as a demonstration of the “Sponge City” concept. The campus is one of the first built examples of this concept. This presentation elucidates the “Sponge City” concept by detailing the design of the campus as a case study. The campus is located in the Jinnan District, Haihe Education Park, Tianjin, China. The site is approximately 2.5 km$^2$ in area with a complex of waterways, wetlands, and uplands. It was designed to serve 35,000 students and 5,000 faculty and staff. The design goals include: protecting the site’s original ecosystem, using ecological restoration and mitigation to repair damages caused by construction, and using low impact development (LID) practices in design and construction. Essentially, the concept resembles “Resilient Design” with a particular focus on stormwater management. The triangular site of the campus is challenging, with three sides defined by historic canals and a highway system as well as shallow groundwater and saline soil because there is little or no natural storage capacity for water on the site. Agricultural fields have been transformed into 1.55 km$^2$ of buildings, 0.15 km$^2$ of water and 0.8 km$^2$ of restored and designed landscape. The landscape is subdivided into three sub-drainage systems to handle stormwater. The sub-basin that forms an outer ring infiltrates stormwater to groundwater, with excess going to the adjacent canals. Within the inner ring of the campus, there is an integration of green infrastructure within the overall landscape elements through use of concave green spaces, pervious pavers, bioswales, and green roofs. This drops the runoff coefficient for the built up area from 0.9 to 0.5. In this area, there are also water features, such as ponds and wetlands, that collect overflow, and thereby reinforcing the sponge-like function of the area and reducing flow from the campus to surrounding waterways.

1.1 Keywords

Sponge city, Ecological Design, LID, China, Tianjin University
2. INTRODUCTION

Since the 1970s, the United States has proposed "best management practices" (BMPs) (Stern, 1974) for stormwater management; over time these practices have become more ecologically sustainable in the ways they control runoff of rainfall and water quality. Then, on the basis of BMPS, "low impact development" (LID) was proposed, and stormwater management methods from the source of runoff (Dietz, 2007). In 1999, the United States proposed the concept of a green infrastructure (GI), imitating natural processes to accumulate, delay, infiltrate, transpiration and reuse rainwater runoff. In the 1980s, Germany began to gradually establish and improve rainwater regulation technology, industry standards and regulations. In 1980, Japan's Ministry of Construction encouraged the collection and utilization of rainwater resources by promoting rainwater retention infiltration programs. Committed to conserve groundwater, revive springs and restore river basins.

In addition, Australia has set up the Water Sensitive Urban Design (WSUD) system centered on urban water cycle (Lloyd, 2002). The UK established the Sustainable Urban Drainage System (SUDS) (Spillett, 2005) to manage the run-off of rainfall through science to achieve a virtuous urban water cycle. At the same time, New Zealand also integrated and developed under the concept of LID and WSUD, and established the "Low Impact Urban Design and Development" (LIUDD) system (Van, 2006). The above ideas all provide strategic support and technical guidance for building a "sponge city."

Like many older cities around the globe, China's largest cities face problems with stormwater management and flooding. Retrofitting older cities can be especially challenging because the upgrading of infrastructure often needs to occur below active streets and buildings. As China has begun to build new cities, many western practices are being tested and incorporated; the ambitious designing and building of new cities creates opportunities for developing new and better stormwater systems.

"Sponge Cities"1, as used in Chinese literature, provide examples of adaptation of low impact development with a strong emphasis on storm water management. In 2003, the concept of "sponge" appeared for the first time in the book titled “The Road to Urban Landscape: Communicating with the Mayor” (Yu 2003). In this book, “sponge” is a metaphor for the function of natural wetlands, especially as they relate to rivers, flood, and drought disaster control in cities. Natural wetlands have been largely disturbed or eliminated around older cities, so this means there is a need for restoration or re-creation of wetlands that can act as sponges for floods and excess nutrients. This is particularly important in moist to wet regions of China, where the majority of rainfall occurs in a few summer months.

During 2011, Liu Bo (as representative of the National People's Congress) submitted a proposal on "building a sponge city and enhancing the city's ecological restoration ability". In April 2012, the concept of "sponge city" was proposed in the "2012 Science and Technology Forum for Low-carbon Cities and Regional Development". In December 2013, General Secretary Jinping Xi emphasized in his speech at the "Working Conference on Central Urbanization" that "priority should be given to leaving only limited rainwater to enhance urban drainage systems, prioritizing more drainage using natural resources and building natural stockpiles of water by naturally infiltrating, natural purifying in a sponge city ". In October 2014, the Ministry of Housing and Urban-Rural Development officially released "The Guidelines for Construction of a Sponge City - Construction of Low Impact Rainwater System "(Jian Cheng Han [2014] No. 275) and put forward the concept of sponge city. By the end of 2014 to early 2015 the country elected to produce the first batch of 16 sponge pilot cities and now China's sponge city construction pilot work in full swing. By 2016, the Chinese central government started pilot projects to support sponge city construction.

Sponge city's construction mainly includes three aspects (Wu 2016):
First is to protect the original ecosystem;
the second is to restore and repair the damaged water body and other natural environment;
the third is to use low-impact development measures to build the urban ecological environment.
Sponge city design indicates development and progress of urban stormwater management theory. It creates an ecological city, primarily focused on storm water management ideas and approaches. There is a clear emphasis on the city's resilience to natural hydrological hazards through low-impact integrated management of urban storm water.

2.1 Problem Statement

In 2012, when planning the new Peiyang Campus for Tianjin University, the concept of “sponge campus” was proposed. Specifically, it was proposed that the campus would have the same capacity and
flexibility as a sponge in adapting to environmental changes and handling flood disasters. When it rains, water would be absorbed, stored, and filtered. The Peiyang campus is now open. This paper introduces the campus design as a case study of this approach to urban design based on stormwater management.

2.2 Background

The City of Tianjin is located in the northern coastal region of mainland China, with a population of over 15 million and an area of nearly 12 thousand square kilometers. At one time, it was an imperial port and still serves Beijing as a gateway to the sea. Within the city, Tianjin University (established 1895) is recognized as China’s first modern university and is now a national university under the Ministry of Education of China. In 2010, this historic institution launched a plan for a new campus to be created in Haihe Education Park. The planning and design of the campus commenced in 2010 and was led by the Landscape Architecture Studio in Tianjin University Architecture Design and Urban Planning Research Institute. Construction commenced in 2013 and the campus was opened in 2015.

The site is approximately 2.5 km² in area with a complex of waterways, wetlands, and uplands. The soils are alluvial, saline, and have a high water table, with high salinity and a pH of about 8.0. The Weijin River and Huxiao Canal create the boundaries of the site. Highways dominate the berms that separate the campus from the waterways. The average annual precipitation is 603mm. The highest rainsfalls occur in July and August, accounting for nearly 60% of the annual precipitation.

The campus was designed to serve 30,000 students and 5,000 faculty and staff. The design goals include: protecting the site’s original ecosystem, using ecological restoration and mitigation to repair damages caused by construction, and using low impact development (LID) practices in design and construction.

3. METHODS

3.1 Design Review

The design of a sponge city begins with the design of the water management system. Therefore, our case study begins with a description and characterization of the water management system. We consider the natural limits of the environment of the building site. Further, we examine how the form of the water management system dictates the campus form. Next, we evaluate how the water management system and campus plan restore ecological forms and functions to the site. Finally we investigate evidence of the application of low impact design principles.

4 RESULTS

4.1 Water Management System

The construction of “flexible” water management system of Peiyang Campus of Tianjin University is divided into three sub-drainage divisions, which are divided into two sub-drainage divisions: the sub-district and the combination of both inside and out side (Table1). Within the central sub-basin, water is collected and reused for the landscape. The next ring outward (inner ring) collects run-off from the central basin and stores it in waterways and soil with potential for landscape application in a drought. The inner ring also connects with the outer ring through overflow sites (lake and wetland). This intends to relieve high water build-up on the campus. Finally, the outer ring reduces storm water pressure through release into natural systems. Figure 1 and Table 2 present early conceptual proposals and Figure 2 presents the details of the built system.

The interconnected pathways for water flow create forms that frame and define spaces on the campus (Figure 3). The visual presence of water is ubiquitous – reinforcing the importance of water management throughout the site. The treatment wetland (on west side of Figure 3a) is drawn with a great deal of open water. It is likely that vegetation and sedimentation will close in the wide streams and form a tighter filtration system over time, as indicated in Google Map images.
Table 1. Three level Stormwater Regulation and Storage System.

<table>
<thead>
<tr>
<th>Management area level</th>
<th>Rainwater facility components</th>
<th>Function</th>
<th>Runoff direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center Island LID Regulation &amp; Storage Area</td>
<td>The use of the green roof, concave green, planting grass ditch and water-permeable pavement construction and storage area</td>
<td>Source reduction, natural decontamination, accumulation and percolation, and construction of aesthetics and function of the integration of ecological rain management and control system.</td>
<td>Based on the design standards, as far as possible no rainwater drainage outside, over standard runoff overflow to inner ring rainfall collecting area</td>
</tr>
<tr>
<td>Inner Ring Rainfall Collecting Area</td>
<td>Relying on the campus of the center of the lake, the center of the river, overflow Lake and Longyuan wetlands, including the planning of water surface Central rainwater corridor</td>
<td>In the area, rainwater is mainly collected through pipes, combined with green infrastructure to encourage runoff and infiltration. Rainwater from pipelines is periodically raised through pumping stations to supplement landscape water</td>
<td>To accommodate the central island LID regulation &amp; storage area overflow, exceeding the standard flow to the outer ring natural drainage area</td>
</tr>
<tr>
<td>Outer Ring Nature Drainage Area</td>
<td>Relying on the regional ditch and strip protection of green space and other construction of the outer ring of rain corridors</td>
<td>The rainwater in the outer ring rainwater area directly infiltrates into groundwater, or makes full use of the vertical drainage of the site, and the rain water is discharged into the Weijin River and the school river.</td>
<td>To accommodate the Inner ring rainfall collecting area overflow, ultra-standard runoff to Wei River and Huxiao Canal</td>
</tr>
</tbody>
</table>

Figure 1. Drainage Area Breakdown. The Outer Ring is a natural drainage area intended to reduce storm season water pressure. The Inner ring combines traditional rainwater pipes and effective utilization of rainwater resources. The Center Island uses LID practices to create a functional integration of ecological flood control system woven into the built landscape. Note that the density of buildings was reduced in the final design.
Figure 2. Water sources and sinks for entire campus. The rectangles on the left indicate sub-basins. Reading from the bottom of the diagram towards the top, we can track the potential flow of water. In the center campus, there is strong reliance on water collection and infiltration into the soil. With a particularly heavy rain, some runoff overflow to one of the lakes or the pump station. In drought conditions, water can flow from the wetland to the Central Lake and the Inner Lake, or from the pumping station to the Inner Lake. Water leaves the inner sub-basin only by the Overflow Lake to the Weijin River. Excess water collected in the outer sub-basin flows into either of the two adjacent rivers, Weijin and Huxiao.

Table 2. Drainage Area Zones of Peiyang Campus. The Center island ecological rainfall area, the water system of the school, the urban green belt, and the water system around the school make up the campus core (66.84 ha).

<table>
<thead>
<tr>
<th>Partition name</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outer ring drainage area</td>
<td>43.54</td>
</tr>
<tr>
<td>Inner ring pipe rainfall collection area</td>
<td>138.26</td>
</tr>
<tr>
<td>Center island ecological rainfall area</td>
<td>25.55</td>
</tr>
<tr>
<td>Water system of school</td>
<td>15.44</td>
</tr>
<tr>
<td>Urban green belt</td>
<td>11.55</td>
</tr>
<tr>
<td>Water system around the school</td>
<td>14.30</td>
</tr>
<tr>
<td>Total</td>
<td>248.63</td>
</tr>
</tbody>
</table>
4.2 Site Remediation and Enhancement

The site is characterized by shallow groundwater and saline soil, with a high pH. Agricultural fields have been transformed into 1.55 km² of buildings, 0.15 km² of water and 0.8 km² of restored and designed landscape. The landscape is subdivided into three sub-drainage systems to handle stormwater. The sub-basin that forms an outer ring infiltrates stormwater to groundwater, with minimal excess going to the adjacent canal or river. Within the inner ring of the campus, there is an integration of green infrastructure within the overall landscape elements through use of concave green spaces, pervious pavers, bioswales, and green roofs (Figure 3). This drops the runoff coefficient for the built up area from 0.9 to 0.5, greatly reducing the likelihood of overflow from the site to the rivers. In this area, there are also water features, such as ponds and wetlands, that collect overflow, and thereby reinforcing the sponge-like function of the area and reducing flow from the campus to surrounding waterways. The outer ring is referred to as the natural drainage area. The reforestation of the edge extends around most of the triangular site. This area functions both as a buffer and a release valve since excess water will be pumped out of the canals to the adjacent rivers to avoid flooding in the core area (Figure 3a).

In summary, the core area retains and infiltrates water through green infrastructure including bioswales, detention basins, rain gardens and a treatment wetland (Figure 3b and A-D). Excess water is stored in the purification wetland and storage lake. Water from these sources can be pumped back to the campus when needed for landscape plants during a drought. When there is excess water in the purification wetland and storage lake, it is pumped into the canal that forms the outer ring. If there is excess water in the canal, it is pumped into the adjacent rivers.

Figure 3. Green Infrastructure Examples. (a) Forests and wetlands create a buffer between the canals and campus core. (b) Bioswales are distributed throughout the campus, as indicated by green lines in the second image. A-D Detention basins and treatment wetlands collect and filter storm water as it passes from the main campus grounds to the inner ring lake.
4.3 Application of LID Principles

The design of the 2.5 km² campus is dense, when we consider the footprint of the buildings and the size of the population that will work and live there (Figure 4). However, the campus is designed to work as a high-functioning watershed and manages the majority of its storm water on-site as well as managing...
its sewer system on-site. We predict that the stormwater impact of this site on adjacent rivers will be negligible. The landscapes around the buildings and the building themselves are designed using LID elements such as landscape design, green infrastructure, and water management.

Figure 4. Illustrative details of campus design with water system integration. Note the direction of flow of rainwater (blue arrows) to the canals an lake that surround the center of campus. Also, note the (orange) circulation pump site that moves rainwater circulating around the campus and sewage to the treatment wetland site for purification.

In general, the goals of LID favor restoring a watershed’s hydrologic and ecological functions. The campus core and adjacent buildings reflect several Low Impact Design (LID) principles. Not only are there attempts to minimize impervious surfaces, there is a wetland which recieves and treats storm water. There is an 11.55 ha urban green belt that includes diverse vegetation. In addition to the bioswales and treatment wetlands, green roofs occur on several buildings. There are architectural elements that reduce water use
and the source of some pollutants. Vegetation is planted in gardens and adjacent to building to provide adequate shade and minimize urban heat island effects.

5 Discussion and Conclusions

Peiyang Campus is one of the first examples of application of the Sponge City model to be built in China. The site for the campus had little urban infrastructure, so the storm water, drinking water and sewer systems could be designed to manage all water on site without the expense of removing or updating low functioning systems. The site engineering could be designed and installed before buildings were added. Vegetation could be placed in clean, fresh soil that replaced initial saline soil. The plantings are flourishing on the clean soil and with the water management systems (Figure 5).

Cai (2017), in a review of the 16 pilot designs that were under development in China based on a national Sponge City Policy introduced in 2014, predicts competing forces in selecting sites for this type of development. He points out that economic and ecological objectives often contradict each other, resulting in "Sponge New Districts" being built in urban outskirts rather than in existing cities. The Peiyang Campus example seems to have side-stepped this pattern by occupying an agricultural site that had already been surrounded by the City of Tianjin. Still, the displacement of historic populations can be contentious, and we can find little documentation about the previous residents of the site.

The campus has been occupied for two years now and is hailed as a success by its residents. There has been one major storm, 7/20/2016, that flooded many streets of Tianjin while water failed to collect on the Peiyang Campus walk ways and streets (pers. com). This kind of success is promising for the ongoing adoption of this planning and design theory for the construction of new urban centers in China. Unfortunately, it is difficult to apply in many of the older urban centers.

Figure 5. Campus Core after planting was completed. The photo shows the water feature in the campus core. The lower picture shows a landscaped gathering space that captures and directs stormwater to the wetland area at the west of campus.
6  ENDNOTES

1. Note that the term Sponge City is also used in Australian planning literature with a very different meaning. Argent and others use the term to refer to cities with the capacity to absorb immigrants. For example, see Argent, N., F. Rolley, J. Walmsley. 2008. “The Sponge City Hypothesis: does it hold water? Australian Geographer 39: 109-130.

7  REFERENCES


CELA MEDIA STATEMENT

Title of Paper:
PEIYANG CAMPUS: A SPONGE CITY CASE STUDY

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Tianjin University, Tianjin, China
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Media Statement:
Tianjin University’s Peiyang Campus elucidates the “Sponge City” concept by detailing the design of the campus as a case study. The landscape is subdivided into three sub-drainage systems to handle stormwater. The sub-basin that forms an outer ring infiltrates stormwater to groundwater, with excess going to the adjacent canals. Within the inner ring of the campus, there is an integration of green infrastructure within the overall landscape elements through use of concave green spaces, pervious pavers, bioswales, and green roofs. Water features, such as ponds and wetlands, collect overflow and, thereby, reinforce the sponge-like function of the campus soil.
PUBLIC TRANSPORTATION AS POTENTIAL REMEDY TO URBAN DECLINE IN DAYTON, OHIO: A CASE STUDY

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1 ABSTRACT
Urban decline is a critical issue in shrinking cities. The collapse of the American housing market in 2008 resulted in widespread foreclosures/abandonment throughout many U.S. cities. Many municipalities in the Rustbelt, a historical region that has experienced massive depopulation since the 1960s, were hit particularly hard, leaving them characterized by vacant land, a visible symptom of decline. Research on how to deal with vacancy and abandonment has become a crucial urban issue. The specific aspects of sustainable urban form which can potentially aid in counteracting decline have not been thoroughly evaluated. It has been shown that cities developed around sustainable public transportation systems tend toward growth and stability as opposed to decline. This research seeks to better understand the relationship between proximity to public transportation hubs and urban decline and whether greater access to said public transportation hubs can encourage urban regeneration using Dayton, Ohio as an area of investigation. Dayton has suffered a 47% population decrease since 1960; these conditions have resulted in an abundance of declining area. This paper 1) presents an index for measuring area of urban decline using suitability modeling and 2) compares the spatial location of that decline to the proximity of three primary public transportation hubs. Results indicate that proximity to multi-modal transportation options is related to lower amounts of decline. Therefore, stronger policies encouraging complete streets, related alternative transportation options, and enabling mobility may be a strategy for preventing decline or spurring regeneration in declining areas in shrinking cities.

1.1 Keywords  
Urban Decline, Public Transportation, Geographic Information Systems, Suitability Modeling
2  INTRODUCTION

The Shrinking Cities International Research Network (SCIRN) defines a shrinking city as “a densely populated urban area that has on the one hand faced a population loss in large parts of it (for at least 5 years, more than 0.15% annually), and is, on the other hand, undergoing economic transformation with some symptoms of a structural crisis (Stryjakiewicz 2013, p. 28).” Shrinking cities are characterized by declines in population, while the symptoms of structural change can include vacancy, abandonment, poverty, and increased crime rates. The United Nations (2012) projects that between 2011 and 2050, the world’s population will increase by 2.3 billion; urban populations are expected to double during this time and account for approximately 67% of the world’s population. Despite this massive projected increase in urban population, there are still many cities which are expected to deurbanize.

Nearly one-quarter of all shrinking cities in the world are located in the United States, and many of those lie within the Rust Belt (Li, Newman 2016). The Rust Belt is a region in the upper Midwest of the U.S. that is popularly characterized by substantial population loss and decline, and this is primarily attributed to the shrinkage of the once-powerful American industrial sector. Cities such as Dayton, OH, Detroit, MI, and Milwaukee, WI were once the industrial heartland of the United States, but with a shift toward the service sector since the 1960s, a decrease in steel and iron production, and movement of manufacturing jobs to the south, neighborhoods in these areas have been especially subject to decline. The population of Dayton has decreased 46% since the 1960s, a loss of nearly half of the city (US Census Bureau 2015). In order to remedy the issue of decline and support regeneration, a number of approaches have been taken by both researchers and planners within communities. Previous literature has shown that equal access to transportation can be a key to curbing poverty and inequality, both of which are symptoms of the decline occurring in Dayton, Ohio (Glaeser, et al. 2008). By examining decline in this shrinking city in the Rust Belt and further examining the accessibility to public transportation hubs in the same area, this investigation hopes to better understand the relationship that exists between the two, and how public transportation hub locations might be used in the future to frame urban regeneration and recovery.

3  LITERATURE REVIEW

3.1  Urban Decline

There are many social, economic, structural, and environmental factors which can contribute to urban decline, but the most cited cause is depopulation—people moving out of urban spaces. Other drivers may include globalization, economic recession, deindustrialization, suburbanization, high rates of unemployment, natural disasters, environmental pollution, war, and epidemics (Hollander et al. 2009). It is important to keep in mind that most causal factors contributing to decline are fundamentally linked, and cities most often endure several simultaneously rather than one at a time. For example, population migration can be an umbrella effect that encompasses deindustrialization, job loss, and a need for structural reorganization. However, natural disaster, war, or epidemics may occur independently and unprompted by other economic or social changes. As a result of this linkage, urban shrinkage is a process, not an instantaneous phenomenon that may be self-perpetuating.

While urban decline is identified primarily by depopulation, but other city characteristics can also be used as indicators to identify instability and propensity for decline. Understanding these indicators requires an understanding of the duplicity of many urban realities. For example, suburbanization and sprawl are closely tied to economic growth and social stability. At the same time, however, they can also be seen as contributing factors to both urban depopulation and decline (Lee et al., 2018) and increasing the supply of vacant land within a city (Wiechmann and Pallagst 2012). This suggests that economic growth and social stability are important measures for urban decline. As a similar example, a younger population is often seen by city officials as contributing to the vibrancy and growth of an urban area, whereas other studies have indicated that cities with older residents typically have lower vacancy rates (Newman, et al., 2016), denoting a more stable demographic. In these ways, the indicators of urban decline can influence one another in unforeseen ways.

Factors other than depopulating that have been shown to be drivers of decline have can be grouped under the phenomena of globalization and deindustrialization, or disinvestment such as education level, changing racial composition of a city, and economic change (Immergluck 2008). Newman, Gu, Kim, and Li (2016) found a statistically significant positive relationship between unemployment rate and vacancy, showing that cities with a higher rate of unemployment were more vulnerable to vacancy and abandonment.
This is important because unemployment rate is typically used as an indicator for assessing economic conditions at a municipal level. The rationale for educational attainment (Glaeser, Kahn, Rappaport 2008; Mallach 2012) poverty, and income rates (Newman, Lee, Berke 2016) look very similar; as the percent of persons 25 years of age and older with less than or equal to a high-school graduate education, the percent of persons whose household income lies below the 50th percentile, or the percent of persons living below the federal poverty level increased, vacant urban land would also tend to increase. The connection between many of these concepts cannot be completely disentangled. Jobs follow people, who follow jobs, which in turn depend upon the economy, and the sequence of causation is circular. It is difficult for a city to experience one negative social, economic or cultural effect without feeling the consequences of others. In terms of land, Mallach (2016) shows that low property values, foreclosed properties, and parcels or properties that are delinquent, vacant, or structurally unsound are reliable indicators of vulnerability to vacancy, which contributes to—and is affected by—decline. The capacity of an individual to own and maintain a home or property is often a reflection of that individual’s or family’s economic and/or social situation, including income, employment, or education.

The use of suitability models can be used to determine the potential effects of urban public transportation hubs in that these models have the ability to overlay multiple variables. Suitability mapping is an application of ArcGIS for planning aiming at identifying spatial patterns of land use conditions according to specified requirements, preferences and inventory mapping overlays (Malczewski, 2004; Newman and Kim, 2017). Suitability overlay models combine multiple rasters by applying a common measurement scale of values to each raster which can be weighted according to judged importance and merged for an integrated output (Mutzke et al., 2001; Newman et al., 2017). Each variable used in this study was given equal weight of influence in the creation of a composite decline index for the purpose of suitability modeling because varying factors contributing to decline have been shown to be highly interrelated (Newman et al., 2018).

3.2 Transportation

With deindustrialization in the Rust Belt during the mid-1900s and relocation of manufacturing south into the Sun Belt, jobs and people moved as well, causing a shift in the structure of Dayton and many other Rust Belt cities. The purpose of this research is not to dissect the particularities of those changes, but rather to draw from that idea of economic and social change to understand other processes that still occur today. In the race for resources, access to and availability of reliable transportation has long been associated with human capital, an indicator of social stability. A person who feels secure in their ability to move about within an urban space—between work, home, leisure—is less likely to seek out a home elsewhere. Further, existing research has shown that a positive relationship exists between access to public transportation systems and the recovery of socially vulnerable populations (Moon 1990), that failing public transportation systems may increase inequality (Glaeser, et al., 2008), and that access to transportation can be crucial to escaping poverty for many individuals (Park and Newman 2017).

The use of many Rapid Transit systems and public transportation elsewhere in the United States has affected regeneration and developmental pursuits in a positive way, and spurred new development in many areas experiencing growth stagnation. For example, the Rapid Transit System in the San Francisco Bay Area was developed around two dozen different stations over the course of the latter half of the twentieth century, resulting in substantial increases in both residential and nonresidential buildings and (Cervero, Landis 1997; Moon 1990). Other authors cite better access to transportation in central cities as a primary cause for the urbanization of poverty and spatial inequality in many areas (Park, Huang, and Newman 2016).

For example, the Philadelphia, Pennsylvania Neighborhood Transportation Initiative was a successful approach in achieving long-term change for declining neighborhoods. Based on various housing, economic, and social characteristics, the Initiative made recommendations for the demolition of more than 5,000 homes over a five year period (Newman et al., 2018). The program was innovative in that it prioritized declining neighborhoods for public investment related to demolition and reuse. Through careful identification and selection of areas, investment spurred where it otherwise may not have occurred as new modes of transportation were linked to these once declining areas for regeneration purposes. The primary motivation for analyzing transportation as a part of this spatial analysis comes largely from connections such as these.
It is important to remember that the effects of a transportation system are constantly working simultaneously with the effects of market forces, economic changes, land-use changes, and other planning interventions such as zoning and growth policies (to name a few). Though, as previously noted, the foundational question in understanding how to mitigate urban decline is that of causation, that is not the purpose of this research. Both market and institutional forces work together, complimenting and reinforcing one another, to shape all transportation-land use outcomes.

4 OBJECTIVES

Newman, Lee, and Berke (2016) suggest that solutions for encouraging urban regeneration vary greatly and remain somewhat elusive. Case studies citing factors from institutional changes to public property ownership reform to leveling of entire neighborhoods show that the underlying question is one of determining causation. The research seeks to better understand the relationship between proximity to public transportation hubs and urban decline and whether greater access to said public transportation hubs can encourage urban regeneration using Dayton, Ohio as a study area. To achieve this, we map decline using a weighted suitability model in ArcGIS and examine spatial conditions related to decline using quarter mile buffers around existing transportation hubs within the city.

5 DATA AND METHODS

Methodology of this research can be divided into two primary sections: 1) a suitability model using ArcGIS to measure declining area (See Figure 1), and 2) a distance buffer comparing declining area in close proximity to accessible transportation hubs to those farther away. To begin, a decline index for the City of Dayton was created by combining twelve raster data sets as variables contributing to urban decline (based on the literature) using ArcGIS suitability modeling. Each of the variables chosen can be used to illustrate the level of decline in a specific area, but it is important to remember that no one variable alone should be thought of as an independent sole cause or of decline; taken together, all twelve demographic, built environment, and land use characteristics can serve as a composite indicator of urban decline. This analysis measured and mapped population density, median age, minority population, educational attainment, poverty level, median income, unemployment, foreclosures, median property value, structurally sound buildings, vacant buildings, and delinquent parcels of land at block group and parcel levels within the city boundaries of Dayton. Data was taken from the American Community Survey 5-year estimates 2008-2012, yearly census estimates, and shapefiles provided by the City of Dayton (see Table 1). The process for this research is explained below.

Figure 1. Visual representation of methodology (Diagram by authors)
Table 1. Variable Sources and Relationship to the Development of the Decline Index.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Data Source</th>
<th>Symbology Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Density</td>
<td>ACS 2008-2012</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>ACS 2008-2012</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Race (non-minority)</td>
<td>ACS 2008-2012</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Educational Attainment</td>
<td>ACS 2008-2012</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Poverty</td>
<td>ACS 2008-2012</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td>Income</td>
<td>ACS 2008-2012</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Unemployment</td>
<td>ACS 2008-2012</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td>Foreclosures</td>
<td>Census est 2003</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td>Structurally Sound</td>
<td>Census est 2004</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Property Value</td>
<td>ACS 2008-2012</td>
<td>Negative</td>
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<tr>
<td>Vacant Buildings</td>
<td>Census est 2014</td>
<td>Each case coded as 3</td>
<td></td>
</tr>
<tr>
<td>Delinquent Parcels</td>
<td>Census est 2004</td>
<td>Each case coded as 3</td>
<td></td>
</tr>
</tbody>
</table>

Step 1: File Conversion – In ArcGIS, the shapefiles required conversion from vector to raster data (pixels) for a more accurate comparison of layered variables and to ensure overlay capabilities. During this step, the cell size was standardized for each mapped variable, which becomes important later in analyzing the total area and the percentage of declining area within a space.

Step 2: Reclassification – Each variable is valued differently because of the varying data characteristics and representation of a unique concept—some with percentages, some as whole numbers representing one thing, and others as decimals representing another—and a comparison of all variables requires standardization. This standardization of measurements was achieved using the Reclassify tool in ArcGIS. Each set of variable values was reclassified using Jenks Natural Breaks into 5 categories scored 1 through 5. For this analysis, a reclassified value of 1 indicates a pixel of low decline, while a reclassified value of 5 indicates high decline. By standardizing all variable values in this way, all urban characteristic data has been broken into 5 categories of analysis; low decline (1), moderately low decline (2), moderate decline (3), moderately high decline, and (4) high decline (5) (see Figure 2 and Table 2).

Step 3: Overlay – To combine all reclassified variables to create a decline index, the Weighted Sum tool was used in ArcGIS. In this study, each variable was analyzed with equal influence and importance, and received equal weight. Further analysis—both longitudinally and across cities—would be required to investigate the true influence of each decline indicator. The suitability output using a Weighted Sum yielded values ranging from 22 to 51—twelve variables each on a scale from 1 to 5—which required one additional reclassification into 5 categories, this time using equal intervals. The output, then, was a map of levels of decline by block group in Dayton on the 1 to 5 scale accounting for LL twelve variables.

Step 4: Multi-Ring buffer – The second major methodological step was the creation of distance buffers around transportation hubs in Dayton. Shapefiles provided by the City of Dayton of active and abandoned rail lines, state roads, local roads, municipal roads, and the Greater Dayton Rapid Transit Authority (GDRTA) bus system were used to identify five major public transportation centers (hubs) in Dayton. These hubs are designated as such by the city of Dayton. Two hubs were excluded as they were technically outside of the city's urban boundary—which left three hubs within the city for the analysis: Westown Transit Center, Wright Stop Plaza Transit Center (downtown), and Eastown Transit Center.
Figure 2. Suitability Mapping Output: decline index mapped for each individual variable
(Diagram by authors)
### Table 2. Suitability Mapping Output by Variable.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total Raster Count</th>
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<td>3</td>
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<td></td>
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<td>49</td>
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<td></td>
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<td></td>
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<td>Poverty</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Unemployment</td>
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<td>Foreclosures</td>
<td>203 552 093</td>
<td>1</td>
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<tr>
<td>Median Property Value</td>
<td>203 320 735</td>
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</table>

Each transit center is supported by the GDRTA multimodal transportation network which consists of diesel, hybrid diesel and electric trolley buses with over 3,000 stops on 34 routes throughout the region, supporting more than 9 million passengers a year (Rafter, 1995). The GDRTA’s goal is to connect people and communities through offering train, vehicle pedestrian, and bike share programs. One quarter mile buffers were placed around each transit hub and the area of decline and spatial conditions within each
buffer were examined. The one quarter mile buffer is a standard distance for buffer analyses due to its relatively comfortable walking distance and the degree of influence to a point that is provides (Li et al., 2016) (see Figure 3).

![Figure 3. Final reclassified suitability mapping output (Diagram by authors)](image)

### 6 RESULTS

After calculating percentage of decline within each ¼ mile buffer and combining that data, it was found that no pixels of high decline (category 5) existed in any of the buffered areas, or the areas within accessible proximity to a transportation hub. Next, the declining area that did exist (category 4) increased from 2.16% in the ¼-mile buffer to 4.54 percent in the 1-mile buffer. Transitional spaces (category 3) increased with movement away from the hub, occupying 45.99%, 49.60%, 54.15%, and 56.56% percent of the space within the ¼, ½, ¾, and 1-mile buffers, respectively. Space in moderately low decline (category 2) occupied approximately 42 percent of the space in both the ¼- and ½-mile buffers, 31.79% within ¾ mile of the hub, and 23.99% within 1 mile. Finally, space in low decline (category 1) occupied 9.44%, 4.43%, 10.08%, and 14.88% percent of the space within the ¼, ½, ¾, and 1-mile buffers, respectively. Taken together, these category 1 and 2 spaces represent areas of low decline or well-conditioned space, which increases significantly with movement towards a transportation hub (see Figure 4 and Table 3). When comparing all buffered space to all of the space in Dayton that exists outside of a buffer, there is more transitional space, less decline, and more well-conditioned space outside of the buffers (see Figure 5).
The Westown hub is located on the Western edge of the city and the Eastown hub, the east; the Wright Stop Plaza is located within the downtown of Dayton. In general terms, a majority of the lower decline area was located in close proximity to the Westown hub. This make intuitive sense, as the city is divided by the Miami River both spatially and economically. Western Dayton is characterized by higher amounts of vacancy, abandonment, and tax delinquent properties. It also has higher minority population, lower average income, and higher unemployment than eastern Dayton. While Westown has the most high declining area, it is important to mention that most of the high decline are resides outside of the buffer zones around each hub. A majority of the declining area in relative proximity to the Eastown hub exists north of the hub in a neighborhood in transition. It was once characterized by vacant lands but has since been redeveloped. The downtown hub has small, localized declining parcels but is not necessarily threatened by the onslaught of general decline.

However, the area in decline within the downtown maybe harder to develop. Many studies have found that small, disconnected, and isolated declining parcels are harder to repurpose than larger swaths or clusters of individual vacant/abandoned areas. This may limit the regeneration potential in the downtown. While Eastown seems to be on the upswing, Westown’s spatial conditions may make regeneration difficult. Hopefully, the existence of the transit hub is sparking some change within the general areas. According to the aforementioned results of this study, this seems to be a probably outcome or can be cautiously inferred.

7 CONCLUSIONS

7.1 Discussion and Implications
This research sought to investigate whether proximity to public transportation is related to the spatial distribution of neighborhood decline using Dayton, Ohio as a case site. Results from this analysis show that a relationship indeed exists between the two and that if more well-developed space is concentrated around the transportation hubs, it may then be argued that a sustainable public transportation system can help deter neighborhood decline and/or spur future regeneration of declining neighborhoods. It can keep cities and urban spaces unified, and can allow people the opportunity to move effectively and efficiently throughout those spaces, allowing them to thrive. Moreover, accessible transportation may also increase the amount of transitional space in a city, saving what may be at risk of
falling further into decline. This leads to the conclusion that greater availability of & access to public transportation can potentially encourage urban regeneration.

Table 3. Final Reclassified Suitability Mapping Output by Buffered Area.

<table>
<thead>
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<th>Decline Category</th>
<th>Raster Count</th>
<th>Percentage of Total Area</th>
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</thead>
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<td>Total City Area</td>
<td>22 468 902</td>
<td>0.123706657</td>
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<tr>
<td></td>
<td>68 704 858</td>
<td>0.378267185</td>
</tr>
<tr>
<td></td>
<td>64 875 334</td>
<td>0.375183039</td>
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<td></td>
<td>24 682 943</td>
<td>0.135896466</td>
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<td></td>
<td>898 463</td>
<td>0.004946653</td>
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<td></td>
<td>181 630 500</td>
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<tr>
<td>¼ Mile Buffer</td>
<td>166 175</td>
<td>0.094461141</td>
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<tr>
<td></td>
<td>745 732</td>
<td>0.423906698</td>
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<td>809 185</td>
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<td>38 097</td>
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<td>1 759 189</td>
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<td>½ Mile Buffer</td>
<td>315 507</td>
<td>0.04432129</td>
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<td></td>
<td>1 050 410</td>
<td>0.428510642</td>
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<td></td>
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<td>5 127 483</td>
<td>0.317934623</td>
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<td></td>
<td>8 734 490</td>
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<td>16 127 476</td>
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<td></td>
<td>28 400 140</td>
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<tr>
<td>Remaining City Space</td>
<td>18 240 665</td>
<td>0.119040802</td>
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<tr>
<td>(Area not within</td>
<td>61 890 003</td>
<td>0.403901701</td>
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<td>48 809 377</td>
<td>0.318505942</td>
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<tr>
<td></td>
<td>23 391 852</td>
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<td>0.005863479</td>
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<td></td>
<td>153 230 360</td>
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Figure 5. Comparison of decline within and outside of all buffered areas by percentage (Diagram by authors)
For example, the inclusion of complete streets measures to connect communities to the exiting transportation hubs could help to amplify this regeneration. A balanced transportation system that includes complete streets measures can bolster economic growth and provide efficient connections between residences and destinations. Simultaneously, they can be a fiscal asset to cities which may be characterized by a large amount of declining area. Integrating sidewalks, bike lanes, transit amenities, and safe crossings into the initial design of any urban regeneration project spares the expense of retrofits later. The costs associated with retrofitting new facilities for travelers are also minimized. Finally, they would allow for multiple methods of getting to and from work for local residents, contributing to the local economy and bolstering employment opportunities for residents, thereby reducing threats of decline.

As the developing world rapidly urbanizes, the demands on transport systems also grow often at a faster pace than the population. Based on our results, this circumstance is still consistent in shrinking cities. Given the above tendency, an effective and coordinated approach to urban regeneration could be to ensure that sound policies be put into place for urban transportation. Such policies could lay the basic framework for regeneration planning but must be based on a thorough inventory and prioritization of vacant land conditions. It is, however, important to remember that this analysis is not determining a causal relationship or a diagnosis of decline in Dayton. Rather, Dayton is used as a case study to determine positive the spatial relationship between accessible transportation and urban decline. Further longitudinal research would be required to determine whether targeting transportation can reverse the process of decline, especially in transitional spaces. Creating a city dynamic that is centered around a sustainable transportation system can certainly be an important element of the regeneration process. By connecting the spaces where people live and work, a community can create accessibility for all residents, ultimately creating better means for people on the move.

7.2 Limitations

There are a few limits to this study. First, not all data sources are consistent. While some is from the American Community Survey 5-year estimates, others were taken from yearly Census estimates. This was due to the limited availability of recent information on all variables. This study was not longitudinal, but rather, sought to snapshot the situation of shrinkage in Dayton holistically. Further, the ephemeral nature of vacant land data makes vacancy and delinquency difficult attributes to capture with high levels of precision.

Though most variables in the analysis can be cited as accurate and telling of the characteristic they seek to portray, educational attainment can be particularly difficult to measure. This analysis used data on individuals with a high school diploma to distinguish between those with relatively higher and relatively lower education, but it has also been shown that the level of bachelor degree or higher education is where the difference really emerges between the "uneducated" and the "educated" (Mallach 2012). This evidence was found after the completion of analysis, and should be considered as a way to refine variable selection and measurement for replications of this research. Finally, the findings of this research are simply looking for a basic relationship and are quite generalized. Treating all of the 12 variables equally and further reducing them to a scale of 5 levels of decline broadly generalizes correlation and categorized findings into approximations.

8 REFERENCES


CELA MEDIA STATEMENT

Title of Paper or Research:
THE MEANS OF MOVING PEOPLE: URBAN DECLINE AND PUBLIC TRANSPORTATION IN DAYTON, OHIO

Author:
Emeric, Ellen Jeanette; Newman, Galen

Institution or Professional Affiliation:
University of North Carolina at Chapel Hill; Texas A&M University

Media Statement:
Urban decline is a critical issue in shrinking cities globally, particularly among municipalities in the U.S. Rustbelt. It has been shown that cities developed around sustainable public transportation systems tend toward growth and stability. In this study of Dayton, Ohio, we develop an index for measuring urban decline, and compare this decline to the spatial location of existing public transportation hubs. Results indicate that proximity to transportation options is related to lower amounts of decline. Therefore, stronger policies encouraging complete streets and related alternative transportation options may be a strategy for preventing decline or spurring regeneration in declining neighborhoods.

Graphic Abstract:
RE-IMAGINING LINNAHALL IN TALLINN, ESTONIA:
SHAPING THE FUTURE OF A POST-SOVIET RELIC
THROUGH ETHNIC INTEGRATION, ADAPTIVE REUSE,
CONTEMPORARY ARTS, AND ECOLOGICAL RECLAMATION

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1. ABSTRACT
A relic of Estonia’s Soviet occupation built for the 1980 Olympics, Linnahall is a contested urban site infused with complex narratives. Linnahall’s imposing Brutalist architecture prominently occupies central Tallinn’s central waterfront on the Gulf of Finland. Originally dubbed the Lenin Palace of Culture and Sports, Linnahall was renamed after the restoration of Estonian independence in 1991, after which its continued use was embraced as a concert hall, ice-skating rink, and large event space. The building rapidly deteriorated, however many complex social, economic, environmental, and regulatory obstacles prevented redevelopment during the post-Soviet transitional period. Programmed use of Linnahall’s interior was abandoned in 2010; only the exterior remains in use today. Storm surges and sea level rise will likely affect portions of the structure by 2100. In 2017, the Port of Tallinn released Masterplan 2030 with initial concepts for the area surrounding Linnahall. The City of Tallinn also unveiled plans to renovate Linnahall as a conference center and concert hall. While strongly focused on development, connectivity, and economic revitalization, these plans are less clear about engaging Linnahall’s important historic, cultural, and environmental conditions. This paper provides a detailed history of Linnahall for the first time in English. It also identifies a set of objectives for reactivating Linnahall in response to contextual conditions and plans released in 2017. The paper culminates in a three-phase conceptual framework emphasizing cultural identity, sea level rise, and heritage. Shifting through periods of temporary markets and art installations, the proposal ultimately envisions Linnahall as a seaside heritage park.

1.1 Keywords
Ethnic Integration, Post-Soviet Urbanism, Post-Industrial, Waterfront, Baltic
2 INTRODUCTION

_Linnahall_, a Soviet-era iconic building and civic space on the waterfront of Tallinn, has a tumultuous past and an uncertain future. Commissioned by Moscow for the 1980 Olympics, but designed locally by Estonian architects Raine Karp and Riina Altmäe, _Linnahall_ has housed many activities since the restoration of Estonian independence in 1991, including an ice-skating rink, a 6000-seat concert venue, exhibition space, and various sports, retail, and transportation functions. With sweeping views of the Gulf of Finland and within walking distance of the passenger ferry terminal at Old City Harbour and the UNESCO-designated medieval district of Old Town, _Linnahall_ is well positioned to be a significant civic asset. Of the cultural destinations within walking distance that could influence _Linnahall_'s redevelopment (Haas and Belanger 2017), the most significant include:

- **Vanalinn**: Old Town
- **Patarei**: the Battery
- **Kalasadam**: The Fishing Port / Kalarand: The Fishing Beach
- **Kultuurikattel**: The Culture Boiler
- **Rotermann Kvartel**: Rotermann Quarter

Rapidly built during a time when quality construction materials and laborers were in short supply (Kurg 2006), the building began to deteriorate quickly after the 1980 Olympics. Since the 1990s, the City of Tallinn and various investment partners have repeatedly attempted to form partnerships to renovate the building and/or redevelop the surrounding site, but far-reaching complications have prevented either renovations or redevelopment. For a detailed historical timeline, see “History of Linnahall” (Section 5).

The building’s interior was closed to formal programming in 2010. A small ferry terminal, café, and helicopter port continue to operate from _Linnahall_’s seaside exterior. While the building itself lapses further into disrepair, its vast outdoor plazas and staircases remain informally occupied. People occupy rooftop plazas of the facility for New Year’s Eve festivities and summer outdoor concerts. The staircases are popular for small-scale social gatherings, often revolving around picnics, photography, fishing, and swimming. Most of the building’s facades within reach are decorated in extensive graffiti.

As a symbol of Soviet occupation, _Linnahall_ has been simultaneously a stark reminder of Soviet times and a node of multi-ethnic, the integrative activities of music, sport, and art. In addition to programmatic and cultural complexities, sea-level rise models suggest the building will be inundated during storm surges by the year 2100 (Haas and Belanger 2017). Further complicating proposed predevelopment, _Linnahall_ is protected by historic preservation regulations.

As _Linnahall_’s exterior deteriorates, plans are being developed for both the building and the adjacent tourist port. In 2017, Tallinn City Council unveiled plans to renovate the building into a conference center and concert hall (Leis 2017), with a proposed budget of €100 million funded jointly from the Republic of Estonia and City of Tallinn (potentially assisted by private investment). Also in 2017, the Port of Tallinn released the winning proposal from their urban design competition to plan redevelopment at the Old City Harbour (Port of Tallinn 2017). The resulting “Masterplan 2030,” by Zaha Hadid Architects (ZHA), proposes dense mixed-use infill across the port territory and adjacent to _Linnahall_.

2.1 Intent

The intent of this paper is threefold: (1) present a history of _Linnahall_, compiling many details from press and interviews for the first time in English, to facilitate the access of this information for international designers proposing redevelopment plans for the area; (2) identify design opportunities and constraints that reflect most recent plans released in 2017 by the City of Tallinn and the Port of Tallinn, building from previous work (Haas and Belanger 2017); and (3) develop a concept for the future of _Linnahall_, incorporating the above, and unfolding in three distinct phases:

_Tõsta_ [Lift]: invest in urban place-making and alterations to _Linnahall_’s exterior to increase use,

_Tõmba_ [Pull]: provide a gritty, culturally vibrant destination to complement adjacent redevelopment, and

_Vajuta_ [Imprint/Submerge]: create an ecologically responsive seaside heritage landscape

This phased design concept strives to support _Linnahall_’s continued relevancy and cultural complexity by integrating creative ideas for adaptive reuse, addressing anticipated sea level rise, reconciling _Linnahall_ with Masterplan 2030.
3 BACKGROUND AND CONTEXT

Approaching Linnahall from the city-side, it is impossible to comprehend the scale of the building. The height and slope of the staircases connecting to the city-side rooftop plaza inhibits views of the space above. Only upon cresting the staircase, does the incredibly vast extent of the building and its first plaza become evident. At the other end of that first 500-foot-long plaza, the grotto-like building entry is gated and locked. Pioneer trees grow from cracks in the concrete, and the building façade is decorated with graffiti. Ascending another set of stairs to the next terrace – reaching the rooftop of the main building – breathtaking 180-degree views of the Gulf of Finland unfold. Evidence of years of deterioration following hasty construction is visible in missing paving tiles, leaking rooftops, cracked walls, and crumbling stairs. The space recalls a ghost of the Chicago World Fair of 1893, built for one event, but persisting into the next era. Photographers relish the intense contrast of Linnahall and the towers of Old Town visible in the background, the seaside views and the extensive graffiti. Small groups gather, speaking different languages; and fishermen cast off the edge of the waterfront promenade into blue waters. Such are the contrasts of Linnahall: simultaneously an imposing and deteriorating symbol of Soviet occupation, and a meaningful, if gargantuan, urban fixture (visible from outer space) embedded with diverse narratives. The building itself covers approximately 7 acres (2.8 hectares); the building and site together comprise approximately 21 acres (8.5 hectares). Linnahall’s vast terraces divide these site amenities (Figure 1):
- the city-side, street-level entry plaza,
- the city-side rooftop plaza bridging Rumbi Street and the former rail line (now a trail),
- the grotto-like entrance to the building itself, which housed diverse functions before 2010,
- the seaside rooftop plaza with heliport, café, and ferry terminal
- the inoperative water feature beneath the heliport, and
- the waterfront promenade adjacent to the Gulf.

Relentless concrete stairways and landings connect the terraces, evoking Mesopotamian or Mayan architecture. Around the building’s perimeter, sloped and intentionally bastion-like berms enclose the building, inspired by the architect’s interest in medieval fortifications (Kurg 2006, p. 47). The expansive parking lots flank the city-side rooftop plaza, and feature mature street trees that are barely noticeable, as they are sunken beneath the entry plaza, and given the scale of their surroundings.

By 2006, Linnahall already resembled “a concrete scar on Tallinn’s shoreline” (Haas, 2006, p. 129). Already at that time, the site’s deterioration was self-evident. In interviews (p. 137), a city official described plans for “a private developer to renovate Linnahall out of pocket, beginning in January or February 2007, in exchange for the rights to develop the shoreline in front of it, 50 years from now.” Haas observed, “Incorporating generous green roofs into plans for Linnahall’s renovation could make a major contribution to green and blue space in the center city,” yet “Linnahall... brings into question, whether demolition or refurbishment is the best choice” (p. 129). At that time, a huge statue of Estonian folk hero Kalevipoeg occupied the top of the stairs of the city-side plaza -- whether in an invitation to multiculturalism or a reclaiming of contested space, was unclear (p. 120). Linnahall persisted through the restoration of Estonia’s independence, while the removal of other Soviet occupation-era monuments such as the 1947 Bronze Soldier catalyzed ethnic conflict and caused rioting (Ehala 2009).

Linnahall is a concrete reminder of the era of Soviet times, and looms out of scale with Old Town in the background, for any visiting tourist arriving by passenger ferry. During the authors’ visit to Linnahall in 2016, anti-fascist sentiment charged the graffiti-covered building façades with political intensity.

Seokho Hwang (2017) notes that the minority Russian-speaking population, many of whom immigrated to Estonia during Soviet occupation, may view the erasure of the remaining traces of Soviet architecture differently than the Estonian majority. With the redevelopment and consequent eradication of Soviet-era buildings and public spaces, “both the remaining Soviet material traces and minorities in Tallinn are neglected by nationalism and capitalism” (Hwang 2017, p. 8). As such, Linnahall may appear to be at the nexus of polarizing views toward Tallinn and a sense of civic identity, yet the site’s history reveals nuance and complexity (Section 5).

Kurg (2006) reflects on the possibility that, while Linnahall was built during Soviet occupation in a brutalist architectural style, it represents something more than occupation. He observes a shift in public opinion; in the 1980’s Estonians viewed Linnahall with “contempt rather than pride,” even when seeing their first Western rock concerts there (Kurg 2006, 48). During the 1990’s, there was a movement to erase many of the city’s Soviet-era symbols, removing monuments and recladding buildings. But by 2004, that sentiment had shifted; when developers proposed demolishing Linnahall to create a mixed-use district with private yacht parking, public support advocating for Linnahall’s continuation was strong. Nostalgia, and a renewed
interest in the now-rare architectural design proved more desirable than new development (already well represented in Tallinn). *Linnahall* had become part of Tallinn’s identity, and “a space that refused to conform to the dominant patterns of thought” (Kurg 2006, p. 53).

![Figure 1. Birdseye view of Linnahall from above Old City Harbour alongside spatial diagram of Linnahall site (2018). Photo source: Maili Saia. (2014). View to Tallinn City. Obtained from Flickr under CC BY-NC-SA 2.0 license on 21 Dec 2017. https://flic.kr/p/oHGFRL. Diagram by B. Belanger 2018](image)

As a grandiose gesture of socialist modernism, *Linnahall*’s plan imprinted imposing plaza spaces of a scale to suit authoritarian regimes, and making the individual site user feel small. At a city planning scale, *Linnahall*’s designers aligned its primary axis with the Viru Hotel, built during Soviet occupation in 1972 as the first high-rise in Tallinn. The planned axial alignment of the two buildings is thought to be part of planners’ attempts to connect the city center with the waterfront (Kurik, 2017). While the intended visual axial alignment is undeniable, true physical connectivity between the two Soviet-era buildings is less successful: interrupted by curves of pre-existing infrastructure (rail and tram lines, arterial streets). However,
the intention to connect the city to the waterfront by re-alignment of infrastructure associated originally with industrialization and military facilities, suggests a shift toward post-industrial planning (Kurg 2006). In an alternative interpretation, this planned axis could simply have been planned to connect the two largest Soviet-era landmarks imposed on Tallinn’s cityscape, regardless of infrastructural context.

In the future, Linnahall’s location adjacent to the coast faces threats from sea-level rise. Mapping sea-level rise and storm surge forecasts revealed that Linnahall will be inundated during storm-surge events by the year 2100 (Haas and Belanger, 2017). In current conditions, maximum storm surge would reach 3.1 meters, flooding Linnahall and adjacent areas planned for redevelopment (Figure 2). By 2100, sea level is expected to rise 74 cm in Tallinn, and maximum storm surge will likely reach 4.5 meters, (Kont et al, 2008 and Suursaar et al 2011). While storm surges are wind-driven and expected to be brief in duration, the redevelopment area potentially requires sea walls or other protective measures.

Figure 2. Sea level rise and storm-surge forecasts for Linnahall and surrounding context (2018).

Data source: Kont 2008 and Suursaar et al 2011, AutoCAD base map courtesy of Tallinn City Planning. Diagram by V. Haas 2018

3.3 Old City Harbour Master Plan 2030

Waterfront cities across Northern Europe are investing in post-industrial port districts. Malmö, Sweden’s Western Harbor is recently completed and serves as a landmark in sustainable urbanism (Austin 2013). Copenhagen’s Nordhavn port redevelopment is under construction and will house 40,000 people and the same number of jobs (By and Havn, n.d.). Stockholm, Oslo, and Helsinki are also in the process of redeveloping their post-industrial waterfronts.

In 2017, The Port of Tallinn released Masterplan 2030, a plan for redeveloping the Old City Harbour (Figure 3). The goal was to “create a comprehensive, long-term solution to form the basis for property development in the port area and to connect city and public space with the functions of the port” (Port of Tallinn 2017). The plan was the winning entry of a yearlong design competition sponsored by The Port of Tallinn. Titled “Stream City”, the design is the result of a collaboration of a the multi-disciplinary design team, including among others: design lead, Zaha Hadid Architects (ZHA), with urban design, landscape architecture, and sustainability consultancy Tyréns UK.

The redevelopment area is re-envisioned to be both a gateway to Tallinn and a link between the city center and the port. Drawing on a stream system metaphor, the master plan proposes a highly
connected pedestrian network with a variety of public spaces, featuring a “planted highline” elevated promenade that separates industrial port activity from pedestrians. In order to create a “unique world-class public realm”, the designers frame the plan around connectivity, placemaking, principles of sustainability, and values of integration (ZHA 2017, p. 2).

Immediately east of Linnahall, the plan proposes the “North Commercial Quarter,” and depicts “Linnehal [sic] Marina” extending into the water, and a courtyard-rich commercial office neighborhood on terra firma (ZHA 2017, p. 2). Another block east, the plan calls for hotels, service apartments, a plaza, and leisure amenities including a “leisure spine,” pools, saunas, and a wellness center (p. 1). Circulation diagrams illustrate pedestrian connections to Linnahall’s waterfront promenade, but not explicitly to the city-side and street-level plaza (p. 6).

Most significantly, the plan calls for an aerial gondola-style “cable car” connecting the North Commercial Quarter to Old Town, routed directly over Linnahall’s south rooftop plaza (Figure 3). The three-quarter mile (1.2-km) gondola ride would afford passengers aerial views of the city center, Old Town, Old City Harbour; and, most relevant to this research, a close overhead view of Linnahall. The phasing plan calls for North Commercial Quarter construction in Phase 1, with incremental rollout through the fourth and final phase (ZHA 2017, p. 4).

Figure 3. Rendering of Masterplan 2030 by Zaha Hadid Architects adjacent to Linnahall (2017). Renders by VA. Reproduced with permission of Zaha Hadid Architects

Aligning with the Port of Tallinn’s goal of property development, the plan emphasizes commercial property and entertainment, noting: “Popularity with the local population as a distinctive shopping and entertainment area will be critical to the success of the master plan” (ZHA 2017, p. 4). The plan gives only brief mention to Linnahall and other nearby cultural heritage sites; renderings depict Linnahall as a static element in the landscape: scrubbed clean, but un-renovated, appearing roughly as it does today.

4 METHODS

Having identified a gap, in that Linnahall’s site planning needs to be reconciled with the masterplanning for the port’s revitalization as a whole, we set a research goal of developing design concepts that reactivate Linnahall while addressing sea level change and Tallinn’s cultural context. In previous work (2017), we identified a set of objectives for the future of Linnahall, organized into three themes: cultural, experiential, and ecological. This paper revisits those objectives in light of recent plans for
Linnahall renovation and Old City Harbour redevelopment (Section 6.1). We use Deming and Swaffield’s (2011) categories to define our methods, dividing our process into three stages: exploration, evaluation, and design concept development.

To explore the site’s history, cultural context, and build an understanding of cultural and political issues affecting Linnahall’s redevelopment, the (Estonian-American) author Haas used Secondary Description to summarize the history of Linnahall from its inception, translating text from Estonian to English as necessary (Section 5). Sources include maps, building plans, and other materials collected from the City archives in Tallinn, as well as books, scholarly articles, and development plans described in Estonian news media outlets. Both authors used Secondary Description to review scholarly articles, online sources, and planning documents for background and precedents. Using Direct Observation, Haas built knowledge of Linnahall from repeated site visits and interviews with City Officials, particularly from 2003-2006 and 2008-2009, exploring the potential of public space to promote ethnic integration in her thesis (2006). Direct Observation also informed our original and revised opportunities and constraints through a recent site visit (2016) and discussions with City Officials regarding the future of Linnahall.

To evaluate design opportunities and constraints, students under Belanger’s direction used Descriptive Case Studies for a class assignment studying a range of waterfront developments, which served as a starting point for our design precedents. Using Descriptive Modeling to create sea level rise models, Haas referenced published sea-level rise forecasts (Kont et al 2008, Suursaar et al 2011) and challenged students to develop 3D models of Linnahall using SketchUp and sections showing the effects of sea level rise on the building (Haas and Belanger 2017). Figure 2 is an additional interpretation of sea level rise using contours and AutoCAD data provided by the Tallinn City Planning office. Using Evaluative Methods, we identified the critical design opportunities and constraints for the site, and compared those with development strategies in Masterplan 2030 and the City Council’s 2017 design proposal. Specifically, we identified significant factors and historic patterns (e.g. repeated failed redevelopment attempts and Tallinn’s ongoing need for ethnic integration), conditions for human experience (e.g. people arriving at the port and engaging in cultural activities in the district), and influential environmental conditions (e.g. sea level rise). With those considerations in mind, we analyzed the existing Linnahall planning proposals for ways in which they addressed (or failed to address) the objectives we identified as critical to the future of Linnahall.

Finally, using Projective Design, we developed a design concept for redevelopment with three phases (Sections 6.2 - 6.5), responding to Linnahall’s shifting environment, which allowed Belanger to prepare diagrammatic phasing plans. Based on our evaluation, we identified opportunities to engage with the port masterplanning proposal, such as physically connecting with Masterplan 2030’s elevated pedestrian promenade and creating an aesthetic experience for cable car riders. Other design strategies focus less on formal composition and more on the agency of design operations. For example, we propose leveraging the arts and culture inertia in the immediate district to address ethnic integration. Similarly, we advocate for indeterminate formal outcomes as sea level rise and storm surge transforms the Linnahall’s building and site into a heritage park in the third phase.

5 HISTORY OF LINNAHALL

“Commies love concrete, but they don’t know how to make it” (O’Rourke 2007, p. 74).

5.1 Linnahall Planning and Construction

Tallinn City archives date Linnahall’s planning back to 1972, after the 1971 city master plan called for a facility to house 6,000 spectators (Karlep 2017). In 1974, Moscow made the decision to host the Olympic regatta in Tallinn (Lindpere 2012). Other locations in Tallinn besides the port were considered for the 6000-seat concert-hall and sporting facility: for instance in Lasnamäe, in Lilleküla, in Mustamäe, and in Kadriorg. Linnahall’s construction began in 1975, with the demolition of old factories that had previously occupied the site. The historic plans show a significant area of fill extending into the water, most likely spoil from excavating the below-sea-level building interior. Reviewing historic photos and the construction documents shows the seaside pavilion was built out significantly beyond the original shoreline (Figure 4). Linnahall’s architects were Raine Karp and Riina Altmäe with interior designers Ülo Sirp and Mariann Hakk. According to architect Raine Karp (in an interview with Karlep, 2017),
“During Linnahall’s construction, we could do what we wanted. There was no specific prescription; they simply wanted a hall to house 6000 people, which could also be used as a hockey arena… It was our luck that at that time there was no bureaucrat at our neck. We consulted with philharmonic people and sports people, and then we decided on the solution ourselves… Today it would not be possible to bring such a large project to life so quickly.”

The construction process itself, however, was another matter, as the architect recalled (Karlep 2017):

“Typical Soviet-era problems: materials could not be sent, it could not be constructed properly. In addition – general chaos. No particular attention was directed to Linnahall’s construction. The whole time, attention was focused on Pirita’s sailing center, the better part of Tallinn’s construction workforce was directed there… The whole undertaking was very mixed up… the Linnahall project was in some ways successful, although its execution was rushed.”

Figure 4. Industrial condition in 1925 and original Linnahall construction documents. Buildings highlighted in red key the location of the Linnahall footprint to the 1925 photograph. Images prepared by V Haas (2018), utilizing source images provided from the Tallinn City Archives.

Linnahall’s construction employed 540 people in 1980 (Küla 2013). The total cost of demolition and construction was 8 million rubles (Karlep 2017). According to historic exchange rates, this amount would have been equivalent to $407,105 in 2017. However, this currency conversion does not adjust for the disparity of purchasing power between the dollar and ruble during Soviet occupation; the cost of renovating Linnahall has most recently been estimated at €100 million or $125 million, wildly disproportionate to the original Soviet-era investment for Linnahall’s construction – regardless of how one calculates exchange rates.

5.2 Programming After the The Olympics

After 1980, Linnahall was used for sporting events (including hockey), fashion shows, and rock concerts (Lindpere 2012). Originally named the Lenin Palace of Culture and Sport, the facility’s name was officially changed after the restoration of Estonian independence in 1991 to Linnahall, meaning “town hall.” Linnahall was never used as a town hall; rather the name began to be used already by 1988 for its sound similar to Leninhall (Lindpere 2012).

In 1995, the Lindaliin ferry terminal was established at Linnahall. In 1997, a dispute arose between long-term leaseholders of Linnahall and the facility’s director (Lindpere 2012); at this time, Linnahall’s designation as a historic monument was first discussed (Küla 2013). By 1998, it was clear that Linnahall required renovations: the roof of the ice skating hall leaked, vandals had damaged the seating, and the plumbing needed immediate repair. That same year, Deputy Mayor Peeter Kreitzberg observed Linnahall’s construction was already showing extreme flaws; from the City’s point of view, it didn’t make sense to
maintain *Linnahall* as a concert venue (Lindpere 2012). In 1999, ETP Grupp established the Copterline helicopter terminal, with architect Peep Urb designing the helicopter pad terrace.

### 5.3 Visions for Renovation and Redevelopment

Around 2000, the firm Österled enlisted Tallinn’s Technical University to evaluate *Linnahall*’s structural integrity; the University concluded the framework of the building was structurally sound and could support renovations. Österled then hired Swedish architectural firms, Wingård Sandell Sandberg and Arkitektbyrå AB, to propose concepts to broaden *Linnahall*’s function and promote economic expansion. They proposed to convert *Linnahall* into an international research center or educational institution, while preserving the facility’s concert hall and conference center functions (Lindpere 2012). This project’s momentum was lost by 2002, when the *Linnahall* director left Tallinn to work for Österled in Stockholm.

In addition to the *Lindalinn* ferry and Copterline, the occupants of *Linnahall* were as follows in 2000: a children’s sport training facility, judo club, bowling alley, a music store, sound studio, auto customization (sound & light), catering, Tallinn City Archive’s warehouse, and Linnahall’s own administration. By 2000, *Linnahall* hosted around 80 events per year, and the ice skating hall was rented 85% of the time. However, Tallinn Mayor Jüri Mõis announced plans to close *Linnahall* and move many of these functions to *Saku Suurhall*, the new 10,000-seat arena just outside of Tallinn (Lindpere 2012).

Österled’s plans for renovation resurfaced as “Forum Tallinn,” proposing to use European Union funds for redevelopment. The City and the *Linnahall* board of directors disagreed about this plan, however; Deputy Mayor Rein Lang said the proposed programming lacked perspective, and would not serve the City’s best interests; the *Linnahall* board of directors maintained it remained the City’s responsibility to define how the project should proceed.

The City assumed ownership of the land beneath *Linnahall* in 2001; confusion over land ownership had been a point of concern for the potential Swedish developer Österled. In 2002, Österled brought a proposal to the City to divide the *Linnahall* parcel into five pieces, leaving the central portion in City ownership and selling the surrounding parcels to finance the development of a conference hall. The City terminated the “Forum Tallinn” project in response (Lindpere 2012).

A 2003 international design competition for *Linnahall*’s redevelopment resulted in proposals from COO Arhitektid, Kosmos, and Rein Murula, among others (Kaan 2003). The terms of the design competition required:

- siting a 4000-seat conference center (rather than a concert hall),
- preserving key elements of the architecture, and
- proposing redevelopment for the neighboring parcels (totaling 17 hectares or 42 acres).

*Linnahall*’s value was estimated at the time at 39.6 million EEK ($4.65 million in 2017 dollars). One proposal, from Danish firm Hvidt & Molgaard (in association with developer Manutent AS), proposed razing *Linnahall*, keeping only lower level of as a platform for 3-story shops, apartments, and cafés (Põld 2004). Prime minister Urmas Paet’s response was to pronounce *Linnahall*’s removal was not likely possible (Küla 2013). Developer Urmas Sõõrumaa stated in an interview with the press, “The city basically wanted to give me the building in 2003-2004; however, nothing came of it… I would have fixed it up for €50 million, and the city would have a functional conference venue today” (Reimar 2017).

The Deputy Mayor Rein Lang reacted against proposals to raze *Linnahall* by pursuing historic conservation. The historic preservation office enlisted the firm DoCoMoMo to analyze the historic significance of *Linnahall*; the consultant recommended *Linnahall* for preservation. In December of 2002, Karl Õiger of Tallinn’s Technical University had been enlisted to evaluate the building’s structural stability; he concluded rather colorfully (in 2004), “I dare to reckon, that even then, if in 10-20 years nothing is done, the hall will still be standing,” (Lindpere 2012). In 2003, Deputy Mayor Toomas Vitsut qualified that measures for *Linnahall*’s historic conservation should not preclude redevelopment, if a suitable investor could be found. In summer of 2004, Piret Lindpere and Veijo Kaasik of the historic preservation office reacted with new special conditions to preserve *Linnahall*’s interior concert hall and bastion-like exterior as architecturally unique. The Estonian Architect’s Union also announced their opposition to redevelopment of the site. At that time, Professor Karl Õiger estimated that *Linnahall* could be renovated at a cost of €23-30 million (Paulus 2004).

In May 2009, Deputy Mayor Taavi Aas and the US-based firm Tallinn Entertainment LLC agreed on a plan for restoration and conversion of *Linnahall*. The ice skating rink was closed. In December the last conference event was held: an exhibit of nature photos. In 2010, all activity within *Linnahall* ceased (Küla 2013). In August 2010, the City agreed to lease *Linnahall* to Tallinn Entertainment LLC, founded by
Ronald S. Lauder (also the CEO of Estée Lauder Companies). The terms called for renovation of the building for 99-years, in exchange for the right to raze and redevelop as a hotel and entertainment center after that time – almost the same terms for a public private partnership proposal that were under discussion three years earlier (Haas 2006).

Reform party speaker Valdo Randpere, spoke out in opposition to the proposal, which was reputed to propose to redevelop Linnahall as a giant casino, and under which terms the City would not charge rent ($800,000 per year) for the first 15 years. Linnahall renovations at that time were estimated to cost 700 million Estonian crowns, or $6 million (Delfi 2010).

Deputy Mayor Taavi Aas claimed in January 2010 that Tallinn Entertainment LLC was approved for a loan up to 2.8 billion crowns ($238 million) from the US government to redevelop Linnahall and other projects within Tallinn (Tere 2010). By February, however, this claim was in disrepute and denied in a “combative” press conference by James Land, press attaché for the US Embassy in Tallinn (Joost 2010).

Tallinn Entertainment LLC was registered in 2007 in the state of Delaware, as owned equally by: RSL Capital (itself owned by Ronald S. Lauder), GF Capital Management Advisers, and Remi International (Joost 2010). Delaware is known for the absence of a sales tax. Rumors soon surfaced of arrests in Hungary and the US after accusations of corruption, bribery, and tax evasion related to the proposed project (Skyscraper City 2011). The Tallinn Mayor at the time, Edgar Saavisaar of the Center Party, was suspended after being suspected for accepting bribes from 2014 to 2015. Another suspect in that case was Aivar Tuulberg, a shareholder in the firm Rand & Tuulberg responsible for the redevelopment of Kuulturikattele (the Culture Boiler) adjacent to Linnahall (Oll & Tambur, 2015). One of the several bribery charges against Saavisaar related his acceptance of €50,000 from Tuulberg to ensure Astlanda Ehitus and Rand & Tuulberg AS would win the €3,146,664 construction bid to redevelop Kuulturikattele (Berendson, Reimar & Kund 2016).

In September 2014, the City announced plans to share the “stagnant” seaside portion of the Linnahall site with private developers, permitting the construction of additional buildings by private investors; the motivation for this proposal was to attract investors to renovate Linnahall as a conference center for 2018’s 100th anniversary of the Republic of Estonia (Värk 2014). Finding great potential in the seaside platforms of the building, Arhitekt Must (apparently unsolicited) proposed converting the central seaside portion basin of Linnahall now below the helicopter landing pad into a swimming pool; their proposal was featured in the Estonian newspaper Delfi in 2016.

5.4 Tallinn Envisions a New Renovation Plan

In September 2017, students of Tallinn’s art academy Tallinna Kunstigümnaasium were commissioned to design and paint on Linnahall’s façade a graffiti mural of Tallinn’s skyline, which they titled Peegelpilt vanalinnast (“Mirror image of Tallinn”). The commission was funded first for €15,000 by Märts Sults, Pirados Studios’ and the Pirados Brand, with an additional €10,000 contributed by acting Tallinn mayor Taavi Aas (Kanarbik 2017). (In 2010, Aas was the Deputy Mayor involved in the “combative” dispute with the US Embassy regarding government financing for Linnahall’s redevelopment.)

The 2017 graffiti commission was organized by the Linnahall board of directors (Tallinna Linnahall AS), but resulted in a dispute with the historic preservation office, which maintained that the painting of Linnahall’s façade was unlawful, and should be removed. Tallinna Linnahall AS plans to ask for an extension until 1 June 2018 of the deadline to remove the mural. A petition supporting the continuation of the graffiti exhibit garnered 1000 signatures in an 85-hour period (Kanarbik 2017), demonstrating local support for the project.

Also in 2017, the Estonian government once again resolved to work with the City of Tallinn to renovate Linnahall into a conference center, proposing to invest €40 million to be matched by €60 million from the City of Tallinn, the latter possibly shared with an investor interested in renovating Linnahall’s concert hall. This led to debate in the press about whether investing €100 million in civic funds would be the best investment for Estonia, given private investors’ hesitancy to undertake the project (Leis 2017). Tallinn City Council produced a video detailing a design proposal that would renovate Linnahall, including a 5000-seat concert hall, preserve the existing structure and enhance functionality by adding green roofs and a glass-walled gathering space (possibly intended as a conference center) to the currently underutilized and expansive rooftop area with a view of the sea. Support for the project would be divided between the Republic of Estonia and the City of Tallinn, and construction would begin at 2019 at the earliest, pending approval of the budget from Brussels (ERR News 2017). In this design, however, the city-side of Linnahall
facing Tallinn is left virtually unchanged (although the €25,000 graffiti mural has been removed in the renderings).

Linnahall’s interior corridors have low ceilings and the building is nearly windowless. Even with a €100 million overhaul, it would be difficult to transform Linnahall into a structure with an abundance of natural light. The City Council plan proposes to add an extensive, glass-walled sea-side rooftop space—which may have the potential to meet contemporary expectations for a world-class conference venue, particularly given the proximity to Old Town and the ferry terminal.

6 SHAPING THE FUTURE OF LINNAHALL

6.1 Design Objectives for Framing Linnahall’s Redevelopment

In previous research, we identified a set of design objectives, organized around three themes: cultural, experiential, and ecological. Table 1 presents a revised set of objectives, responding to Tallinn City’s plans for Linnahall renovation and Masterplan 2030, both released to the public in 2017.

Table 1. Design Objectives. (adapted from Haas and Belanger, 2017)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Objectives</th>
</tr>
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<tbody>
<tr>
<td>Cultural</td>
<td>- Address contested social and historic narratives of occupation and ethnic integration</td>
</tr>
<tr>
<td></td>
<td>- Re-integrate Linnahall with the developing arts and cultural district surrounding it</td>
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<tr>
<td></td>
<td>- Integrate Linnahall with adjacent port redevelopment</td>
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<tr>
<td></td>
<td>- Ensure that current user groups (inter-ethnic youth subcultures, ethnic minorities, neighborhood users) still feel welcome as the surrounding neighborhood gentrifies</td>
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<td></td>
<td>- Conform to shifting requirements for protection as a cultural heritage monument</td>
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<td></td>
<td>- Display transparency and encourage public participation during the planning process</td>
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<td></td>
<td>- Maintain Linnahall’s character to retain a sense of identity valued by local population</td>
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<tr>
<td>Experiential</td>
<td>- Provide accessible public space for different size groups and different user types</td>
</tr>
<tr>
<td></td>
<td>- Enhance the views of the sea, and views from the sea</td>
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<tr>
<td></td>
<td>- Build a broader base for tourism by adding cultural interest along the waterfront</td>
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<td></td>
<td>- Enhance Linnahall’s function as a gateway for tourists arriving by sea</td>
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<td></td>
<td>- Make Linnahall’s street-level threshold plaza more inviting and more accessible</td>
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<td></td>
<td>- Create a visual experience for people looking down onto the site from the cable car</td>
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<td></td>
<td>- Develop programming to complement and provide cultural alternatives to the commercial and entertainment program</td>
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<tr>
<td></td>
<td>of Masterplan 2030</td>
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<tr>
<td>Ecological</td>
<td>- Provide site design strategies that address sea level rise</td>
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<td></td>
<td>- Soften Linnahall’s Brutalist aesthetic through landscape interventions, integrating it with Tallinn’s present character and the Masterplan 2030 planting design strategy</td>
</tr>
<tr>
<td></td>
<td>- Integrate ecosystem service strategies to improve landscape performance and</td>
</tr>
<tr>
<td></td>
<td>celebrate native ecologies of the regional waterfront</td>
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<tr>
<td></td>
<td>- Integrate low energy, high efficiency systems on par with recent public space design in other Northern European cities.</td>
</tr>
<tr>
<td></td>
<td>- Maximize unique site features, notably the bastion walls and stairways</td>
</tr>
</tbody>
</table>

6.2 Re-imagining Linnahall’s Future

Linnahall is valued by diverse people for a variety of reasons and is protected by historic preservation, so it’s unlikely to be razed and replaced. With a record of unsuccessful redevelopment attempts, deteriorating building conditions, and uncertainty about investing €100 million of public funds for renovation, we assert the building’s interior is unlikely to attract major re-investment. So the question posed by a leading Estonian media outlet remains, “What do you do with a giant Soviet-era ‘mothership’ in the middle of Tallinn?” (Estonian World, 2016). One answer lies in Linnahall’s cultural past and its environmental future.

Linnahall stand[s] simultaneously as a monument to a bygone era and as a sign of the beginning of a new one (Kurg 2006, 53). As part of Tallinn’s identity, as a symbol of the past, and as an icon of new beginnings, Linnahall will continue to refuse to conform to redevelopment status quo. Neither simply a
symbol of Soviet occupation, nor simply an icon of contemporary multi-ethnic civic pride, Linnahall is rather a complex layering of narratives for generations of Tallinn residents.

Our design concepts propose a gritty counterpoint to the polished redevelopment proposal in Masterplan 2030, extending the legacy of Linnahall by building upon its deeply-rooted and diverse cultural heritage. This design concept acknowledges that storm surges will likely flood the lower third of the Linnahall building by 2100 (Haas & Belanger 2017). We favor ultimately allowing natural processes to overtake the building, transforming it over time into an outdoor heritage site. The resulting landscape will serve Tallinn as a public space, available to all for engagement and interpretation. Responding to cultural, experiential, and environmental opportunities and constraints, our proposal unfolds in three phases.

6.3 Tõsta [Lift]

The first phase, Tõsta [Lift] strives to enhance Linnahall’s occupiable civic space quickly, attracting visitors through site improvements and temporary programming, promote ethnic integration, and elevate awareness of sea level rise. The site’s vast exposed plazas would become considerably more comfortable with tree plantings, enhanced site lighting, comfortable seating grouped to promote conversation, and other pedestrian amenities. Some of these same ideas are also present in Tallinn City Council’s (2017) renovation proposal.

Tõsta [Lift] would include a mix of temporary and permanent art installations, recreational activities, market booths, and play areas to invite residents and tourists to explore Linnahall, thus attracting activity to the site. Offering both warm- and cold-weather activities would ensure year-round programming and vitality. A similar strategy has been implemented on Copenhagen’s Paper Island, where planners strived to create a “scrappy and appealing” cultural destination, which has attracted creative businesses and artists (O’Sullivan, 2016).

The street-level and city-side rooftop plazas would feature formal bosques of trees following the grid and axial alignment of the original layout. The existing, blocky concrete seats could be enhanced with warmer and softer materials, and new seating areas could be integrated among the trees. The street-level plaza, programmed with market vendors, a four-season water/ice feature, and a creative play area for children would activate the gateway to Linnahall from the city-side.

On the city-side rooftop plaza, intensive green roof plantings would provide tree canopy and shade. Additional seating, large-scale outdoor sculptures, temporary graffiti art and other exhibits, and gas fireplaces for winter gatherings would activate space.

On the rooftop of the main building and on the sea-side rooftop plaza, panoramic views of the gulf would be maintained, limiting the introduction of vertical elements. Taking advantage of the open sky and expanses of stairs, an informal outdoor theater would provide a venue for films and concerts, with seating on the seaside stairs and terraces.

Throughout the site, current infrastructure would be creatively adapted to form enhanced recreational space. The citizen-led transformation of abandoned ironworks facilities in the Ruhr District in Germany provides many transferable design strategies. Now known as Landschaftspark Duisburg-Nord, the former industrial complex features climbing walls, ropes courses, panoramic overlooks, outdoor hammocking rooms, slides, interactive light installations, and other amenities for adults and children (Landschaftspark Duisburg-Nord, 2018). Most recreational amenities were adapted using existing industrial site features.

To address contested social and historic narratives of occupation, site improvements and art installations would feature themes promoting ethnic integration. In addition to concentrating on past conditions, artists would collaborate with environmental scientists and political leaders to nurture integration by looking forward. Linnahall could become an interactive and didactic set for raising awareness about sea level rise, and provide inclusive solutions that benefit all residents of Tallinn. While addressing sea level rise generally, the theme would also provide a platform to describe the long-term plan for Linnahall outlined here.

6.4 Tõmba [Pull]

The second phase, Tõmba [Pull] reflects Masterplan 2030 objectives by improving access to Linnahall’s rooftop plazas, enhancing the exterior with architectural additions (similar to the City’s 2017 plan), and creating an immersive art installation for the building’s interior. The ZHA design team’s proposal to elevate pedestrians above ground level on a highline linear park presents an opportunity to physically connect the proposed pedestrian network to Linnahall’s rooftop plazas. An elevated connector would pass
through the North Commercial Quarter, leading directly onto Linnahall’s southern rooftop plaza. The proposal would not only enhance vitality at Linnahall, it would also support Masterplan 2030’s objective to connect with the existing “green network,” specifically identifying Linnahall as a destination (ZHA 2017, p. 5). To further enhance accessibility, an outdoor elevator would connect Linnahall’s street-level plaza with the city-side rooftop plaza, and by extension the proposed highline linear park. A large-capacity elevator would provide access for pedestrians as well as artists and vendors installing fixtures on the city-side rooftop plaza; security measures would be implemented to prevent vandalism or mischief. The elevator would be placed between the two street-level staircases with doors on the front and back.

To connect to the local art and cultural communities, an immersive art installation would occupy Linnahall’s interior. This phase builds upon Linnahall’s recent engagement with students of Tallinn’s art academy Tallinna Kunstigümnaasium. The art installation would be intended for removal or relocation once sea level rise and storm surges threaten Linnahall’s below-grade interior. The art installation would provide a creative, interactive, and highly unique experience. Our concept is inspired by Meow Wolf’s House of Eternal Return, a 20,000 square foot former bowling alley in Santa Fe, New Mexico, purchased by an art collective and transformed into a dreamlike world of multiple dimensions and interactive experiences (Meow Wolf, 2018). The surreal Meow Wolf exhibit, which opened in 2016, has been featured in publications around the world, and “models for us the art of synthesis, of adaptive reuse, a key component of all creativity” (Linett, 2017, p. 368). The exhibit was constructed by a team of dozens of artists, engineers, and carpenters of various trades in fourteen months. Attracting over 400,000 visitors in the first year, Meow Wolf estimates it has injected $6 million into the local economy and an additional $13 million in marketing value to Santa Fe (Rodgers, 2017). Serving to attract visitors into the nondescript building, Meow Wolf’s entrance features gigantic statues (a blue wolf, a robot smelling a flower) in scale that would be effective at Linnahall, and parallel to prior temporary art installation and schemes for a large statue of Estonian folk hero Kalevipoeg within the harbor (Haas 2006).

6.5 Vajuta [Imprint / Submerge]

The third and final phase, Vajuta [Imprint/Submerge] acknowledges that wind-driven storm surges will likely flood the entire port area for short periods of time by 2100, by which time Linnahall will have fallen further into disrepair. Inspired by the bastion-like geometric landforms bounding Linnahall and Tallinn’s Old Town wall, sculptural forms would allow the Baltic Sea to reclaim portions of the site, memorializing the site’s history and encapsulating culturally significant civic space. While Masterplan 2030 and other future developments can incorporate flood protection systems into infrastructural plans, in these schemes Linnahall itself remains vulnerable to storm surges. With a below-grade interior, flooding is likely to become an increasing threat to Linnahall. As Tallinn’s first post-industrial waterfront redevelopment, Linnahall’s engagement with the water’s edge is central to the design. Armoring Linnahall with sea walls or other protective measures might delay flooding, but it would simultaneously destroy the essence of Linnahall’s relationship to the sea.

Historic preservation would have us treat the building as a static object; complete renovation would require flood protection. Instead, emergent preservation maintains the cultural legacy of the site while allowing natural processes to occur unchecked.

Once storm surges threaten the integrity of the interior space’s art installations, Linnahall would begin the transition into a seaside heritage park, allowing people direct access to the water and permitting flooding during storm surges. The installations proposed in earlier phases Tõsta and Tõmba, are either located in elevated areas safe from 2100’s projected storm surges, or designed to withstand the occasional wind-driven storm surge, or in the case of the immersive art exhibit, removed / relocated in time. By selectively retaining portions of the structure, particularly the plazas, staircases, and bastion walls, the site would retain the forms of cultural legacy that are meaningful to Tallinn’s residents. In some areas, the interior spaces of the building would be demolished; in other places, they would be sealed off from public access and structurally enhanced to continue supporting plazas above. With the majority of Linnahall’s rooftop serving as plaza space, it is impossible to separate the site from the building. However, by vacating and reinforcing the interior space, it is possible to remove the function of the building but retain the site.
7 CONCLUSION

The future of Linnahall is uncertain. Through the years, proposals for redevelopment have followed one parallel track: repeating similar programmatic goals of interior renovation into a conference center and concert venue. To date, those proposals have not been realized; investors have not committed. This paper proposes an alternative program for Linnahall’s redevelopment, integrating by creative ideas for adaptive reuse, strategies for addressing anticipated sea level rise, alignment with Masterplan 2030, and cultural vibrancy.

Like the City’s 2017 vision, we propose investing initially in the redevelopment of Linnahall’s exterior spaces. The first redevelopment phase Tõsta [Lift] would shift the focus from building renovation to urban place-making. This paper’s novel contribution lies in the second and third design concept phases. In Tõmba [Pull], with the initiation of interior programming introducing a creative and experiential art installation, Linnahall will be restored to a culturally vibrant destination for local residents and visitors alike. In and Vajuta [Imprint/Submerge], as Linnahall is transformed into a seaside heritage landscape, it will continue to resist conforming to the redevelopment status quo.

The design concepts presented here would require funding from public sources, but at a level much less than the amount currently under discussion (to renovate the building into a conference center and music hall). The money saved after funding our proposed Linnahall improvements could be invested in a brand new conference center and music hall, located in the Old City Harbour redevelopment area, where it could more easily meet current expectations for building interior volume and light. Furthermore, placing a conference center and music hall in the port area aligns with Masterplan 2030’s vision to create a distinctive entertainment area for Tallinn residents. The pledged funding of $125 million by Tallinn City the Republic of Estonia is over ten times the original cost of Linnahall’s. More effectively engaging Tallinn’s creative community can generate economic drivers, likely at a much lower cost.

The research findings and design ideas presented in this paper provide new perspectives on the future of Linnahall, providing specific ideas for a particular site, but also generalizable concepts for similar sites. This paper provides information available in English for scholars studying post-Soviet landscapes, researching post-industrial waterfront redevelopment, and/or focusing on waterfront planning responding.
to sea level rise. We hope this work will generate dialogue among Tallinn residents, planners and designers, decision-makers, and civic leaders affiliated with *Linnahall*.

8 REFERENCES


CELA MEDIA STATEMENT

Title of Paper or Research:
RE-IMAGINING LINNAHALL IN TALLINN, ESTONIA: SHAPING THE FUTURE OF A POST-SOVIET RELIC IN THE CONTEXT OF MODERN URBAN REDEVELOPMENT

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Media Statement:
Linnahall is a contested site infused with complex narratives. This paper provides a concise history of Linnahall, and proposes a design concept with three phases:
- **Tõsta [Lift]:** invest in urban place-making and alterations to Linnahall's exterior to increase use.
- **Tõmba [Pull]:** provide a gritty, culturally vibrant destination to complement adjacent redevelopment.
- **Vajuta [Imprint/Submerge]:** create an ecologically responsive seaside heritage landscape.

This paper envisions Linnahall’s future, integrating creative ideas for: adaptive reuse, addressing sea level rise, and building Tallinn’s cultural vibrancy. We hope this work will generate dialogue among: Tallinn residents, planners and designers, decision-makers, and civic leaders affiliated with Linnahall.

The Landscape Research Record publishes top quality articles selected from manuscripts submitted to the Council of Educators in Landscape Architecture (CELA) annual conference each year. The Record serves the mission of the CELA, that is, to encourage, support and further education in the field of landscape architecture specifically related to teaching, research, scholarship, and public service. The Record contains recent research and scholarship in all aspects of landscape architecture, distributed in the following tracks:

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- Sustainability
- Urban Design
- Film

The steps and typical timeline of the peer review are described below.

**Abstract Submittal: September**
Peer-reviewed article publication on the Record starts from the abstract submittal to the CELA annual conference. The CELA executive office sends out Call for Abstracts around August each year.

**Abstract Review: September-October**
The Vice President for Research leads the track chairs in the abstract review. Double blind review is used. Each abstract is reviewed by at least two reviewers.

**Paper Submittal: January 20-25**
Authors of accepted abstracts receive the invitation to submit a full paper in November. The deadline is in January of the following year. The papers submitted at this time are not peer reviewed but only edited to satisfy the conference standard. Papers that do not follow the template of the conference are rejected.

**The CELA Annual Conference: March-April**

**Paper Review: May-June**
Papers that are submitted in time in January and stratify the conference standard become eligible to enter the peer review for the publication in the Record. The track chairs manage the review for their tracks and select high quality papers based on the score of abstract review, grammar, completion of study, contribution of new knowledge, format quality, etc. The track chairs then send out selected papers to at least two reviewers.

**Review Result and Revision: July**
Track chairs collect review results and make recommendations on the manuscripts. Papers that are accepted with revision requirement will be sent back to the authors in July.

**Final Manuscript Submittal: August**
Authors submit final manuscripts by August 31st. All papers are published by December 31st.

**The Outstanding Paper Award: December-March**
The CELA Executive Committee has authorized The Outstanding Paper Award for published papers in the Record. The Vice President for Research and track chairs collectively select the winning paper. CELA notifies the winner(s) of the award, which is presented at the following CELA Annual Conference.