DESIRING WASTE: A PEDAGOGY OF LIFECYCLE APPROACHES TO WASTE AND BROWNFIELD TRANSFORMATION

DE ALMEIDA, CATHERINE
University of Nebraska—Lincoln, Lincoln, NE, cdealmeida2@unl.edu

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 Lapercie, 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 Lapercie, 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 Lapercie, 2016).

3.3 Circular economy
According to Gallaud and Lapercie (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 Lapercie, 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).
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><strong>Phase 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Introduction to Brownfields, Reclamation, and Remediation</em></td>
<td>Weeks 1-2 (2 weeks)</td>
<td>Reading discussion (Wk 1)- Waste Landscapes Case Study Analysis (topic selection from list)</td>
</tr>
<tr>
<td><strong>Phase 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Mapping + Representing Regional Landscapes; Symbiotic Systems through Hybridizing Waste</em></td>
<td>Weeks 3-6 (4 weeks)</td>
<td>Reading discussion (Wk 3)- Mapping Reading Discussion (Wk 5)- Contemplating Waste Mapping Analysis (Wk 3-5) (topic selection from list) Mapping Speculation (Wk 5-6)</td>
</tr>
<tr>
<td><strong>Phase 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Site Analysis and Context</em></td>
<td>Weeks 7-8 (2 weeks)</td>
<td>Reading discussion (Wk 7)- Visiting Site Site Analysis (topic selection from list)</td>
</tr>
<tr>
<td><strong>Phase 4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Multiscalar Site Design</em></td>
<td>Weeks 9-16 (7 weeks)</td>
<td>Reading discussion (Wk 9)- Infrastructural Landscape Programmatic Development (Wk 9-10) Site Design (Wk 11-12) Spatial and Material Details (Wk 13-14) 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
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 2. Outline of scaffolded phased structure of the seminar 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 1-6 (6 weeks)</td>
<td>Waste Reflection (Wk 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reading discussion (Wk 2)- Waste Culturally Constructed Reading discussion (Wk 3)- Sanitation + Managing Waste Reading discussion (Wk 4)- Brownfields and Wastelands Waste Reflection (Wk 4) Waste Topic Analysis [Part 1] (self-selected) (Wk 1-6)</td>
</tr>
<tr>
<td>Phase 2</td>
<td>Weeks 7-10 (4 weeks)</td>
<td>Reading discussion (Wk 7)- Design, Waste, and Benefits Reading discussion (Wk 8)- Reframing Waste: Concepts Waste Reflection (Wk 9) Waste Case Studies [Part 2] (self-selected) (Wk 7-10)</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


