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A Framework to Unveil Design Decisions in Ecological Urbanism

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A FRAMEWORK TO UNVEIL DESIGN DECISIONS

IN ECOLOGICAL URBANISM

by

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ABSTRACT

A Framework to Unveil Design Decisions in Ecological Urbanism

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Ecological urbanism describes an approach to landscape architecture fit for addressing dynamic infrastructure projects. As shifting climates and human-based systems stress current infrastructure, approaches utilizing dynamic Nature-based Solutions (NbS) are becoming more prevalent. To increase the success of implementation, aesthetics play an important role in nature-based solutions. However, until now, there has not been a systematic approach to assess the form-based design of landscape architecture in practice. The purpose of this study is to provide a rapid assessment framework to address this gap in landscape architecture. Incorporating aesthetic considerations into infrastructure projects builds upon the existing discourse of regenerative systems negotiating between ecological and anthropocentric functionality, contributing to the overall sustainability and resilience of urban environments.

The literature review indicated the need for avenues of application to operationalize the lofty ideals of ecological urbanism. This has resulted in the creation of the Ecological Urbanism Rapid Assessment. Based in the conceptual frameworks of regenerative design and ecological urbanism, three sections, Ecological Function (EFx), Anthropocentric Function (AFx), and

Anthropocentric Form (AFm), are supported by 27 categories of metrics, many of which are defined in existing evaluation frameworks. Utilizing a four-part rating system, projects could potentially gain up to 183 points under required metrics, with an additional 93 points available for optional or bonus metrics, resulting in a total of 276 potential combined points. This framework is intended to operate as a rapid assessment for landscape architecture practitioners reviewing an existing project post-implementation, as well as serving as a guideline for implementing the tenets of ecological urbanism during the design process.

For proof of concept, the pilot test used this assessment tool to rapidly review three selected projects exhibiting diverse water-based infrastructure of varying scale and geolocation in urban and peri-urban environments; this was done to determine if the tenets of ecological urbanism are represented. The results of this study indicate the applicability of a rapid assessment, evaluating ecological urbanism projects through the parsed lenses of ecological functionality, anthropocentric functionality, and anthropocentric form. Assessors in the pilot test attributed similar scores for respective projects, validating the approach of this tool. Most assessments were completed within or below the desired threshold of 15–30 mins. The qualitative approach to form-based design metrics seems appropriate for use by those trained in landscape architecture. Building upon the well-researched metrics of functionality, both anthropocentric and ecological, this study provides novel contribution through the suggestion of form-based metrics. If the success of nature-based solutions is dependent on aesthetic, experiential, and appeal, it seems form-based analysis is critical for projects supporting regenerative urban systems.

(113 pages)

PUBLIC ABSTRACT

A Framework to Unveil the Design Decisions in Ecological Urbanism

Addison C. Martin

Ecological urbanism offers a framework for landscape architecture to address the challenges posed by dynamic infrastructure projects in the face of changing climates and human impacts. As Nature-based Solutions (NbS) become more prevalent, the role of aesthetics in these solutions becomes increasingly important. However, there has been a lack of systematic approaches to assess the design aesthetics of landscape architecture in practice. This study aims to fill this gap by providing a rapid assessment framework tailored for landscape architecture practitioners. Drawing from the concepts of regenerative design and ecological urbanism, the framework comprises three sections: Ecological Function (EFx), Anthropocentric Function (AFx), and Anthropocentric Form (AFm), supported by 27 categories of metrics. The pilot test of this assessment tool on three diverse water-based infrastructure projects in urban and peri-urban environments demonstrates its applicability and effectiveness. The results indicate that the rapid assessment can evaluate projects through the lenses of ecological and anthropocentric functionality, as well as form, with assessors attributing similar scores to respective projects. The categorical phrasing of the metric descriptions seems suitable for landscape architecture practitioners, with most assessments completed within the desired timeframe. This study contributes novel insights by proposing form-based metrics to complement existing functionality metrics, recognizing the importance of aesthetics in the success of nature-based solutions and infrastructure for regenerative urban systems.

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Addison C. Martin

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CHAPTER 1

INTRODUCTION

Good design, encompassing both form and function, is often imperceptible. Infrastructure, when functioning adequately, typically fades into the background of social awareness until its performance is compromised. As shifting climates and expanding urban development necessitate renewed, dynamic infrastructure, ecological urbanism emerges as a framework aiming to cultivate multi-dimensional communities within harmonious systems. Designing within this framework entails crafting environments that seamlessly integrate form and function to support community well-being and resilience (Beatley et al., 2013; du Plessis, 2011; Folke, 2006; Hawken, 2021; Koh, 1998; Mang, 2009; Mostafavi et al., 2010). Despite the prominence of aesthetics in award-winning projects, there remains a noticeable absence of discourse surrounding form-based design decisions in not only ecological urbanism projects, but throughout the profession of landscape architecture. Therefore, this study seeks to shed light on these seemingly invisible design decisions, exploring the avenues for creating harmonious and multi-dimensional urban environments through the application of ecological urbanism principles.

Drawing from a rich legacy of visionary thinkers, disciplines such as design, architecture, landscape architecture, and related fields have continually evolved their understanding of “good” design. Design decisions in landscape architecture have often appeared arbitrary, but the profession has undergone a notable transformation towards incorporating logical parameters, as demonstrated by the Rational Method approach championed by Ian McHarg (1969). Evolving from critiques of past trends, the focus here shifts from stylistic preferences to enduring principles of analysis. These guidelines for functional design decisions are applicable to any project, informing site management prior to the overlayed, form-based design. When functional design decisions respond to both ecological and anthropocentric systems, form-based design decisions can be adequately informed (Landscape Institute, 2012). As the form and function of these designed landscapes unfold, a contemporary landscape architect's goal is to uncover the harmony therein (Van Etteger et al., 2016).

The essence of "good" design often lies in its subtlety. In a landscape marked by changing climates and evolving urban landscapes, there is a growing need for adaptable and sustainable infrastructure (Hill, 2015; Hirschfeld et al., 2020; IDB, 2020, Klemm et al., 2017). Ecological urbanism seeks to foster holistic communities within interconnected systems (Mostafavi et al., 2010). However, there remains a gap in discussions concerning the form-driven decisions within ecological urbanism landscape projects. Thus, this study aims to delve into the decision-making process underlying ecological design, examining three implemented stormwater projects through the lens of ecological urbanism which encapsulates principles of landscape ecology, green infrastructure, landscape performance, and form-based design theory. By acknowledging the form-to-function relationship evident in each project, this research builds upon the principles of ecological urbanism, highlighting the role of aesthetics in infrastructural endeavors.

Utilizing the foundation of ecological urbanism to create dynamic infrastructure within urban contexts, perhaps the aesthetics of infrastructure projects might add essential aspects of identity and delight. As Anne Whiston Spirn eloquently articulates:

> Humans' survival as a species depends upon adapting ourselves and our settlements in new life-sustaining ways, shaping contexts that acknowledge connections to air, earth, water, life, and to each other, and that help us feel and understand these connections, landscapes that are functional, sustainable, meaningful, and artful. (Spirn, 2008)

Another enduring debate revolves around the interplay between form and function. If form indeed follows function, as asserted by Louis Sullivan's maxim, it inherently influences design interventions, including those in landscape architecture (Weingarden, 2009). Natural ecosystems have long shaped their forms based on functional necessities, serving as a wellspring of inspiration for human endeavors. However, the imposition of human-centric forms onto ecological systems has blurred this harmony. Climate change further exacerbates the need for alternative approaches to design, emphasizing systemic thinking and adaptability.

Ecological urbanism builds upon existing knowledge systems by identifying synergies between ecological and anthropocentric systems, particularly through green infrastructure initiatives. While dynamic, green infrastructure offers resilience advantages over some static, gray infrastructure, it presents unique maintenance and adoption challenges (Hill, 2015; IDB, 2020; Klemm et al., 2017). Moreover, ecological urbanism extends McHarg's suitability analysis framework by integrating social systems into design decision-making parameters (McHarg, 1969; Malczewski, 2004). Despite these advancements, there remains a dearth of discourse surrounding form-based design decisions in projects with significant ecological intent. Therefore, this study aims to explore how landscape architecture navigates the incorporation of anthropocentric form in dynamic, nature-based infrastructure projects, particularly in the context of climate adaptation initiatives.

Conceptual frameworks, such as ecological urbanism and regenerative design, aspire to redefine the relationship between human and natural systems. Landscape architects play a pivotal role in translating these priorities into tangible designs and technical structures. This study aims to explore these priorities through a matrix aligned with the conceptual framework of ecological urbanism, drawing inspiration from existing evaluation frameworks. By categorizing metrics based on motivations, such as ecological functionality, anthropocentric functionality, or anthropocentric form, this approach facilitates reflective practice within the industry, fostering continuous improvement and innovation.

By examining three water-based infrastructure projects that prioritize ecological functionality while also demonstrating attention to form-based design, this study seeks to elucidate the role of form in ecological urbanism projects. Additionally, by developing a rapid assessment tool grounded in the theoretical underpinnings of ecological urbanism, this research endeavors to bridge the gap between theory and practice. This evaluation framework aims to provide tangible criteria for identifying genuine examples of ecological urbanism within contemporary projects, facilitating its practical application and fostering a more sustainable built environment.

The purpose of this study is to investigate the intersection of ecological principles, aesthetic considerations, and practical considerations in landscape architecture within the context of ecological urbanism. By examining how landscape architects navigate the tension between ecological functionality and anthropocentric design preferences, this research seeks to uncover the decision-making processes, challenges, and potential benefits associated with integrating ecological and aesthetic considerations into landscape projects. Furthermore, this study aims to explore the implications of incorporating aesthetic considerations into infrastructure projects with a focus on how these considerations contribute to the overall sustainability and resilience of urban environments (Holling, 2001; Klemm et al., 2017). Through a comprehensive analysis of these themes, this research intends to provide valuable insights and recommendations for enhancing the integration of ecological and aesthetic principles in landscape architecture practice, contributing to the creation of more sustainable and resilient urban landscapes.

> To some it may seem odd that landscape architects looked toward art and design theory and practice when seeking direction about folding ecological principles and environmental values into their creative processes. But this simultaneous look to art as well as science and to theories of site specificity and phenomenology as well as ecology is critical to the successful integration of environmentalism into landscape architectural design. (Meyer, 2000)

Design comes in many scales and mediums. In architecture-based disciplines, design describes the process of being iterative, synthesizing analysis, and providing form-based interpretation. In landscape architecture, this form is the symphony of circulation pathways, nodal viewpoints, utility accommodations, and a balance of active and passive programming. This results in places such as plazas, streetscapes, parks, botanical gardens, and much more. As preferences come and go, styles describing formal composition shift over time. Landscape architecture research is deeply influenced by an interdisciplinary approach, integrating insights from social sciences alongside environmental and design considerations, particularly in understanding human-based behavioral trends and patterns.

In response to the escalating ecological requirements intensified by climate change, there arises an urgent need for regenerative system design (Munang et al., 2013; Scholes, 2016). This approach seeks to harmonize ecological imperatives with anthropocentric needs of complex urban systems. Central to this endeavor is the role anthropocentric form-based designs play, particularly in the realm of green infrastructure. These designs not only serve functional purposes but also contribute to the broader ecological and social resilience of urbanizing environments (Holling, 2001). Recognizing the importance of documenting these shifts, this study is focused on investigating one such transformation in the theoretical knowledge base of landscape architecture.

The definition of “good” design varies across disciplines. Engineers typically prioritize the efficiency of anthropocentric functions; architects often prioritize aesthetic appeal; and user interface software designers emphasize the necessity of intuitive navigation. The functionality inputs thus far have been described as “anthropocentric” and “ecological.” Anthropocentric, or human-facing systems, describes circulation, access, utilities, health, and safety considerations, as described for professional licensure (ASLA, 2023). Urbanists recognize that, “cities are…lived-in landscapes where human presence and perceptions are deeply enmeshed with biophysical and built infrastructures” (Andersson, 2017). Within an intricate web of relationships, connections, patterns, and processes in the physical, biological, and social environment, the consequences of human actions must first be grasped prior to understanding the fuller picture of ecology (Hill et al, 2002).

Ecological functionalities include everything else—climate regulations to habitat populations—simultaneously describing the macro and micro ecosystems providing habitation for all life on earth. As the Anthropocene has grown exponentially over the last few centuries, the stress human systems put onto ecosystems has brought the broader global ecosystem into a state of instability, seeking major regulation (Hubbert, 1993; Scholes, 2016). Attempting to intervene, humans have inserted themselves as landscape restorationists for thousands of years (Anderson, 2005). Ecological restoration is defined as "assisting the recovery of an ecosystem that has been degraded, damaged or destroyed," according to the Society for Ecological Restoration (SER, 2004). Nevertheless, sustainable restoration aims to practice the implementation of a self-supporting ecosystem, deterrent of continued intervention (Alberti, 2005; Urbanska et al, 1997; SER 2004).

In design foundations, the principle of "form follows function" stands as a cornerstone (Weingarden, 2009). However, in the realm of ecological systems, human intervention often seems to diverge from this theory, as the capacity to impose form can disregard ecological functionalities. An important consideration here is the temporal scale. As static, human-facing systems of functionality (e.g., infrastructure) begin to degrade over time, one can witness the regulating power of ecological systems establishing priorities other than the contemporary values of human systems (e.g., money and materials manufacturing). While conventional design principles dictate form-based decisions on functional utilities—such as dimensions for parking lots and the cost of surfacing options—these conventions frequently neglect ecological compatibility. In other words, when the static anthropocentric water systems of levees and pipes burst, consider these disruptions as systems-based advocacy for solutions of dynamic harmony.

As technology advances, humans possess the capability to shape form according to desires, yet this often comes at the expense of ecological integrity. Thereby, the negotiation between ecological and anthropocentric functions ought to significantly influence the form of human-made environments. An alternative approach to form-based decisions is essential for creating functional, regenerative systems (Edwards, 2010; Folke, 2006; Klemm et al., 2017; Mang et al., 2012; Meyer, 2000). Drawing inspiration from green infrastructure and adopting a systems-based approach to landscape architecture projects illuminates the role of form-based decisions in fostering functional landscapes (Barnett, 2011; Beatley et al., 2013; Edwards, 2010; du Plessis, 2012; Gobster et al., 2007; Mostafavi et al., 2010; Munang, 2016).

The concept of “deep form” is pivotal in understanding these integrated systems. According to Lyle (1990), achieving “deep form” requires a rationally balanced blend of natural systems and creative intuition. This entails a design process that seamlessly integrates analytical and creative thinking—an approach that landscape architecture is increasingly primed for. As highlighted by Nina-Marie Lister, while ecological design is essential, there is a risk of “ecological myopia” if there is an overemphasis on strictly replicating natural processes (Lister et al., 2007). Such tunnel vision may hinder the potential for creative fusion between cultural and natural elements within intricate ecologies. Lister underscores the necessity for a more creatively driven design practice, one that allows for the harmonious integration of human culture, aesthetics, and ingenuity alongside ecological considerations (Lister et al., 2007). This integrated approach is deemed critical for addressing the multifaceted challenges that contemporary landscape architecture faces, combining cultural ingenuity and ecological functionality to curate remarkable formal designs (Corner, 1992; du Plessis, 2009, 2012; Folke, 2006; Gobster et al., 2007; Klemm et al., 2017; Koh, 1998; Lister et al., 2007; Mang, 2009; Meyer, 2000; Mostafavi et al., 2010; Nassauer, 1995; Newman et al., 2008; Spirn, 1984, 2008, 2011; Steiner, 2011; Thayer, 1994). Ultimately, infusing design practice with systems thinking primes projects to be harmonious and resilient places.

This thesis study explores the role of landscape architecture in addressing climate change. Operationalizing the tenets of ecological urbanism and regenerative design principles for practitioners equips these practitioners as crucial agents in designing dynamic environments. Despite various existing sustainability-focused frameworks, this tool differs by using ecological urbanism as the basis to more quickly incorporate holistic considerations of ecological functionality, anthropocentric functionality, and form-based decisions.

Research Questions

1. How does the tension between ecological functionality and anthropocentric priorities influence form-based decisions in ecological urbanism projects?
2. How might principles of ecological urbanism be turned into a practical rapid assessment tool designed for practitioners of landscape architecture?

CHAPTER 2

LITERATURE REVIEW

Landscape Architecture Background

Since 1863, the term “landscape architect” has denoted practitioners who enhance human environments through the manipulation of landforms (Olmsted Network, 2023). However, the origins of landscape architecture trace back to ancient times, where practices heavily intersected with those of urban design and planning. Evidence from Ancient Greece suggests an early appreciation for garden design, epitomized by the concept of *genius loci*, or the “spirit of place” (Boults et al., 2010). In the 16th Century, English Romanticism introduced a plethora of distinct styles—such as *pastoral*, *beautiful*, *picturesque*, *sublime*, and *gardenesque*—that further delineated the scope and aesthetic preferences of landscape design (Mizukoshi et al., 2001).

These styles define landscape beauty in anthropocentric terms. Each vary in their tidiness, with attempts to balance natural inspiration with the human compulsion to organize and define edges (Mizukoshi et al., 2001; Nassauer, 1995). The pastoral style evokes a sense of tranquility through the expansive views of rolling hills, peaceful meadows, and serene lakes. In contrast, the beautiful style emphasizes harmony, balance, and the aesthetic pleasure derived from soft and graceful natural features and tranquil vistas. The picturesque trend introduces more dramatic elements and playful woodlands, seeking to balance edges and restore order for compelling compositions. The sublime style aims to evoke a sense of human insignificance in the face of awe-inspiring natural phenomena such as thunderstorms, towering mountains, and powerful seas. Lastly, the gardenesque style embraces spontaneity in garden design, characterized by irregular shapes, varied massing, and winding paths through informal plantings.

The City Beautiful movement, which emerged just before the start of the 20th century, introduced aesthetic, experiential, and identity considerations to large scale planning efforts (Tunnard, 1950). Employing form-based design in comprehensive city planning, this movement suggests urban design ought not to be separate from civic and social issues. Inspired by the Renaissance value of collaboration, this age of civic planning encouraged weaving piecemeal sites into a cohesive, grand vision (Tunnard, 1950). This emphasis on cohesive and beautiful-style planning considerations during the early 1900s marked a renewed sense of unity, particularly as governing authorities grappled with the challenges of accommodating growing populations (Tunnard, 1950). As we enter the next phase of informed urban design, it is important to acknowledge the enduring influence of this movement.

Sixty years later, leaders in landscape architecture, such as Ian McHarg, were perpetuating an objective-rational method through "tehno-utopian" ideas (McHarg, 1969). Utilizing large-scale data, compounding layers of systems could now be used to determine the best "fitness" or use of land. This suitability approach re-centered ecological concepts within the practice of landscape architecture. Once again, a return to form responding to ecological functionality setting precedent for considering the parameters of contemporary dynamic urban systems.

In the realm of landscape design, achieving a sense of tidiness often involves striking a delicate balance between allowing the ecology of a site to run their course and satisfying the human inclination to organize and delineate boundaries, as proposed by

Nassauer (1995). This balance is exemplified through various landscape cues outlined by Nassauer, such as “mowing, flowering plants and trees, wildlife feeders and houses, bold patterns, trimmed shrubs, linear planting designs, fences, architectural details, lawn ornaments, and foundation planting” (Nassauer, 1995). These elements serve not only to enhance the visual appeal of inhabited landscapes but also to frame novel ecosystems within them, making these new landscapes more familiar and inviting to human inhabitants. By skillfully incorporating these cues, landscape designers can imbue landscapes with a sense of order and coherence while simultaneously fostering connections with nature and promoting biodiversity (Bormann et al., 2001; Corner, 1992; Lyle, 1994; Nassauer, 1995; Peterson et al., 1998; Thayer, 1994).

The acronymic framework, LandSCAPES, outlined by Crewe and Forsyth (2003), offers a comprehensive overview of the diverse approaches and considerations involved in landscape architecture, encompassing aspects of synthesis, artistic expression, analysis, flexibility, ecological sustainability, and spiritual connection. Overall, these variations of landscape practice reflect the multifaceted nature of landscape architecture, encompassing ecological, cultural, artistic, and spiritual dimensions in the creation and management of landscapes. This summary of the discipline suggests long-standing alignment with the inputs necessary for appropriately designing innovative infrastructure within complex urban systems (Crewe et al., 2003).

Drawing insights from contemporary thought leaders, the work of researchers like Mark Francis (2001), James Corner (2005), Anne Spirn (2008), and Danielle Wilde (2020), provides valuable context for this research. Francis (2001) emphasizes the importance of case studies which “provide the primary form of education, innovation, and testing for the profession," an initiative supported by Schön's (1983) advocacy for reflective practice. Furthermore, Corner (1997) emphasizes ecology's cultural significance within landscape, while Spirn (2008) advocates for multi-faceted solutions within complex urban systems. These works are effectively bridged through Wilde's (2020) underscoring of the urgent need for transformative approaches to address global ecological concerns. To make these reflective changes within the discipline, perhaps collecting case studies centered on ecological urbanism and defining a framework to inventory these tenets could prove critical in evolving the discipline of landscape architecture to meet the global needs of compounding systems.

Design Principles in Landscape Architecture

Principles are used to describe form-based compositions. Although often exhibiting overlap, graphic design, data visualization, and architecture each have their own way of describing hierarchy in visual grammar per their scale of implementation. Both design elements (i.e., scale, form, space, movement, texture, variety, repetition, line, color) and design principles (i.e., dominance, contrast, unity, variety, balance, rhythm, repetition) are critical for describing the relationship between humans and their environments (Booth, 1990). In landscape architecture, key tenets of design include line, color, form, texture, scenic, rhythm, emphasis, and legibility (Abdulhussain et al., 2023; Arnheim,1969; Atkin, 2013; Booth, 1990; Bormann, 2001; Boults, 2010; Ching, 2017; Corner, 1992; Dee, 2001; Dosen et al., 2016; Frederick, 2007; Gobster et al., 2007; Lister et al., 2007; Nassauer, 1995; Rogers, 2001; Rottle et al., 2017). Others are often speculated to be added, but these eight principles have limited overlap, allowing them to stand on their own. The historical landscape styles, such as picturesque and sublime, as well as contemporary approaches to landscape design, each wield these tenets in their own way, allowing these terms to describe design decisions, regardless of trending styles.

The principle of *line* describes the delineation of space through edges, explicit and implied. This can be attributed to creating micro-habitats and encouraging intended behaviors of human and non-human populations alike (Atkin, 2013; Nassauer, 1995b). Lines found within natural landscapes are often subtle and understated—characterized by sweeping curves following water sources, topography, elevation changes, soil types, and disturbance patterns (Atkin, 2013; Booth, 1990; Dee, 2001). Axial arrangements can be indicative of the use of line as well (Ching, 2017). It should be noted that in landscape, edges can be perceived along a spectrum of permeability (Lynch, 2015). Key overlaps exist between emphasis and legibility, as line tends to indicate contrast, yet it stands alone as a principle of form-based design theory.

The design element of *color* can introduce variety, repetition, emphasis, and affect the visual weight of a form (Ching, 2017). This principle describes a version of visual balance that can come from either similarity or contrast (Schloss et al., 2011). Cohesion in a design can come from either approach, yet some examples are more effective than others. Moreover, utilizing the color of the region indicates a contextualized approach to site design (Atkin, 2013; Hunter, 2011; Whiting, 2014). For ecologically responsive designs, this is an important principle to be cognizant of (Hunter, 2011). A key design principle, color plays an important role in landscape design.

The design principle of *form* describes the compositional styling of massing in various dimensions. Form can refer to both the inherent shape of the object as well as the composition of an object or objects within space (Arnheim, 1969; Dee, 2001; Ching, 2017). In landscape, form can be assessed through a site overview when viewed from above in plan-view or from a higher vantage point; in experiential perspectives or sections at a human scale; and even zoomed into the selected vegetation specimens themselves. For instance, to describe the efficacy of planting choices, tree massing can be described as columnar, spreading, vase, rounded, oval, weeping, or pyramidal (Whiting, 2014). While commentary on the compositional arrangement through "the line [and] direction" materials are also descriptors of overall form (Arnheim, 1969; Dee 2001, Whiting, 2014). American urban planner and architect, Edmond Bacon, suggests that the interface between mass and space highlights the relationship of man and his environment (Bacon, 1976). The management of form in design influences the perception of scale, both macro and micro (Dee, 2001; Whiting, 2014).

The design principle of *texture* describes the balance of materiality—both vegetated and built. Furthermore, the incorporation of texture is supported by architectural theory as "the visual and especially tactile quality given to a surface by the size, shape, arrangement, and proportions of the parts" (Ching, 2017). In general design, texture can be employed and perceived through visual and tactile contrasts in a variety of modalities from pavement, architectural materials, plant materials, depth in color, and the movement therein. Plant material can be described through terms such as fine, course, heavy, light, thin, and dense (Whiting, 2014). Textures of plant material are typically influenced by climate conditions, another example of form following function. As Whiting (2014) notes, the impact of texture changes depending on the distance of perception, as it transitions from an interplay of light and mass, to the size and shape of the material itself.

The principle of *scenic* describes the innate draw towards lush environments beaming with life, as well as the preference for an expansive viewshed. Throughout evolution, humans have held onto expansive views as an indicator of safety and authority. It is believed this emanates from the prospect-refuge theory providing the optimal dynamic to see threats from points of advantageous shelter (Dosen et al, 2016; Spirn, 1984; Waldheim, 2006). Strategies include vistas, a variety of sheltered spaces, explorative pathways with options for retreat or escape, as well as the balance of openness and enclosure. The related "hide and reveal" theory emphasizes intentional mystery, anticipation, and release (Dosen et al, 2016; Kaplan et al., 1989). Strategies to effectively design using hide and reveal include sequencing, layering, framing, surprise, and juxtaposition (Dee, 2001; Frederick, 2007). Together, this translates into the scenic qualities of a landscape, articulating with a balance between lush corners and expansive releases. This design principle incorporates the retorted aspects of "sense of place" by being responsive to cultural and ecological context adjacencies (Frederick, 2007).

The principle of *rhythm* encompasses the cadence and flow of a design, serving to unify elements within a landscape (Corner, 1992; Frederick, 2007). Within this framework, the design principles of repetition, rhythm, and unity are merged and included under the umbrella of rhythm, emphasizing the cohesive and harmonious arrangement of elements throughout the design. Rhythm "provides cohesion, preventing a composition from appearing fragmented and chaotic" (Atkin, 2013). This wielding of mediums—in landscape this includes plant material, pavement, materiality textures, as well as viewsheds—infuses a design with balance through periodic releases (Frederick, 2007). This can be conducted in formal symmetry or informal asymmetry yet should convey strong intention in either case. Balance can be stabilized in symmetrical forms, or dynamic in asymmetrical compositions (Whiting, 2014). The overall experience of a space is often influenced by this design principle.

Emphasis is the thoughtful framing of a focal point. This brings intrigue and purpose, two important aspects to engage humans (Corner, 1992). Countering a regular cadence, the design principle of emphasis brings in a different type of intentionality. Curating a point of focus provides a space or objective for the audience to be drawn to. Effective emphasis in a design will include both a focal point and the supplemental framing necessary to guide participants either visually or physically toward the objective (Atkin, 2013). This aspect often has a tight relationship to what Atkin (2013) describes as "design expression." This is a practice of designers and architects, also known as a "parti," to both study a site and to communicate the revised intention of a design concept. By curating emphasis in a design, humans can perceive the dominant element, encouraging satisfaction (Whiting, 2014). Providing perceivable purpose to a landscape, emphasis is a key design principle in landscape architecture.

The last design principle to be discussed here is that of *legibility*. This element describes the instinctiveness of a place. Visitors should be able to intuitively grasp the intended purpose, diverse uses, varying permeability of edges, and distinctions between spaces, regardless of their ability to articulate these perceptions. Legibility, as described by Atkin (2013), is essential for creating a sense of familiarity within a new landscape and providing the structure and cues necessary to encourage human participation. Building upon the principles outlined by Nassauer (1995), this concept incorporates the inclusion of entourage as a key element eligible for facilitating the implementation of this design principle. Although on a spectrum of permeability, edges need to be perceptible to the audience. This has shown to be beneficial to human acceptance of “messy” landscapes (Nassauer, 1995b). The aspect of intuitive legibility of a design could be considered critical to increased social adoption of green infrastructure.

The form-based design tenets included in the proposed rapid assessment draw upon established theories from general design, architecture, and landscape architecture. These principles, distilled into eight categories, provide a framework for analyzing the form-based qualities of built landscape projects. Interconnected, these principles serve as a bridge between existing theory and the demand for practical application, facilitating a more realistic assessment of form-based landscape design.

Climate Change and Dynamic Infrastructure

The acknowledgment of shifting climates breeds opportunity for regenerative, dynamic action. Currently, 80% of the world’s population live in coastal areas and 40% of the global population, upwards of 3.3 billion people, live in the tropics (Edelman et. al, 2014). Recent studies indicate a concerning trend of tropical zones expanding poleward in both hemispheres, with subtropical regions encroaching into areas previously characterized by Mediterranean climates (Isaac et. al, 2014). Environmental injustice is evident on many fronts, but particularly in that roughly 85% of the world’s poorest people find refuge in tropical climates and are most likely to feel, and not be able to adapt to, the shifting climate and the subsequent implications (Edelman et al., 2014).

While the expansion of tropical climates may seem benign initially, the implications for the planet and its inhabitants are far-reaching. A global shift to tropical conditions would lead to rising temperatures and altered rainfall patterns, fundamentally reshaping human habitation worldwide. The projected heat stress would strain existing systems and could conjure social unrest and economic instability, disproportionately impacting marginalized communities (Edelman et al., 2014). Landscape architecture, charged with safeguarding the "health, safety, and welfare" of the public, must address these environmental injustices in its projects (ASLA, 2023).

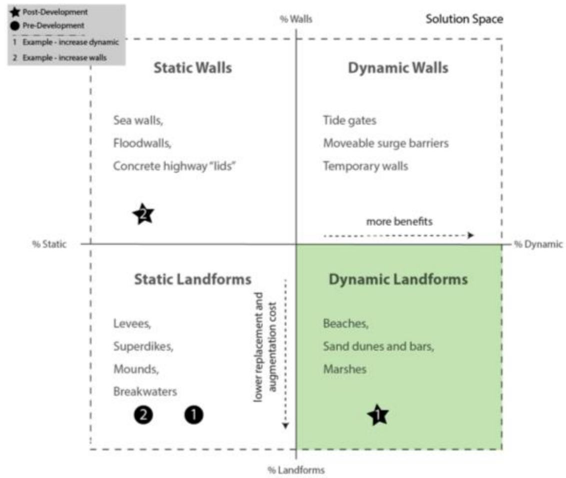
Development patterns are anticipated to change as people seek refuge in new areas due to these climate shifts (Edelman et al., 2014). Such new areas likely to see rapid urbanization might be the relatively untouched and rural land in North America (Dale et al., 2000; Theobald et al, 1998). Nevertheless, we know from landscape ecology that "urban development fragments, isolates, and degrades natural habitats; homogeniz[ing] species composition" (Alberti et al., 2003). Simply put, to just relocate and replicate existing development typologies will likely perpetuate these crises. Furthermore, the utilization of landscape as infrastructure might aid in improved regenerative systems as regulating ecosystem services are brought directly into new and adapted infrastructure. These trends highlight the dynamic nature of the parameters landscape architects and adjacent professions must consider.

A vast majority of the current roadway and water infrastructure in the United States is static, waning, and unfit for current conditions. Pipes, roadways, and city grids on the eastern side of the continent tend to be older and more restricted. As development moved west, populations spread out, only concentrating over time, primarily on the coast. In a time of war, threatened by the gap separating either side of the country, President Eisenhower proposed and implemented the Highway and Infrastructure Act in 1950 (Popovich et al., 2021). This massively introduced highway access connecting cities across the continent. As existing communities were replaced with infrastructure and new development, residents became drastically dependent on vehicular means of transportation (Salimbene, 2023). Nearly 75 years later, most of this infrastructure is outdated, unsafe, and unable to meet current demands (Popovich et al., 2021). As funding for replacing this infrastructure comes through, perhaps there is an opportunity to approach this new infrastructure differently than before.

Using terms such as *static*, *dynamic*, *green*, *gray*, and *hybrid* to describe infrastructure opens the conversation to alternative approaches. Rather than a binary, these infrastructure typologies situate on a quadrant-based framework proposed by Hill (2015) (See Figure 1). Static-gray solutions describes much of the existing infrastructure in North America. This indicates rigidity and the difficulty in adapting to changing parameters, such as climate shifts. Consequently, dynamic-gray and dynamic-green infrastructure might out-perform the conventional approach to infrastructure in the United States. The exact intervention should be localized, responding to "geomorphological, ecological, and land-use context . . . when selecting various infrastructure strategies, to ensure that they function as intended" (Hill, 2015).

Figure 1

A Dynamic-Static Typology Quadrant



Employing dynamic infrastructure recognizes the realities of shifting parameters influenced by the behaviors of human populations, non-human populations, climate cycles, and natural hazard events. Interventions categorized as green infrastructure and Nature-based Solutions (NbS) tend to fall under the umbrella of dynamic infrastructure. The literature on landscape multifunctionality indicates that leveraging green infrastructure can be a strategic approach to enhance system resilience. The literature on landscape multifunctionality indicates that leveraging green infrastructure can be a strategic approach to enhance system resilience (De Groot, 2006; Lovell, 2013). This approach can enable adaptation and transformation in response to diverse challenges such as "climate change, food insecurity, and limited resources" (Lovell, 2013). Nature-based Solutions (NbS) encompass a range of elements including natural features, nature-based features, and integrated solutions that combine natural and gray elements (Sowińska-Świerkosz, 2022). Integrated solutions are particularly highlighted within NbS, representing activities involved in the protection, management, enhancement, and restoration of nature aimed at delivering climate-resilient infrastructure (IDB, 2020).

Within Nature-based Solutions (NbS), there seems to be a distinctive threshold between formal and informal interventions. Informal implementations of Nature-based Solutions (NbS) can serve as an intermediary infrastructure option for informal settlements (Diep et al, 2022). As such, successful aspects of Nature-based Solutions (NbS) are ecosystem services, urban flood management, slowed biodiversity loss, and even improved quality of life (Lehmann, 2021). These social drivers highlight an imperative role of aesthetics and the identity of place critical for social adoption and requisite project success.

Design Thinking as Systems Thinking

The notion of regenerative design responds to the need for sustainable systems, rather than failing typologies (du Plessis, 2009; Edwards, 2010; Hawken, 2021; Newman et al., 2008). Ecologists tend to neglect urban areas, perhaps viewing humans as separate from nature, despite their prominent role and impact on ecosystems (Martin et al., 1997). Every large system is made of a series of compounded ecosystems and could be fragmentated by any such system; in this circumstance, ecological systems and anthropocentric systems have created the parameters for ecological urbanism (du Plessis, 2012; Lyle, 1985). Humans have disrupted the status quo of ecological systems and now need to reframe a positive role in this global ecology. Proposed by Paul Hawken (2021), a slew of interventions ranging in scales, climates, and habitats, such as land, forests, ocean, wilding, food, cities, transportation, energy, and various market-based challenges, is supplying pathways for regenerative actions. “Ironically, human activities may disrupt the very life systems on which we all depend” (Bormann et al., 2001). Utilizing these recommendations at various scales, perhaps the human-included ecosystem might find the regulation it is yearning for.

Providing pathways to sustainability, “urban landscapes play a significant role in supporting municipal, ecological and social systems” (Alizadeh, 2018). Another crucial aspect to acknowledge is the identification of key levers that can facilitate the transition towards sustainable pathways. As articulated by Chan (2020), these levers encompass eight distinct areas: (1) visions of a good life, (2) total consumption and waste, (3) latent values of responsibility, (4) inequalities, (5) justice and inclusion in conservation, (6) externalities from trade and other tele-couplings, (7) responsible technology, innovation, and investment, and (8) education and knowledge generation and sharing.
Effectively addressing these points of intervention is essential for fostering equitable and resilient anthropocentric systems.

To provide an international perspective on strategies for adapting urban areas to climate change, Sana Lenholzer (2020) reviews a range of approaches employed by different cities worldwide to address the challenges posed by climate change, such as rising temperatures, extreme weather events, sea-level rise, and urban heat islands. The article explores various adaptation measures, including green infrastructure, sustainable urban design, heat mitigation strategies, flood management, community engagement, policy frameworks, and governance structures (Lenholzer, 2020). Discussing the importance of collaboration between stakeholders, knowledge sharing, capacity building, and financing mechanisms to support effective climate adaptation in urban areas, further suggests the relevance of this discussion in landscape architecture.

Moreover, the category of “urban ecology” in the discipline of urban design, perpetuates the concept of integrating "humans and nonhumans in functional and just ecosystems" (Palazzo, et al, 2011). To alleviate the negative consequences of development, cities—which are hybrid phenomena—can serve as a framework for simultaneously hosting human and biophysical systems in harmony (Alberti, 2008; Schneider, 2003). Urban ecology, as described by Alberti (2008), has emerged as a field that takes an interdisciplinary approach to understanding the drivers, patterns, processes, and outcomes associated with urban landscapes. This interdisciplinary perspective, similar to regenerative design, allows for a deeper understanding of the complex interactions between human activities and ecological systems (Alberti, 2008; du Plessis, 2012; Folke, 2006). This becomes increasingly important within urban systems as more human population resides within urban areas (Moreno-Monroy et al., 2021). It is under this discretion that the direction for innovative landscape infrastructure projects be analyzed within an urban framework.

Cities are complex urban systems which can no longer be solely anthropocentric. Architectural forms, such as "buildings, and open space are now considered integral parts of the same system" (Barnett, 2011). In landscape architecture, the balancing of these systems highlights, "an intimate yet complex relationship between aesthetics and ecology" (Gobster et al., 2007). Primarily in restoration landscapes, the role of aesthetics has been argued to have, "little if anything to do with the ecology of landscapes" (Gobster et al., 2007). Yet, others suggest that "almost all acts of design have...environmental impacts on the world" (Eckbo, 1998). This would imply a critical relationship to understand if landscapes are to be dynamic infrastructure serving a variety of ecological and anthropocentric systems. Therefore, this space of controversy indicates a need for further investigation.

Furthermore, “the aesthetic quality of landscapes, designed or natural,” encourages a crucial crossover between humans and their positionality within ecological systems (Atkin, 2013). While much inspiration for designed landscapes originates in nature, the “messiness” is not always in alignment with anthropocentric standards of beauty (Nassauer 1995b). Atkin (2013) affirmed this investigation of how the principles of design (i.e., line, color, form, texture, variety, repetition, emphasis) might support meaningful ecological functionality, benefiting human and non-human populations alike. Similarly, “Italian Renaissance humanists believed that there was a set of ideal forms for port cities, and that implementing a rational and beautiful form would both reflect and contribute to making human society more rational and humane” (Konvitz, 1978, 1994). Perhaps this opens the opportunity to leverage form-based design and aesthetics to improve degraded human and non-human habitat.

Bridging anthropocentric form and ecological function through combining the design principles described by Booth (1990), Ching (1996), and Dee (2001), approaches to design developed by Nassauer (1988, 1995a, 1995b, 1997) and Gobster, Nassauer, Daniel & Fry (2007), compounded with ecological considerations and best practices (Alberti, 2005; Millennium Ecosystem Assessment, 2005; LAF, 2018), perhaps the application of ecological urbanism might become plausible. Studying the composition of ecologically functional landscapes overlayed with aesthetic preferences informed by Nassauer’s (1995b) landscape “cues to care” informs form-based design successes of functional landscapes. Each of these cues is a social demonstration of principles of design (i.e., line, color, form, texture, variety, repetition, emphasis) described by Arnheim

(1969), Booth (1990), Ching (1996), and Dee (2001).

In line with this camp of thought is the notion of ecology driving decisions. For instance, in planting design, plants can be grouped to encourage successful ecologies through soil, slope, aspect, moisture, and light requirements, as well as their proximity to water, depth to water table, and wildlife considerations (Diedelmann et al., 2002). Following these parameters impacts aesthetic design decisions. Additionally, these parameters support organic maintenance, allowing sustained landscapes that require less human intervention, post-implementation (Atkin, 2013). Acknowledging these considerations early in planting processes encourages harmonic design propositions. These parameters of eco-functionality guide form-based interventions.

The composition of landscapes, built or unbuilt, can serve as a manifestation of ecological function, resulting in ecological aesthetics (Koh, 1998). Aesthetics and form-based design might serve as the crucial lynch pin of our perceived understanding of what nature is, influencing our enthusiasm for thorough ecological urbanism projects. Yet, beyond anthropocentric form, there are also anthropocentric functionalities.

To address these unjust climate concerns at various project scales, are the conceptual frameworks of ecological urbanism and its predecessor, landscape urbanism. Derivative of design theory in both architecture and landscape architecture, as coined by Charles Waldheim, landscape urbanism “melds high-style design and ecology” (Almy, 2007; Steiner, 2011; Waldheim, 2006). Whereas, ecological urbanism addresses critiques of landscape urbanism tendencies to drift away from ecological functionality while still leveraging the elevating merits of form-based design. Descriptive of this concept, Jusuck Koh (1998), outlines and reviews the ten principles of landscape urbanism. Ecological urbanism builds upon these same tenets, supplementing this framework with more ecological principles (Mostafavi et al., 2010). First, the anthropocentric elements will be covered, then the ecological tenets.

The concept of the city as landscape (Koh, 1998) implies a seamless integration of spatial and material elements between urban and rural areas. This integrative approach to design and urbanism emphasizes the interconnectedness of built environments with their surrounding landscapes. Furthermore, landscape is viewed as a multifunctional entity, serving as a machine or medium for various ecological processes such as energy, water, food, and waste treatment. This expanded understanding of landscape extends beyond recreational purposes to integrate diverse functions within urban parks and other open spaces. Integrative design also entails considering the spatial and temporal dimensions of landscapes, as highlighted by Koh (1998). In this view, landscape is not static but evolves over both space and time. Thus, spatial thinking must be complemented by a consideration of temporal dynamics, recognizing the indivisible and interrelated nature of space and time in the design and experience of landscapes.

Generative design operates on principles of self-organization, life cycle, system development, emergence, and evolution. It shifts the perspective of the city from a mechanical construct to an “intelligent, living, learning, self-organizing system” (Koh, 1998). Within this framework, the city and community are conceptualized as a unified system, emphasizing “community empowerment, self-design, and self-similarity" (Koh, 1998). This approach requires an adaptive structure that integrates the city and its inhabitants. The scale and nature of this approach necessitates a participatory method that allows the community to take ownership of the design and management process.

However, this participatory approach presents both pros and cons. On one hand, it empowers communities and fosters a sense of ownership. On the other hand, it may challenge designers to balance community desires with functional and aesthetic considerations, potentially impacting the overall form-based aesthetics and functionality of the design. Nonetheless, this tension can also serve as a test of the designer's skill in translating community preferences into appropriate, award-winning formal gestures.

Dynamic design encompasses not only the creation of dynamic processes but also the ability for designs to adapt and evolve alongside these processes as construction and development unveil new challenges and opportunities (Koh, 1998). The city, intricately interwoven with the natural processes of the landscape and the social processes of the community, emerges as a dynamic and living system (Koh, 1998). Operating within layers of systems demands a responsive and flexible approach, as conditions are constantly in flux. The fluidity of parameters and conditions necessitates a shifting emphasis between ordering and disordering, with a delicate balance between top-down and bottom-up approaches. While rapid development and economic growth may call for a top-down approach, social stability, distributional justice, and democracy often require a bottom-up approach (Koh, 1998). This shift marks a departure from a binary categorization toward an intentional balancing of order and disorder, recognizing the inherent complexities of urban dynamics. Ultimately, the reconciliation of opposing qualities within a dynamic landscape underscores the fundamental truth that no static equilibrium exists, “not even in nature,” highlighting the need for continual adaptation and innovation in the face of change (Koh, 1998).

Strategic design, as discussed by Koh (1998), is characterized by principles that acknowledge the cognitive and perceptual processes involved in structuring landscapes, in addition to nature's inherent self-organization. This approach differs from minimalist ideologies found in modern architecture, instead drawing parallels to Taoist philosophies of creating space to be filled and harnessing opposing forces to one's advantage, akin to the strategic maneuvers of judo (Koh, 1998). This approach follows the simple rules contingent on strategic timing to protect critical resources and vulnerable areas while maximizing access to essential sources of energy, food, and water. Furthermore, landscape urbanism recognizes the intelligence and creativity inherent in both nature and residential communities, often surpassing that of individual designers in “dealing with a situation in flux” (Koh, 1998). This strategic approach to design ties back to the principle of generative and dynamic design, emphasizing the merits of involving communities in the design process to harness collective intelligence and equitable creativity.

Land-economic design, as elucidated by Koh (1998), adopts a landscape approach to urbanism that acknowledges the unique ecological and experiential values inherent in each piece of land. This perspective aligns with the framework of ecosystem services outlined by the Millennium Assessment (2005), which identifies the diverse capacities of land to provide essential resources and functions. Koh emphasizes the importance of formulating urban land use strategies that minimize waste transfer and fully utilize the land's capacities, thus preventing the city from becoming entropic, inefficient, and unsustainable (Koh, 1998). Moreover, such an approach fosters a sense of identity, vitality, and connection within the urban fabric. By embracing an ecological aesthetic and valuing the characteristics of native ecosystems, landscapes can retain their ecological function while enhancing their perceived value (Atkin, 2013). This shift towards sustainable land use not only promotes ecological resilience but also mitigates equity and climate injustices by ensuring that all communities have access to essential resources and opportunities. Ultimately, this approach allows the city to expand and thrive beyond its conventional ecological footprint, fostering a harmonious relationship between urban development and the natural environment.

Bottom-up design as a tenet of landscape urbanism prioritizes the groundline and the intimate connection between buildings and the surrounding site, as emphasized by Koh (1998). Unlike a top-down approach that starts from the sky and moves downward, a bottom-up approach begins at the soil level and moves upward, prioritizing ecological functionality and street-level interactions. This landscape-forward approach “cares more about how the building touches the site, how the city settles on the landscape" (Koh, 1998). This perspective values the day-to-day experiences of the city, recognizing that interactions at the street level are paramount. At the ground level, the connection between indoor and outdoor spaces becomes especially significant. While plans and bird's-eye views may illustrate organizational aspects, they fail to capture the experiential qualities, “charm, and emotional attachment of the everyday city” (Koh, 1998). Furthermore, engaging the community and incorporating local knowledge necessitates a bottom-up approach to urban and regional planning, ensuring interactive design and engaging management of the city over time (Koh, 1998). This participatory approach aligns with the principles of generative design, facilitating community involvement in shaping the built environment. Leveraging bottom-up design approaches prioritizes the ground plane, where ecology, society, and complex urban systems converge.

Phenomenological design transcends mere considerations of systems, structures, forms, and functions; it underscores the significance of experiential aspects, “particularly the everyday experiences of residents,” over the superficial allure of tourist attractions (Koh, 1998). In this case, "experience” is the sense of emphasizing the physiological, spiritual, and subliminal connections between individuals and their environment (Koh, 1998). Landscape itself is viewed as a living entity, with seasonal variations in street tree colors contributing to the collective memory and rhythm of the city. In a landscape-oriented approach, the city is perceived as more than just visual aesthetics or iconic structures; it encompasses the sensory experiences of “inhaling, drinking, touching, tasting, and smelling the landscape” (Koh, 1998). This perspective acknowledges the intimate relationship between humans and their environment, where the landscape is ingrained within our bodies, shaping our perceptions and experiences of the urban realm.

Ordinary urbanism, as described by Koh (1998), advocates for a city of democracy where the everyday experiences of ordinary citizens take precedence over grand monuments and spectacular boulevards. In such cities, “the main streets, alleys, routes,” and public spaces residents frequent daily hold greater significance than tourist attractions (Koh, 1998). The focus on livability underscores the prioritization of residents' well-being beyond an over extension of profitable development ventures. In a city designed for its residents, everyone has the opportunity to mix, interact, and be part of the vibrant urban fabric, making city life attractive not only for residents but also for tourists. Ultimately, it is the people who inhabit and animate the city that make it truly appealing, highlighting the importance of social connections and shared experiences in shaping the urban environment (Koh, 1998). This emphasis on human interaction critiques the barren sidewalks of American cities, calibrated to a vehicular scale rather than the human dimension which breathes life into urban societies.

In the realm of landscape urbanism, postmodern design principles bring attention to the past, vernacular traditions, and cultural landscapes, as noted by Koh (1998). This emphasis on historical context and local identity enriches the urban environment by integrating diverse cultural influences into the design process. Furthermore, postmodern designers prioritize the contextual aspects of landscapes, recognizing that the built environment is inseparable from its surroundings (Koh, 1998). In this approach, architecture serves as the framework for interaction with landscapes rather than dominating or overshadowing them. Postmodern design sensibilities focus on the senses, emotions, and temporality of place, fostering a deeper connection between people and their environment (Koh, 1998). By integrating these principles into the design of cities, landscapes are transformed into dynamic and meaningful settings that reflect the diverse layers of human experience and cultural heritage.

Eco-feminist principles suggest that a landscape urbanism approach to city building emphasizes horizontality described by Koh (1998) as "horizontal spread." This approach values the integration of buildings within the natural landscape, advocating for structures to align with the scale and form of surrounding trees. By limiting building heights to match tree height, cities in the Netherlands prioritize harmony between the built environment and the natural world (Koh, 1998). Additionally, eco-feminist design acknowledges the inherent chaos and complexity of self-organizing systems, embracing both order and disorder as integral components of the urban landscape. This perspective challenges traditional notions of urban planning focused solely on imposing rigid order and control. Instead, eco-feminist principles seek to create cities that are deeply interconnected with the natural environment, fostering a sense of balance and integration for humane and cultured living. Recognizing the profound influence of landscape and waterscape on urban beauty and romance, eco-feminist design emphasizes the importance of preserving and enhancing natural elements within the urban fabric (Koh, 1998). Ultimately, this approach aims to create cities that are ecologically cognizant and socially just, reflecting a commitment to the wellbeing of both people and the planet.

The concept of landscape urbanism, as outlined by Steiner (2011), involves integrating principles of landscape architecture, urban design, and ecology to create sustainable and resilient urban environments. Steiner identifies three main layers of landscape urbanism: program, habitat, and circulation. This approach emphasizes the importance of designing urban spaces that accommodate various functions, support biodiversity, and facilitate movement within the city.

There are several points to glean from landscape urbanism. Firstly, this conceptual framework challenges the traditional divide between city and landscape by positioning landscape as the fundamental element of urban form (Thompson, 2012). It operates at vast scales, both temporally and spatially, preparing fields for action and serving as stages for performances (Thompson, 2012). Furthermore, it embraces ecological complexity and encourages hybridity between natural and engineered systems, recognizing the potential for remediation inherent in the landscape (Thompson, 2012). Thayer's notion of societal technophobia and the adoption of greener technologies also intersect with the discourse of landscape urbanism (Thayer, 1994). Additionally, landscape urbanism seeks to make the invisible aspects of the urban landscape visible, highlighting neglected or marginalized elements and pushing them to the forefront of urban priorities (Thompson, 2012). By bridging performance and aesthetic quality, landscape urbanism describes an approach to landscape architecture primed for award-winning human habitat.

In examining critiques of Landscape Urbanism, Thompson (2012) delves into Treib's manifesto, which outlines key principles or axioms guiding this urban design approach. Alongside these principles, Thompson poses six critical questions that challenge the assumptions underlying Landscape Urbanism. Firstly, the philosophical inquiry of whether one can derive normative principles from empirical observations. Secondly, Thompson (2012) questions the binary opposition between city and landscape, probing whether this dichotomy should be abolished altogether. Thirdly, he ponders the fate of wilderness within the context of Landscape Urbanism's focus on integrating urban and natural systems. Drawing on John Dixon Hunt's categorization, Thompson (2012) explores the role of people within landscapes, considering the balance between pristine, cultural, and designed environments. Additionally, he raises concerns about the potential cultural bias inherent in Landscape Urbanism, particularly its roots in American urbanism. Finally, Thompson (2012) reflects on the treatment of heritage within this approach, questioning how historical and cultural legacies are preserved or transformed in the pursuit of urban innovation. Further, a major critique of landscape urbanism is that it is too vast, and subsequently vague, making it difficult to implement in practice. It remains unclear which projects can be categorized as landscape urbanism and if a claim might be deemed lofty or inappropriate. These critical inquiries challenge the underlying assumptions and implications of Landscape Urbanism, inviting deeper reflection and discourse within the field of urban design and landscape architecture.

Evolving beyond the conceptual framework of landscape urbanism, iterations include a heavier focus on ecology. As Spirn (2011) noted, “ecological urbanism” is the practice and ecology of human settlements. Rottle et al. (2010) defines ecological design as both a verb and a noun, highlighting its role in improving environmental health, preserving resources, and fostering resilience. This emphasizes the importance of integrating ecological principles into the fabric of communities through a process that considers pattern-process relationships and applies landscape ecology principles (Beatley et al., 2013; Rottle et al., 2010). Whereas, ecological urbanism intends to add ecological functionality to the design parameters featured by landscape urbanism. This practice represents a design philosophy that seems to be in motion but remains relatively unexplored within cultural discourse, akin to the emergence of environmental architecture in the 1990s (Hagan, 2015). Nevertheless, ecological urbanism takes the noteworthy intent of landscape urbanism and applies additional tenets so that the approach might be more holistic, designing for both humans and non-humans by integrating ecological, social, and technological considerations to create resilient and adaptive peri-urban environments (Mostafavi et al., 2010). It places greater emphasis on regenerative design principles, community engagement, and the creation of resilient and adaptable urban environments.

The emergence of the term "ecological urbanism" gained traction following its mention in Miguel Ruano's (1999) book "Ecourbanism, entornos humanos sostenibles: 60 proyectos." Champions of ecological urbanism, such as Jeffrey Hou and Mohsen Mostafavi, advocate for an inclusive approach that addresses social equity, density, and beautiful public space alongside ecological concerns. Mostafavi emphasizes the need for an ethics of size, social mix, and density in urban design to mitigate the widening gap between rich and poor and to reduce resource consumption. In their 2010 book, Mostafavi and Doherty further elaborate on the principles and tenets of ecological urbanism, which aim to create multi-dimensional communities in harmony with their surroundings (Mostafavi et al., 2010).

Central to the implementation of ecological urbanism is the concept of regenerative design, which goes beyond mere labels and incites active enhancement of compounding systems, in essence, anthropocentric and ecological. By emulating the resilience of and integrating within the adaptability of natural ecosystems, cities can evolve into thriving, regenerative environments that contribute positively to the planet. Furthermore, ecological urbanism places a strong emphasis on human-centered design, ensuring that urban spaces are not only environmentally sustainable but also conducive to human well-being and social equity. This balanced approach prioritizes the needs and experiences of residents, human and non-human. Preservation and enhancement of biodiversity are also core principles of ecological urbanism. By promoting the creation of green spaces, wildlife habitats, supporting diverse plant and animal species, and interconnected ecological networks, urbanists can rethink how cities operate, so instead of ecological demise, they can foster healthier and more resilient urban ecosystems.

Considering climate change and other environmental threats, ecological urbanism advocates for resilience and adaptation in urban infrastructure strategies. This entails implementing green infrastructure, dynamic flood management, and climate-responsive architecture to enhance urban resilience and safeguard against future challenges.

The concept of regenerative design, as explored by various scholars and practitioners, offers a holistic approach to creating sustainable and resilient environments with an integrative systems approach (Andersson, 2018; Beatley et al., 2013; Cole, 2011; du Plessis, 2009, 2011, 2012; Folke, 2006; Lehmann, 2021; Lovell et al., 2013; Mang, 2009; Mang et al., 2012; Palazzo et al., 2011; Scott et al., 2016). They highlight the limitations of traditional mechanistic worldviews and advocate for an ecological perspective that acknowledges the interconnectedness and complexity of social-ecological systems (Cole, 2011; Mang et al., 2012). Du Plessis (2011) further critiques dominant sustainability paradigms, arguing that their conceptual foundation in a mechanistic worldview hinders effective engagement with the dynamic and living world and calls for a shift towards a regenerative paradigm that embraces complexity and adaptability. Dias (2015) and Lyle (1994) explore the principles and methodologies of regenerative design, emphasizing its potential to foster ecological health, resource generation, and resilience in built environments. Akturk (2016) evaluates regenerative design frameworks, aiming to develop a holistic framework which encompasses myriad dimensions of sustainability. Overall, regenerative design offers a promising approach to addressing the complex challenges of sustainability and resilience in the built environment, advocating for a shift towards holistic, adaptive, and ecologically responsive design practices (Beatley et al., 2013; du Plessis, 2009, 2011, 2012; Folke, 2006; Lehmann, 2021; Mang, 2009; Palazzo et al., 2011).

One of the key benefits of ecological urbanism is the enhancement of ecosystem services. Ecosystem services refer to the various benefits that humans derive from nature; provisioning services (e.g., food, water, and energy), regulatory services (e.g., climate regulation and water purification), support services (e.g., nutrient cycling), and cultural services (e.g., recreational experiences and spiritual inspiration) (Steiner, 2011; MEA, 2005). By integrating ecological principles into urban design, ecological urbanism aims to enhance ecosystem services and promote the overall well-being of urban residents through compounding systemic inputs (du Plessis, 2012).

In summary, ecological urbanism outlines a holistic approach to urban design and landscape architecture that prioritizes the regenerative sustainability of ecological systems, biodiversity conservation, as well as the human-facing elements of experience, identity, and utility (du Plessis, 2009; Folke, 2006; Mang, 2009; Mostafavi et al., 2010; Newman et al., 2008). By integrating principles of landscape architecture, urban design, and ecology, ecological urbanism seeks to create environments that are both ecologically and anthropocentrically functional through thoughtful form.

Anthropocentric Landscape Evaluation

Moving beyond the academic space of theory, translating these concepts into practice seems to be the most difficult hurdle. Overcoming this is critical for elevating the profession. Schön (1983) emphasizes the importance of practitioners reflecting on their actions, questioning assumptions, and experimenting with new approaches to improve their practice. This concept of reflective practice extends beyond individual endeavors and can be applied to the broader profession, driving continuous advancement and evolution within the discipline. A variety of tools exist for assessing existing project work. Proliferating the industry, various frameworks address a spectrum of motivations, assessing ecosystem services, anthropocentric landscape performance, building and site sustainability, living systems thinking, and regenerative design (EPA, 2009-2014; LAF, n.d.; Living Future, n.d.; MEA, 2005; USGBC, n.d.; SITES, n.d).

The Landscape Architecture Foundation's Landscape Performance Series provides case studies and tools for evaluating landscape performance, primarily in terms of anthropocentric, or human-facing, functionality (LAF, n.d.). The certifications of LEED (Leadership in Energy and Environmental Design) for buildings as well as cities and communities, and SITES (Sustainable Sites Initiative) are all complementary frameworks for assessing and certifying the sustainability of buildings, communities, or landscapes (USGBC, n.d. a; USGBC, n.d. b; Sustainable SITES Initiative, n.d.). The Environmental Protection Agency Water Quality scorecard as well as the Land Use and Green Infrastructure scorecard are tools for assessing and improving the environmental performance and the low-impact development strategies of water-based infrastructure, respectively (EPA, 2014; EPA, 2023). The Living Building Challenge (LBC) is a rigorous green building certification program that promotes the creation of building sites that are regenerative and self-sufficient (Living Future, n.d.). Additionally, various regenerative design tools and methodologies are available for evaluating planning and design processes (Akturk, 2016). This overview is visualized in Table 1.

Table 1

Existing evaluation frameworks and tools

Approach or Tool	Scale	Data Demand	Resolution	Specialist technical knowledge	Time	Effort or Staff Capacity	Cost
LAF Landscape Performance	Site	Intermediate-High	Intermediate	Intermediate	High	High	Intermediate-High
Sustainable Sites Initiative (SITES)	Site	High	Intermediate-High	High	Intermediate-High	High	High
Leadership in Energy and Environmental Design for Cities and Communities (LEED)	Site-City	High	Intermediate-High	High	High	High	High
Living Building Challenge (LBC)	Site-City-Region	Low-High	Low-Intermediate	Intermediate	Intermediate	Intermediate-High	Intermediate
Toolkit for Ecosystem Service Site-based Assessment (TESSA)	Site	Low-High	Low-High	Low	Low	Low	Low
Ecological Urbanism Rapid Assessment	Site-City	Low	Low-Intermediate	Intermediate	Low	Low	Low

Select elements from these precedent frameworks have been included in the Ecological Urbanism Rapid Assessment. Topics inspired by the SITES framework include insights into the ecological integrity of a landscape through assessments of soil health, disturbance, conservation efforts, and biomass levels, as well as metrics related to floodplain protection, recognizing the significance of mitigating flood risks while also preserving natural hydrological processes. Moreover, this framework includes anthropocentric functionality by emphasizing connectivity and accessibility within the built environment through multi-modal transit networks. Additionally, SITES metrics extend to more innovative concepts such as evolutionary design, which focuses on adaptability and resilience to changing environmental conditions (Koh, 1989; USGBC, n.d. b). Collectively, these metrics from the SITES framework offer thoughtful ecological and social considerations.

The United States Green Building Council (USGBC) developed the Leadership in Energy and Environmental Design (LEED) rating system to evaluate the sustainability and environmental performance of development in the form of buildings and communities. Each variation consists of various categories with specific criteria for achieving points towards certification. In the LEED for Cities and Communities, the v.4.1 Guide 2022, pertinent sections focus on ecological systems, transportation infrastructure, water management, energy consumption, quality of life indicators, and regional priorities, aiming to foster sustainable development practices and create healthier, more resilient communities rather than site-specific interventions, which the LEED for Buildings focuses on. Overall, this scoring framework encourages a regional approach with broad considerations for sustainable design and construction, mindful of environmental, social, and economic factors to promote the creation of healthy, efficient, and environmentally responsible buildings and communities.

The Landscape Architecture Foundation (LAF) Landscape Performance initiative provides a framework comprising 33 assessment categories divided into environmental, social, and economic benefits (LAF, n.d.). These metrics are designed to be flexible and contextual, allowing projects to be assessed based on available data and specific contexts. The landscape performance series, while versatile, can be daunting. Its customizable evaluation system can leave interested parties unsure where to start without dedicated LAF support.

The Living Building Challenge (LBC) evaluation framework encompasses categories such as urban agriculture, human-scaled living, net-positive carbon, equitable access to nature, universal access, ethical materials sourcing, localized food systems, living economy, human-scaled living, connection to nature, and education. Each category is designed to assess different dimensions of sustainability and resilience in built environments, with a focus on achieving net-positive outcomes. Furthermore, the Living Building Challenge promotes universal access, advocating for designs that are inclusive and accessible to people of all ages, abilities, and backgrounds. The LBC evaluation framework encourages projects to exceed traditional sustainability standards by embracing innovative strategies and holistic approaches to design and construction.

Frameworks like LAF Landscape Performance and SITES each aim to evaluate the performance of a landscape. They seem to be interconnected rather than competitive with one another. Procedurally, a SITES certification occurs during the development process, while a Landscape Performance case study intends to occur post-implementation. Yet, as the LAF Landscape Performance framework is entirely focused on human-centric benefits, it does not serve as an evaluation framework for regenerative systems. Moreover, neither approach evaluates the social performance of form-based design decisions in ways that adequately further push this focus in the profession of landscape architecture. The Landscape Performance Series has a section dedicated to social benefits while SITES has two relevant sections, one that focuses on the design process and the other on human well-being. Yet none of these evaluations assess the form-based merits of a landscape project from the perspective of a designer. This research proposes a tool to address this gap, building upon many of the existing evaluation methodologies.

Ecological Landscape Evaluation

Defining categories of assessment enables design practitioners and researchers to determine patterns of strengths and weaknesses in landscape architecture projects. While building architecture and engineered infrastructure might have highly moderated capacity regulations to follow, the performance of ecological systems, which tend to be looser and irrespective of human systems, can be more difficult to regulate. As many learn about the myriad facets and implications of ecosystems and appropriate priorities, various attempts have been made towards describing the levers of ecological function. Many frameworks in use are still anthropocentric in numerous ways.

Bridging ecological priorities with anthropocentric framing, the Millennium Ecosystem Assessment framework is a utilitarian approach assessing and valuing services provided by systems at various scales of intervention (MEA, 2005). Ecosystem services account for the sustaining processes, “such as clean water, timber, habitat for fisheries, and pollination of native and agricultural plants” (Atkin, 2013). This framing intends to span across market sectors—allowing humans to talk to other humans about seemingly non-human things. Within this framework Alcamo and Bennett define “human well-being" as a construct achievable only through a combination of security, necessities, health, good social relations, and freedom of choice and action (Leemans et al., 2003). These aspects of well-being are theorized to be dependent on several categories of “provisioning,” “regulating,” “cultural,” and “supporting” services (MEA, 2005).

Regulating ecosystem services refer to the systems regulating the water, air, and climate of a region or site. Provisioning ecosystem services refer to aspects such as the production of food, sourcing of water for consumption, and industrious uses like mining and extraction. Cultural ecosystem services refer to the recreational opportunities, aesthetic value, and community attributes curated by an environment. Supporting ecosystem services refer to the nutrient cycling, biodiversity intertwined with each of the other types of services. In sum, “engagement fosters a sense of ownership that may result in the protection of a landscape and the ecological services it can provide, such as clean drinking water, groundwater recharge, wildlife habitat, decomposition of waste, food production, and recreation” (MEA, 2005). This perspective ascertains that society protects modalities of utility, an important consideration in reformed behavioral systems.

Nassauer’s (1995a, 1995b) landscape cues are particularly relevant in this context. Gobster et al. (2007) expounds upon this concept by suggesting these cues invite human engagement with a landscape. The aesthetic attributes of a landscape communicate the efficacy through both apparent and subliminal means. This evaluation varies by user and is informed by their paradigm of values, straddling their preferences for compartmentalized compositions and the awe nature can provide.

Two diagrams for ecosystem services describing the relationships between services have been selected for discussion. The first was included in the original Millennium Ecosystem Assessment (Figure 2). The alternative (Figure 3) was created in a graduate-level studio at Utah State University as the authors, Amy Reid, Joelle Dickson, and Andrew Hughes, felt the of the visual relationships could be refined to more intuitively reflect the description provided in the Millennium Assessment (A. Reid, personal communication, February 2, 2023). Used for a bioregional analysis project, they put the subject of their study at the center, in their case, the Great Salt Lake. Elements of the categories are represented as icons in the respective sections.

Figure 2

Millennium Assessment Ecosystem Services framework

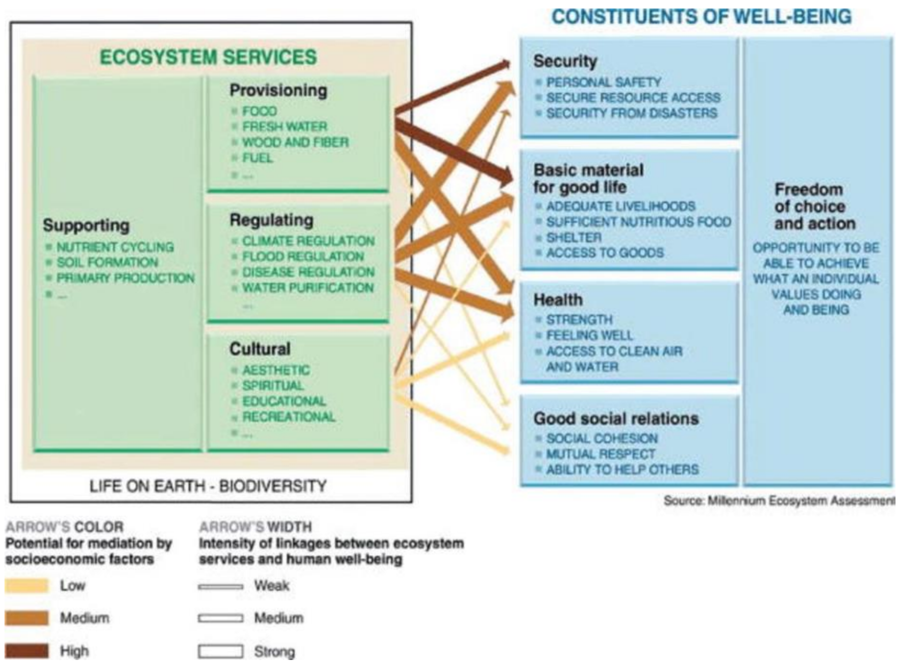


Figure 3

Revised ecosystem services framework

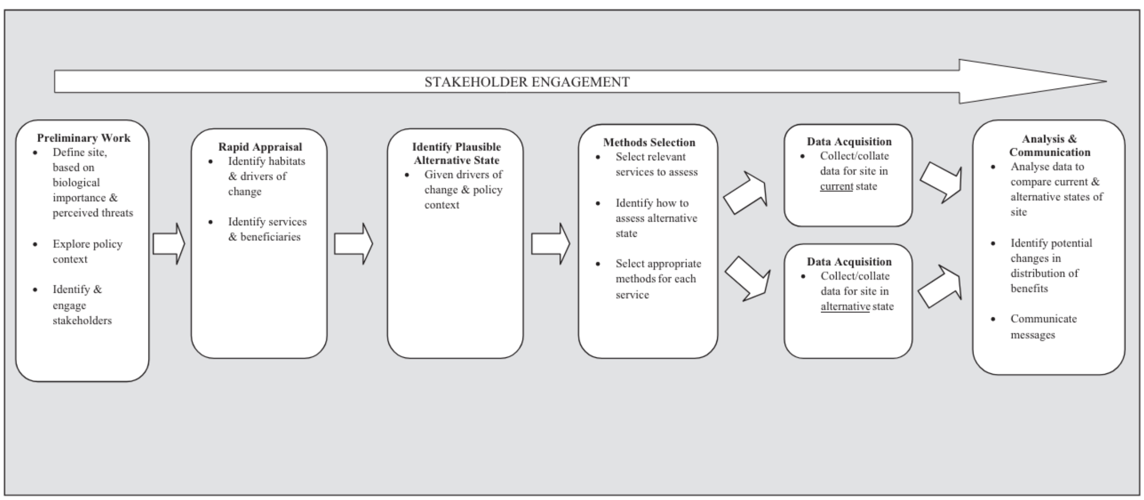
The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) is an independent intergovernmental body established by the United Nations in 2012. Its purpose is to strengthen the science-policy interface for biodiversity and ecosystem services by providing policymakers with objective scientific assessments and policy-relevant recommendations. IPBES conducts comprehensive assessments of various aspects of biodiversity and ecosystem services, including their status, trends, drivers of change, and impacts on human well-being (IPBES, 2022). These assessments involve thousands of scientists from around the world who contribute their expertise to the process. Additionally, IPBES encourages the integration of indigenous and local knowledge into its assessments, recognizing the importance of traditional ecological knowledge in biodiversity conservation and sustainable management (IPBES, 2022). These findings are synthesized into reports, which are accessible to policymakers, decision-makers, and the public. While IPBES does not have a specific evaluation framework tailored for landscape architects, its reports of biodiversity and ecosystem services, and systems-based thinking approach all provide valuable information to inform landscape planning and design practices.

In search of ways to employ these broad theoretical frameworks, the Toolkit for Ecosystem Service Site-based Assessment (TESSA) and Common International Classification of Ecosystem Services (CICES) surfaced. Building upon the CICES toolkit aimed at comparing various ecosystem services frameworks, TESSA serves as a prime example of a rapid assessment tool designed for community members seeking to comprehend the ecosystem services provided by a given site (Peh et al, 2013). A diagram of its methodology can be viewed in Figure 4.

The Toolkit for Ecosystem Service Site-based Assessment (TESSA) guides local non-specialists through a range of accessible methods for identifying the ecosystem services of a site, and assessing the current benefits derived from them, to compare to anticipated shifts with different land-use scenarios. This is a notable insight from TESSA, utilizing existing data whenever possible, as well as facilitating low-cost and low-effort for new field data collection. Despite the abundance of conceptual frameworks, recent research has revealed their inadequacy in estimating the net impacts of specific actions, which often constitutes the primary concern for decision-makers (Peh et al, 2013).

Figure 4

Methodology of the Toolkit for Ecosystem Services Site-based Assessmen



An example of a rapid assessment for practitioners aiming to understand the biodiversity of their plant menus is the Plant Ecology Worksheet. Developed by academic researcher and practitioner, Byron Brink, this tool assists in calculating the localized proportionality of habitat success (B. Brink, personal communication, November 2, 2023). This versatile worksheet includes a set of calculations that allows practitioners to quickly assess the success and distribution of plant habitats within specific localized areas, aiming to provide a practical tool for understanding and managing plant communities in various ecosystems.

Utilizing ecosystem services as a language to translate value across industries, the Millennium Assessment, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), the Common International Classification of Ecosystem Services (CICES), and the Toolkit for Ecosystem Service Site-based Assessment (TESSA) each provide an existing framework to evaluate landscapes. While provocative, critiques of the Millennium Assessment approach include outdated language, motivations, and considerations, as well as a vagueness in application (Everard, 2021). While IPBES is involved in critical policy work and support organizations in understanding and improving their impact, there does not seem to be an application toolset primed for use in landscape architecture (IPBES, n.d.). Similar to IPBES, CICES provides a platform of updated definitions and policy direction (CICES, n.d.). The TESSA approach prioritizes intuitive bucketing of these same theories, effectively operationalizing for use by non-experts (Peh et al., 2013). From this inventory, distilling these concepts into actionable processes seems to be a favorable direction or trend.

Beyond a static perspective, regenerative tools can be brought into the design process for navigating layered systems in a thoughtful manner. Referencing five tools and methodologies, Akturk (2016) outlines how regenerative design principles might be integrated into the design process; REGEN, Eco-Balance, LENSES, a framework by Perkins + Will, and the Living Building Challenge (LBC). Each of these frameworks offers unique approaches to promote sustainability, resilience, and regenerative design in various contexts. While these are helpful conceptual frameworks for approaching systems thinking in the design process, the one most applicable to the purpose of this study is the Living Building Challenge (Living Future, n.d.). Even so, it does not seem to idyllically align with the needs of ecological urbanism.

There exists a notable gap in the existing knowledge base, which this study aims to address. First, the inventoried frameworks neglect to produce a form-based evaluation rubric beyond singular "aesthetic" metrics. Second, aside from TESSA, each of these frameworks are notoriously cumbersome or abstract, becoming impractical for typical landscape architecture practitioners to use (Canfield et al., 2014). Despite these departures, there are valuable similarities and inspirations that can be drawn from existing frameworks. However, there remains a need for a more streamlined and accessible approach that integrates form-based evaluation criteria into these frameworks, catering to the needs of landscape architects.

Rapid assessments offer several merits for effectively applying theory into practice, especially in the context of landscape architecture and related fields. The inventoried landscape evaluation frameworks tend to be reliant on either technically demanding or expensive fieldwork (Fisher et al., 2011; Peh et al, 2013). This has established a barrier for practitioners to leverage this intended bridge between academia and application. As a departure from the existing modality that many landscape evaluation frameworks are based on, rapid assessments respond to the desk-bound practitioner who has parameters of efficiency, cost-effectiveness, flexibility, accessibility, real-time feedback, stakeholder engagement, and decision support. This addresses the current need for an initial proof of concept. Overall, rapid assessments offer a practical and efficient means of applying theory into practice, providing valuable insights and supporting informed decision-making for sustainable and resilient landscape design and management. The rapid assessment avenue provides an approachable application avenue of employing ecological urbanism principles in the practice of landscape architecture.

By heeding the wisdom of Ian McHarg, Anne Whinston Spirn, Tim Beatley, Richard T. T. Forman, Nina-Marie Lister, and numerous other experts, it becomes evident that there is a pressing need for a rapid assessment tool that translates the theoretical principles of ecological urbanism into actionable steps. These influential figures have significantly influenced the dialogue surrounding practical application of ecological urbanism.

CHAPTER 3

METHODOLOGY

In searching for a framework to assess the form-based design of implemented landscape architecture projects, a gap in the knowledge base became evident. A system for assessing form-based qualities, human-facing functionality, and ecological functionality of landscapes seemed to be missing. The aim of this study is to provide a rapid outlining tool based on the conceptual frameworks of regenerative systems design (Beatley et al., 2013; du Plessis, 2011; Folke, 2006; Hawken, 2021; Mang, 2009) and ecological urbanism (Mostafavi, 2010). Drawing from Wilde's (2020) and Spirn's (2008) advocacy for adapting complex urban systems and Francis's (2001) acknowledgment of the significance of case studies in professional development, there arises a clear need for a specialized framework aimed at crafting project studies in landscape architecture, particularly in the context of addressing climate change. Three methodology types are used here: (1) matrix formation, (2) project assessment, and (3) comparative analysis.

To determine the design parameters of ecological urbanism, a literature review was conducted to determine the three overarching themes of this Ecological Urbanism Rapid Assessment framework, Ecological Functionality (EFx), Anthropocentric Functionality (AFx), and Anthropocentric Form (AFm). Each of these categories are informed by the myriad of metrics available in existing frameworks (LAF, nd; Living Future, nd; MEA, 2005; Peh et al, 2013) as well as distillations from form-based theory and principles (Booth, 1990; Ching, 2017; Corner, 1992; Dee, 2001; Eckbo et al, 1998; Lyle, 1985, 1990; Nassauer, 1995a-b).

An overview of the far-reaching role of landscapes is evident through Jusuck Koh's (1989) report on landscape urbanism, which later evolves into ecological urbanism. These principles demonstrate the necessary harmony between ecological and anthropocentric systems. These findings inform priorities and approaches to the wide umbrella covered by the practice of landscape architecture, as recognized by Katherine Crewe and Ann Forsyth (2003) under their LandSCAPES framing.

A key aspect that seems to be missing from existing evaluation frameworks in landscape architecture is form-based design metrics. At present, the performance of a landscape can be articulated based on its environmental, social, economic, and infrastructural merits, but the same frameworks do not consider form-based design principles. Typically, if included at all, these considerations might fall under the singular, "aesthetic" metric in a social or cultural category (LAF, nd.; MEA, 2005; USGBC, n.d.b; Yang et al, 2016; Pieranunzi et al, 2017). Not all designs are equal in their visual, experiential, or phenomenological success, yet at present, a singular "aesthetic" score may or may not be included in a high-profile evaluation. Perhaps for experienced landscape architects, the aesthetic value of a given project has become an intuitive assessment. However, to push the profession towards mastering highly functional landscapes articulated through exceptional form-based design, a basis for this practice-wide discourse is needed. It is the intent of this investigation to articulate and expound upon form-based design metrics in conjunction with performance-based metrics, encouraging elevated design in critical infrastructure projects.

This study diverges from regenerative frameworks that prioritize non-metric-based approaches, opting instead for a rubric-based assessment (Akturk, 2016). By employing this rubric, the study seeks to understand the effectiveness of operationalizing the conceptual frameworks of regenerative systems design and ecological urbanism, like the efforts of Peh et al. with TESSA (2013) and ecosystem services.

Furthermore, the product of this research is not intended to take the form of a high-profile evaluation framework, such as LEED, SITES, LBC, LAF LPS, or others. The deliverable of this research is to serve as an outline of design principles, accounting for the multi-faceted parameters and concepts encouraged in regenerative systems design. This supports dynamic design interventions more appropriate for ecological systems.

Beyond many of the anthropocentric categories of existing approaches to landscape evaluation, here, as a product of this investigation, an alternative matrix has been developed to address the realities of compiled systems, featuring compounding motivations. The categories of Ecological Functionality (EFx), Anthropocentric Functionality (AFx), and Anthropocentric Form (AFm) each convey key aspects of these compounded systems, infusing this rating system with qualitative metrics for diverse motivations. Through this approach, the lofty, overlapping ideals of regenerative design and ecological urbanism might be represented in a practical format for landscape architects. While not a comprehensive regenerative systems evaluation tool, this Ecological Urbanism Rapid Assessment remains inspired by the overlapping nature of each of these systems, finding importance in framing design decisions through this lens balancing human-facing and ecological.

The basis for this study is founded on a combination of utilizing a matrix of design parameters to review projects, supported by the case study method (Francis, 2001). Employing a methodology of project review allows this study to illustrate the applicability of ecological urbanism in this guideline format. To study this application format, three example projects were selected. The selection criteria aimed to represent landscape projects across various scales and habitats exhibiting known attributes of ecological urbanism. Projects were required to explicitly address all three motivations categories: Anthropocentric Functionality (AFx), Ecological Functionality (EFx), and Anthropocentric Form (AFm). Diversity in scale and geolocation was sought to capture a range of landscapes, with a particular focus on water-based green infrastructure in peri-urban settings. Furthermore, projects needed to be situated within human environments and demonstrate strong representation of both ecological and anthropocentric concerns. Ultimately, the selection process aimed to curate a list of projects thoughtfully designed within the parameters of ecological urbanism.

Matrix Development

This study leverages the existing foundation of the LAF Landscape Performance evaluation framework (LAF, n.d.), SITES scorecard (v4), TESSA rapid assessment (Peh et al., 2013), and the Living Building Challenge (Living Future, n.d.) to address the merits of green infrastructure, Nature-based Solutions (NbS), landscape ecology, ecosystem services, and elements of anthropocentric functionality. However, despite exhibiting helpful metrics, the important distinction between anthropocentric and ecological motivations for design decisions is not explicitly depicted in any of the existing landscape evaluation frameworks.

Furthermore, to review the form-based design of each project, additional assessment criteria rooted in design theory have been incorporated. This section of evaluation metrics draws on foundational design principles (Booth, 1990; Ching, 2017;

Corner, 1992; Dee, 2001; Eckbo et al, 1998; Lyle, 1985, 1990; Nassauer, 1995a-b) and is adapted from similar research initiatives (Akturk, 2016; Atkin, 203; Yang, 2016), providing a robust basis for assessing the projects' design aspects. The categories have been grounded in the prevailing body of knowledge; this is shown in Table 2. Metric Justification, in the appendix.

The Ecological Urbanism Rapid Assessment (EURA) framework has three overarching sections; Ecological Functionality (EFx), Anthropocentric Functionality (AFx), and Anthropocentric Form (AFm). Each section has descriptive metrics defining various categories assigned to the section. Each metric corresponds to an orientation code, such as "EFx5.4," which directs one to the Reconnected Habitat metric under the fifth category of Habitat Quality, nested within the Ecological Functionality (EFx) section. Formatted as a rapid assessment, the metrics included are largely observational. For ease of use, the required metrics, prompts, and rating system are categorical. To highlight merits of deeper investigation under pertinent categories, some optional metrics have been included. These require additional investigation through data collection, analysis, resources, and/or in-depth understanding of the site. For this reason, these metrics start to move beyond the reasonable parameters of a rapid assessment, and thus the scores associated with these metrics pool into an alternative point total. The justification for the purpose of each category has been provided in Tables 2–4.

Categorized under the Ecological Functionality (EFx) section is Land Efficiency, Soil Health, Water Quality, Groundwater Recharge, Habitat Quality, and Carbon Sequestration. The metrics within these six categories describe ecological urbanism tenets in application and provide the opportunity for 66 total combined points possible, with 18 points from optional metrics. Table 2 describes who justifies the inclusion of these selected categories.

Within Land Efficiency are four potential metrics. The first two dive into the efficiency of development on a plot of land. This supports employing conservation development strategies by defining a goal of at least 30% of the land on the site dedicated for vegetation. The first metric is a binary, “yes” or “no” question, which then branches into a descriptive metric of the same prompt but with a defined spectrum of proportionality. This aims to define actionable areas of improvement. The second type of metric within this category is land preservation with the aim to define the proportion of regionally native vegetation to irrespective plants defined in the project’s plant schedule.

With two metrics, Soil Health is the second category under EFx. First, soil conservation describes the intent of the project to support appropriate local and regional soil types through employment of regionally appropriate vegetation. Furthermore, the soil restoration metric aims to certify that since construction has been completed, soils that may have been disturbed seem to have been appropriately restored. As a categorical assessment, indicators of restoration of biological processes include low use of gravel mulch and/or weed barrier so that the soil might function how it naturally would.

Water Quality uses aquatic habitat, erosion, and chemical balances to determine a high-level reading on the estimated impact of the project on water quality on and off the site. The first metric asks if there is water onsite and/or if maintenance practices support local water quality, with an optional metric prompting to investigate reports of macro-invertebrate population levels. The third metric leans on the design of site infrastructure to determine the likelihood of erosion and sediment loading in the hydrological system.

The final water quality metric is optional as it requires additional resources (i.e., testing kit, field visit, and resulting analysis) to determine.

Under the Groundwater Recharge category are two required metrics and one optional metrics. The first metric questions the use of conveyance, encouraging projects to find ways to slow the water flow, allowing the water to sink rather than be conveyed offsite. Another important element is the allowance of flooding events. This supports healthy soils, habitats, and an appropriate water table for the area. With resources permitting, one could investigate the infiltration rate of the soils onsite, determining if the site retains an appropriate amount of run-off onsite, as prompted by another optional metric.

Table 2

EFx Metric Justification

Section	Evaluation Categories	Significance	Body of Knowledge
Ecological Function	EFx1: Land Efficiency	A key indicator of conservation development reflects a majority of the site is softscape.	SITES, Landscape ecology
	EFx2: Soil Health	A key component of regulating and supporting ecosystem services is rich, healthy soil.	SITES, Ecosystem Services, Regenerative design, Landscape ecology (habitat), LAF Landscape Performance
	EFx3: Water Quality	Integral to healthy ecosystems (ecological and human utility) with roles in provisioning, regulating, cultural, and supporting ecosystem services.	Ecosystem Services, Regenerative design, Landscape ecology (habitat), LAF Landscape Performance
	EFx4: Water Body and Groundwater Recharge	Critical to ecological and anthropocentric utility, water supply is underpinned by underground stores. Conventionally, humans tend to convey water offsite, displacing this balance of supply.	SITES, Ecosystem Services, Regenerative design, LAF Landscape Performance
	EFx5: Habitat Quality	Restoring habitat requires reigning in some conventional human impositions such as light fixtures, plant varieties, and connectivity considerations.	Landscape ecology, Regenerative design, LAF Landscape Performance
	EFx6: Carbon Sequestration	Having produced an imbalance in carbon at a global scale, incorporating, protecting, and restoring sequestering landscapes might help support ongoing balance.	SITES, Regenerative design, IPCC, LAF Landscape Performance

Categorized under the Anthropocentric Functionality (AFx) section is Stormwater Management, Water Conservation, Recreational and Social Value, Cultural Preservation, Health and Wellbeing, Safety, Noise Mitigation, Food Production, Transportation, Access and Equity, Economic Development, Energy Use, and Temperature and Urban Heat Island. These 13 categories supply the opportunity for 120 total combined points possible, with 45 points coming from optional metrics. An overview of how these categories situate within the literature is provided in Table 3.

In the first category of stormwater management, there are three metrics, two of which are optional, providing a potential for nine points. The required metric, (AFx1.1) Stormwater Management, assesses whether stormwater infrastructure (green, gray, blue, and/or hybrid) is evident onsite. The following optional metrics, (AFx1.2) Infrastructure Efficacy, reference reports of utility infrastructure maintaining functionality during storm events, while (AFx1.3) Flood Protection aims to assess reports of built structures and critical infrastructure remaining undamaged by flooding events.

Water Conservation addresses water-wise plants, passive rainwater collection, and dependency on sprinkler support systems. (AFx2.1) Water-wise Plants assesses whether onsite vegetation is appropriate for the climate type. (AFx2.2) Passive Collection evaluates how water is collected for consumption onsite (e.g., rainwater harvesting). The three optional metrics are (AFx2.3) Water Support, which asks if sprinkler systems leave vegetation unsupported after 3–5 years, with an exception provided for drought conditions; (AFx2.4) Sprinklers assesses whether low-flow water distribution systems are used in place of conventional sprinkler systems or watering techniques; while (AFx2.5) Water Cycling evaluates whether water is recycled and vegetation is watered using gray water. The total points possible for the Water Conservation category is 15, nine of which come from optional metrics.

Recreational and Social Value assesses the social merits of spaces for congregation, identity, and recreation, offering the opportunity for 15 points, with 12 coming from required metrics. (AFx3.1) Gathering Spaces evaluates whether community gathering spaces are part of the onsite program, either indoor or outdoor, using a binary scale where “Yes” receives a score of 3 and “No” receives a score of 0. (AFx3.2) Identity of Place assesses whether the site maintains a unique identity, supporting the dynamic of the region, where "supporting" can include either similar identity for continuity or different identity for depth. (AFx3.3) Recreation asks if physical activity is supported through multi-functional turf spaces, trails, water recreation, etc. (AFx3.4) Formal Sports evaluates whether formal sports have been factored into the project program, with dedicated area(s) for field, court, and/or spectator sports onsite or within a half-mile of the site, scored similarly on a binary scale. Additionally, (AFx3.4b) Formal Sports, a branching metric, can only be answered if (AFx3.4) was "yes," and asks if area(s) for field, court, and/or spectator sports consumes less than 50% of the site area, with scoring ranging from 0 to 3 based on the percentage of site area consumed.

Cultural Preservation assesses the historical importance of the site using three metrics, with two being mandatory. AFx4.1, concerning Historic Structures, evaluates the preservation of buildings and structures of historical significance on-site, along with accompanying interpretive signage. AFx4.2, Memorial, ensures that relevant history is appropriately commemorated onsite through methods such as interpretive signage or statues. AFx4.3, Historical Preservation, is an optional metric which considers the presence of a historic preservation society or similar governing body in the area, responsible for monitoring and advocating for protected sites.

The Health and Wellbeing category focuses on human-centered aspects such as streetscape design, demographic health trends, and overall quality of life. The required metric AFx5.1, Human-scaled Design, assesses the degree to which the onsite design supports comfortable living and mobility, with scoring based on the percentage of implementation. Optional metrics in this section include AFx5.1b, which evaluates the promotion of human-scaled living and mobility through local economy and design approaches, AFx5.2, which considers the health status of surrounding areas, as well as metrics AFx5.3 and AFx5.4, which assess community satisfaction and air quality reports.

The fifth category within the Anthropocentric Functionality section, Health and Wellbeing, evaluates human-scaled streetscapes, demographic health trends, and quality of life. AFx5.1, Human-scaled Design, assesses the support for comfortable living and mobility onsite, with scoring based on the percentage of support provided, and the following breakdown: less than 15% of built structures providing an appropriate human dimension receives 0 points, 15–30% receives 1 point, 31–75% receives 2 points, and 76–100% receives 3 points. The remaining metrics in this category are optional. AFx5.1b, Human-scaled Design, evaluates human-scaled living and mobility promoted through local economy and design modalities. AFx5.2, Healthy Demographics, considers healthy demographic data in surrounding areas, including low rates of diseases like cancer and cardiovascular diseases. Optional metrics AFx5.3, Satisfaction, and AFx5.4, Air Quality, assess community satisfaction reports and air quality, respectively.

The Safety category allows for a maximum of 12 points, with six metrics requiring investigation beyond what may be readily available to an assessor. AFx6.1 evaluates the presence of Crime Prevention Through Environmental Design (CPTED) principles onsite, with a binary scoring system (Yes: 3 points; No: 0 points). If AFx6.1 scores "Yes," then AFx6.1b assesses how well CPTED principles are implemented onsite, with scoring ranging from 0 to 3 based on the percentage of compliance (less than 15%: 0 points; 15–30%: 1 point; 31–75%: 2 points; 76–100%: 3 points). AFx6.2, an optional metric, evaluates the crime rate in the immediate area compared to national, state, and/or county averages, while AFx6.3 assesses the code compliance of onsite buildings and structures, also optional.

The Noise Mitigation category offers a maximum of nine points, with one optional metric. AFx7.1 evaluates Offsite Noise Screening, focusing on whether sources of offsite noise are adequately screened to mitigate noise pollution. AFx7.2 assesses Onsite Sound Management, examining whether areas with conflicting programs are appropriately contained and separated onsite. Additionally, AFx7.3, an optional metric, examines the Onsite Soundscape, which entails reviewing existing reports of community satisfaction or initiating a custom survey to assess the quality of the soundscape.

The Food Production category leverages metrics from the Living Building Challenge (Living Future, n.d.). AFx8.1 evaluates Food Production, determining whether area(s) dedicated to food production are present onsite through a binary evaluation (Y:3; N:0). AFx8.2, Edible Plants, is an optional metric focusing on whether roughly 30% of vegetated materials are edible to humans, with scoring ranging from 0 to 3 based on the percentage of edible vegetation present. Additionally, AFx8.3, another optional metric, evaluates Urban Agriculture, examining whether onsite food production is promoted and initiatives are in place to harvest produce, maintain cleanliness, and ensure satisfaction.

The ninth Anthropocentric Functionality category, Transportation, encompasses 12 possible points with six optional metrics. AFx9.1, Multi-Modal, assesses whether Multi-modal access to, from, and among the site is evident, including support for micromobility onsite. AFx9.2, an optional metric, evaluates Micromobility based on data suggesting effective encouragement, support, and availability of non-vehicular transportation to, from, and among site amenities. AFx9.3, Complete Streets, examines whether onsite vehicular circulation incorporates tactics to slow cars down and encourage pedestrian and cyclist activation. Additionally, AFx9.3b, another optional metric, considers data-based reports of pedestrian and cyclist safety.

The Access & Equity category emphasizes the importance of ensuring that the landscape project is accessible to individuals with differing capacities. AFx10.1, Accessibility, evaluates the promotion of optimum site accessibility, safety, and wayfinding. AFx10.2, Mental Restoration, examines whether the site design includes spaces for mental restoration. AFx10.3, Interpretive Signage, assesses the presence of interpretive signage onsite. Additionally, AFx10.4, an optional metric, considers whether signage onsite promotes active and passive education in various communication modalities. AFx10.5, another optional metric, evaluates whether the site design provides equitable access for individuals experiencing visual, physical, and/or auditory impairments through the inclusion of design modalities.

The Economic Development category comprises a total of nine points, including six points from optional metrics. AFx11.1, Local Economy, evaluates whether local businesses are supported adjacent to and/or onsite. AFx11.2, an optional metric, considers whether adjacent property values reflect the site as an amenity rather than a nuisance. AFx11.3, another optional metric, assesses whether the site serves as an anchor in the broader economy, promoting a localized, living economy.

The Energy Use category encompasses up to nine points, including two optional metrics. AFx12.1, Clean Energy, evaluates whether the site includes alternative forms of clean energy sources (such as solar panels or wind turbines), using a binary evaluation system. AFx12.2, an optional metric, considers reports of sustainable materials resourcing and manufacturing through reused and recycled options. AFx12.3, another optional metric, assesses reports of net positive carbon emissions.

The Temperature & Urban Heat Island category comprises several metrics aimed at mitigating heat buildup in urban areas. As Klemm (2017) states, climate-responsive design ensures outdoor spaces remain thermally comfortable and suitable for various activities throughout the year. AFx13.1 evaluates the presence of a vegetated canopy covering at least 40% of the site. AFx13.2 assesses hardscape mitigation efforts, while AFx13.3 measures the proportion of softscape to hardscape. AFx13.4 examines the availability of shaded areas for climatic comfort, and AFx13.5, an optional metric, considers reports of temperatures within human comfort thresholds.

Table 3

AFx Metric Justification

Anthropocentric Function	AFx1: Stormwater Management	Built structures are vulnerable to the impacts of water.	ASLA, APA, Green Infrastructure, IPCC, LAF Landscape Performance
	AFx2: Water Conservation	Conventionally manipulated water systems tend to impose on regional water supply.	ASLA, APA, Green Infrastructure, Ecosystem Services, LAF Landscape Performance
	AFx3: Recreational and Social Value	Humans are drawn towards community. This aspect of the public realm infuses spirit of place through community access, recreation, and identity.	ASLA, Green Infrastructure, Ecosystem Services, LAF Landscape Performance
	AFx4: Cultural Preservation	Memorialization of historical significance brings depth of identity and demonstrates layers of the human dimension.	ASLA, SITES, Ecosystem Services, LAF Landscape Performance
	AFx5: Health and Wellbeing	With a lack of well-designed human habitat, conventional anthropocentric environments are sterile, unhealthy, and produce low quality of life	ASLA, LEED, SITES, Ecosystem Services, Green Infrastructure, Urban Design
	AFx6: Safety	Crime can be mitigated through environmental design, improving quality of life and project success.	ASLA, APA, LEED, SITES, Ecosystem Services, CPTED, LAF Landscape Performance
	AFx7: Noise Mitigation	Noise can be disruptive to the quality of experience, as well as having chronic health implications, lowering general quality of life.	ASLA, LEED, SITES, Ecosystem Services, LAF Landscape Performance
	AFx8: Food Production	Creating opportunities for diversified access to food adds social resilience to a community.	SITES, LBC, Regenerative design, Ecosystem Services
	AFx9: Transportation	Diversifying transportation modalities adds systemic resilience, as well as providing active, healthy, and safe alternatives to vehicular transit.	ASLA, APA, LEED, SITES, LBC, Regenerative design, Ecosystem Services, Urban Design
	AFx10: Access & Equity	Providing empowering spaces improves social resilience, identity, and site satisfaction.	ASLA, APA, SITES, Green Infrastructure, LAF Landscape Performance
	AFx11: Economic Development	Localized, living economies infuse the commuity with financial resilience, enabling continued governance.	ASLA, APA, LAF Landscape Performance
	AFx12: Energy Use	Incorporating clean energy infrastructure and supporting localized resourcing, lowers polluting emissions.	LEED, SITES, LBC, Regenerative design, LAF Landscape Performance
	AFx13: Temperature & Urban Heat	Impervious surfaces tend to reflect solar heat, perpetually warming urban areas beyond thresholds of human comfort.	ASLA, SITES, Ecosystem Services, Green Infrastructure, LAF Landscape Performance

Categorized under the Anthropocentric Form (AFm) section is Line, Color, Form, Texture, Scenic, Rhythm, Emphasis, and Legibility. For this section, these eight topics of focus have been synthesized from foundational design, architecture, and landscape architecture theory. To substantiate the usage of these categories for evaluating landscapes, guidance from a 2013 thesis has been referenced as well (Atkin, 2013). While the topic of Atkin's thesis is tangential to the purposes in this study, the form-based design metrics are in alignment. Atkin (2013) suggests that "criteria such as context, spatial character, movement/paths, edges/transitions, foci, color, texture, variety, repetition, surrounding urban development patterns/design, and potential ecological contributions" each feed into the effectiveness of a landscape. Furthermore, design elements (e.g., scale, form, space, movement, form, texture, variety, repetition, line, color) and design principles (e.g., dominance, contrast, unity, variety, balance, rhythm, repetition) are critical for describing the relationship between humans and landscape (Booth, 1990). These eight categories total up to 90 possible combined points, including 30 points from optional metrics. Table 4 describes how these metrics situate.

The concept of line encompasses both explicit and implied delineations within a landscape, influencing micro-habitats and human behaviors. These lines, often subtle in natural settings, follow curves dictated by elements like water sources, topography, and disturbance patterns (Atkin, 2013). AFm1.1 evaluates intentional lines in site design, while AFm1.2 assesses delineations between landscape shifts, such as changes in materiality or habitat. Additionally, AFm1.2b, an optional metric, considers the perceptibility of these delineations and invites feedback through surveys.

Within the AFm section, the concept of color cohesion is translated into four metrics, including two optional ones. Stating that color can introduce variety, repetition, emphasis, and affect the visual weight of a form, Ching (2023) describes the powerful design tool of color. AFm2.1 evaluates the coherence, relation, and balance of material colors present onsite. AFm2.2 assesses intentional contrasts in material colors, while AFm2.3, an optional metric, examines the contextualized use of regionally appropriate plant color palettes. Additionally, AFm2.4, another optional metric, ensures that the color palette remains discernible across spectrums of color-blindness.

Many attempts of defining the foundational design element of form explain it this way: ". . . by defining the juncture of mass and space, the landscape architect or designer from other disciplines is making a statement about the interrelationship of man and his universe [or environment]" Bacon (1967). The Form category consists of three metrics, one of which is optional, offering up to 12 potential points. AFm3.1 evaluates the presence of a discernible formal style, such as curvilinear or arc-tangent design elements. AFm3.2 assesses the use of supplemental forms, including playful or formal structures like sculptures or benches, to provide structure to the design. The optional metric, AFm3.3, considers Vegetated Form, focusing on how vegetation complements the selected style, including the appropriate selection of tree shape and massing techniques.

Furthermore, the incorporation of texture is supported by architectural theory as "the visual and especially tactile quality given to a surface by the size, shape, arrangement, and proportions of the parts" (Ching, 1989). Texture in the realm of plant material is often a reflection of the ecological functionality requirements of the climate zone. In general design, texture can be employed and perceived through visual, tactile, contrasts at a variety of scales from pavement, architectural materials, plant materials, and depth in color. The Texture category comprises four metrics, allowing for a total of 12 possible points, with two required and two optional metrics. AFm4.1 assesses Visual Texture, focusing on the perception of cohesive and/or complementary textures in plan-view. AFm4.1b, an optional metric, extends this evaluation to textures perceived 5–10 ft away. AFm4.2 evaluates Local Textures, ensuring that plant and man-made materials reflect the climatic conditions of the area appropriately. Finally, AFm4.3, another optional metric, examines Tactile Texture, considering whether the texture of materials used in entourage and amenities aligns with the design intent.

Throughout their evolution, humans have held onto the preference for cozy places of refuge and expansive viewsheds to prospect from. Today, this translates into a scenic design element, articulating the landscape with a balance between lush corners and expansive releases. The Scenic category encompasses seven metrics, with three required and four optional, offering a total of 21 potential points, with nine points attributed to optional metrics. AFm5.1 evaluates Viewpoints, determining if dedicated viewpoint area(s) are present on the site. AFm5.2 assesses Expansive views, whether isolated or throughout the site. AFm5.3 focuses on the perception of lush and lively Vegetation, while AFm5.3b, an optional metric, considers reports of this perception. AFm5.4 examines Hide and Reveal elements in the site design, assessing the presence of a range of open and hidden spaces in plan-view. Optional metrics include AFm5.5, which evaluates the Perception of Protection, and AFm5.6, which considers reports of community approval ratings.

To further unify a landscape, the design principles of repetition, rhythm, and unity remark on the cadence of elements throughout a design. This can be conducted in symmetrical or asymmetrical manners yet should convey strong intention. Rhythm, “provides cohesion, preventing a composition from appearing fragmented and chaotic (Atkin, 2013).” An adapted definition from musical rhythm, visual rhythm organizes, structures and sets elements into motion—creating a sense of harmony and connection. The Rhythm category comprises five metrics, with four being required for evaluation. AFm6.1 assesses the presence of a cadence of components providing structure throughout the site design. AFm6.2 focuses on the periodic repetition of elements to define formal cohesion. AFm6.3 evaluates the repetition of components, such as color, line, texture, and form. AFm6.4 considers the balance achieved through symmetrical or asymmetrical compositions. Additionally, AFm6.5, an optional metric, explores experiential reports of an intuitive structure or trust in the site design.

Countering a regular cadence, the design principle of emphasis brings in a different type of intentionality. Curating a point of focus provides a space or objective for the audience to be drawn into. AFm7.1 evaluates the presence of at least one focal point in the site design, employing a binary scoring system (Y:3; N:0). AFm7.2 assesses the framing of focal points using vegetation and/or built modalities to enhance their visual prominence. If AFm7.2 yields a "Yes" result, the evaluation proceeds to AFm7.2b, where the effectiveness of framing using vegetation and/or built modalities is further explored through cross-section analysis, close-up image examination, or onsite inspection.

The final element of the form-based design metrics is the legibility of a design. Creating a sense of familiarity within a new landscape, legibility provides the cues necessary for inviting human participation (Atkin, 2013). These cues build upon those described by Nassauer (1995). In the rapid assessment, this translates into four metrics, with the combined total of 12 points possible. AFm8.1 evaluates the clarity of delineation between different uses or areas within the site design. AFm8.2, an optional metric, considers reports of intuitive differentiation between programmatic landscape uses, such as spaces designated for tidy and messy landscapes. AFm8.3 assesses the conventional balance of programs and landscape uses, while AFm8.4, another optional metric, examines the perception of spaces as tidy or messy landscapes.

In Atkin's (2013) suggested design principles, the aspects of variety and site location are also included. The variety category pertains to the biodiversity of the plant materials. The site location aspect refers to the land efficiency and thoughtful context considerations. Given the overlapping metrics in the AFx and EFx sections, these have been removed from this AFm section.

While this is not an exhaustive list of design principles, the literature strongly supports these eight elements, and each one adds poignance to the landscape performance framework. The importance of effectively wielding form-based design elements determines the successful social adoption of a site. Designers can infuse their interventions with conceptual links between both natural environments and constructed landscapes (Williams et al., 2001). As Atkin (2013) suggests, the organization of space, directing movement, providing rhythm and comfort through texture and repetition, all funnel into an effective design framework.

Table 4

AFm Metric Justification

Anthropocentric Form	AFm1: Line	Drawn towards organization, direction, and purpose, humans intuitively look for lines to comprehend a landscape.	ASLA, Booth, Nassauer, Norberg-Schulz
	AFm2: Color	Providing contrast, contextualization, and cohesion, color adds depth to landscape.	ASLA, Booth, Nassauer
	AFm3: Form	Effective, balanced clustering of spaces adds satisfying structure to a landscape design.	ASLA, Arnheim, Booth
	AFm4: Texture	Evident in details as wayfinding support, satisfying contrast, and localized contextualization.	ASLA, Universal Design, Lynch, Arnheim, Booth, Norberg-Schulz
	AFm5: Scenic	Prospect refuge theory suggests human preference for a balance of enclosed lush spaces, expansive viewsheds, and permeable access throughout an environment.	ASLA, SITES, Appleton
	AFm6: Rhythm	Providing structure, unity, and balance, rhythmic elements curate satisfying spaces.	ASLA, Arnheim, Booth
	AFm7: Emphasis	Framing nodal focal points adds intentionality to a design.	ASLA, Booth, Norberg-Schulz
	AFm8: Legibility	Utilizing edges varying in permeability adds an important layer of legible contextualization to a landscape.	ASLA, Nassauer, Lynch, Arnheim

Positioned as a rapid assessment tool, the included metrics primarily rely on observational data. The required metrics, prompts, and rating system are categorical for ease of use. Optional metrics, included to underscore the value of deeper investigation in relevant categories, necessitate additional scrutiny. Each of the metrics builds upon the knowledge base and various evaluation frameworks, as described in Tables 2–4. Overall, the framework allows for a total of 276 possible points, consisting of 183 points from required metrics and an additional 93 points from optional metrics.

Rating Scale

To assess multiple projects within this research study, a four-part categorical rating scale has been applied. To undertake the depth of evaluation provided in an LAF Landscape Performance case study investigation is outside the scope of this study. Instead, by using a categorial approach, which simplifies metrics used in existing frameworks, the proposed Ecological Urbanism Rapid Assessment might be more accessible to practitioners.

In the context of this study, a four-part scale has been established with distinct definitions. A score of "0" or “N/A” signifies that the topic is either not applicable or entirely absent from consideration. Conversely, a "1" indicates a minimal effort towards inclusion, while a "2" suggests deliberate incorporation, albeit with an unclear depth of integration. Finally, a score of "3" reflects a substantial and prominent inclusion of the evaluation topic. This scale has been uniformly applied across all categories of the framework, encompassing Ecological Functionality (EFx), Anthropocentric Functionality (AFx), and Anthropocentric Form (AFm).

Often used in anthropology, rapid appraisal tools afford the assessor the capacity to quickly determine “cost effective” and qualitative results (Beebe, 1995; Harris, 1997). As a rapid assessment, this framework caters to the landscape architecture practitioners who are aiming to quickly evaluate what is working in an existing built project in terms of ecological urbanism. Further research and development is needed to create a full performance evaluation which follows the same tenets, most notably the form-based metrics. Yet, this space in between seems to have been overlooked in the industry. Besides the TESSA rapid assessment, existing evaluation frameworks seem to be cumbersome on practitioners’ time, effort, and resources, yet even TESSA exhibits a different audience than the Ecological Urbanism Rapid Assessment described here (Peh et al, 2013). While in-depth evaluation efforts are important undertakings, a rapid version of assessment has been missing thus far.

Selection Criteria for Pilot Projects

A selection criterion was defined to determine the projects to use in this research. For the purposes of this study, the following elements were deemed integral to the project framing. First, the intent of the project must have been to maintain or reinstate ecological functionality through an effort of reconfiguring systems. The project scale would not be fixed. Rather, to address the breadth of applicability, each project under investigation represents a different scale range. Similarly, the geolocation was not fixed so that a sampling of climate types might be preliminarily assessed—coastal, mountain, and prairie have been included here. The focus on stormwater management projects affords enough contextual similarity for comparative design evaluation.

Utilizing case studies to provide a basis for comparative analysis, the aim of this study is to inform the usage of a supplemented landscape performance matrix. These case studies vary in scale, geolocation, and wetland type. Case studies were chosen from different locations to harness a similar level of excellence/success across a variety of applications. Case studies provide the best avenue for testing the matrix, addressing the argument of this thesis by increasing the thorough application of this framework. To test the form-based design metrics, selected projects would need to be of a pre-determined caliber, having received recognition in the industry of landscape architecture.

Each evaluator in this study reviewed the process of using the Ecological Urbanism Rapid Assessment through the pseudo-assessment of three example project cases. Each of these projects have been implemented and had supporting documentation providing the project in plan-view as well as documentation informing a general overview of intent.

Projects were selected for explicitly addressing tenets of ecological functionality, anthropocentric functionality, and discernible form-based design. While situated within urban and peri-urban environments, each project needed to showcase an intention to provide adaptive interventions through key ecological components. In this case, the throughline in project selection was water-based infrastructure. Here, water serves as a starting point as it effectively demonstrates how landscapes function. It aims to explore the interplay between ecological functionality and anthropocentric functionality, examining how these motivations can be effectively distinguished and analyzed.

Beyond these commonalities, the project scales and geolocations were diversified. This provides diversity, intentionally aiming to expose anticipated gaps in the assessment framework. One project was a five-acre site featuring a series of freshwater wetlands for water quality improvement in a high mountain climate, completed in 2007. Another project was focused on 15 acres of prairie floodplain restoring trees and pollinator habitat, completed in 2019. The largest site assessed in this pilot study was 33 acres of coastal, tidal marsh habitat, completed in 2001.

Study Protocol

To initiate the review session, materials such as hard copies of the Ecological Urbanism Rapid Assessment and packets containing project briefs and support documentation were assembled. Each examination would be timed and scored individually, with no discussion of score.

The protocol for examining the Ecological Urbanism Rapid Assessment utilized a structured approach aimed at ensuring thorough and efficient assessments of landscape architecture projects. Assessors were each trained in landscape architecture, equipped with a diverse range of experience in the field. Prior to each assessment session, materials essential for the evaluation, including the rapid assessment scorecard, rating system key, and project documentation, were gathered and organized. With a focus on efficiency, each review was timed, with a target duration of 15–30 minutes per project. No evaluation session would be cut short, rather a running clock approach was used to set a baseline of how long the assessment might take to complete. Assessors were expected to record notes, questions, and any concerns of the EURA procedure. Following the completion of each session, a brief period of reflection was used to discuss insights. Through adherence to this protocol, the evaluation process remains systematic, transparent, and conducive to the generation of valuable insights for enhancing the initial development of the Ecological Urbanism Rapid Assessment scoresheet.

CHAPTER 4

RESULTS

To review the Ecological Urbanism Rapid Assessment, documentation from three built-projects was used to conduct a pilot study. The goals of this were to determine (a) if the framework provided an intuitive and approachable avenue to assess landscape architecture projects; (b) if the assessment adequately addressed various project types, scales, and climates; (c) if the tenets of ecological urbanism were reasonably incorporated; (d) if each metric provided valuable design reflection; and (e) if the assessment could be done within a practical timeframe.

Throughout the review process, assessors recorded notes, questions, and any concerns arising during their evaluation. This ensured thorough documentation of observations and insights gathered during the assessment process. Additionally, a brief reflection session followed the evaluation of each project, providing assessors with an opportunity to discuss their observations, share insights, and identify potential areas for further exploration or improvement. This protocol facilitated a systematic, transparent, and efficient evaluation process, fostering valuable insights for enhancing landscape architecture projects within the realm of ecological urbanism.

Research Questions

1. How does the tension between ecological functionality and anthropocentric priorities influence form-based decisions in ecological urbanism projects?
2. How might principles of ecological urbanism be turned into a practical rapid assessment tool designed for practitioners of landscape architecture?

These research questions aim to explore the complexities surrounding the intersection of ecological principles, aesthetic concerns, and practical considerations in landscape architecture, particularly within the context of ecological urbanism. They provide avenues for investigating the decision-making processes, challenges, and potential benefits associated with integrating ecological and aesthetic considerations into landscape projects.

Presentation of Findings

To evaluate the rapid assessment scoresheet for its inclusion of ecological urbanism and capacity for practical application, six reviews were completed. The first took the longest, at 44:38, but included sustained orientation and systematic workflow considerations. The rest of the assessments ranged from 13 minutes to 17 minutes, with the fastest time being 13:12 completed on the final round of evaluation by the practitioner with the most career experience. From the selected projects, the time to complete assessments seems to have had no bias towards project size or scale.

The initial round (44:38) included the verbal review of each metric, adjusting wording and adding important clarification, so each assessor would be aligned on how to interpret each item. While these revisions were not officially implemented prior to the rest of the evaluations, the scorecards were manually adjusted for consistency. Assessors came into the evaluation session with a mix of knowledge and familiarity with each project. It seemed the most discrepancy found in scores pertained to comprehension of the materials provided. Categories with the largest discrepancies included Water Quality (EFx3), Habitat Quality (EFx5), Cultural Preservation (AFx4), and Form (AFm3). If one assessor had conducted a site visit, or if the provided materials displayed a variety of images to showcase features throughout the site, this seemed to impact the precision of score assigned per metric.

Generally, the scores of each metric, per project, per assessor, reflected similar trends. Three total scores can be derived using this assessment tool: a general score of all required metrics, a total of bonus metrics, and a combined score of each. This allows control over the metrics that might require additional investigation resources, such as data, time, funding, and field test tools. The optional metrics encourage important indicators of healthy environments, community satisfaction, and demographic analysis. Use of these optional metrics have been limited to allow for this tool to primarily be used as a rapid assessment. As this framework is not necessarily a comparison tool, the compiled scores, including both required and optional metrics, may not provide an equitable representation for comparison between multiple projects as some data might be more readily available or perceivable in some projects than others. While optional metrics were used if the assessor felt the information was available, these scores are not considered here. This limited use of optional metrics responded to an alternative hypothesis, not of comparative score, but for discerning necessary materials for evaluation. Therefore, the general score, which does not include optional metrics, has been the primary source of these results.

This procedural evaluation focuses on using the projects as test scenarios, shifting the focus away from the direct comparison between projects which might prematurely aim to determine the project which best exemplifies ecological urbanism. This is reserved for a future study.

In overview, each assessor ultimately ranked the three reviewed projects in the same order, while assigned scores were not identical, they were within an appropriate threshold. This exemplifies the flexibility, yet generally consistent reporting qualities of this rapid assessment. The general score, not inclusive of optional metrics, for Test Project 1 resulted in a score of 110 by Assessor A, and 101 by Assessor B. The general score for Test Project 2 resulted in a score of 127 by Assessor A, and 132 by Assessor B. The general score for Test Project 3 resulted in a score of 122 by Assessor A, and 115 by Assessor B. These results are exemplified in Table 5 for further clarity.

These results suggest promise in utilizing this rapid assessment method to evaluate the ecological urbanism merits of peri-urban landscape projects. This affirms that there is potential in pursuing this form of rapid assessment for reviewing the merits of ecological urbanism, or lack thereof, in landscape projects.

Table 5

General totals in pilot test

Assessor	Test Project 1	Test Project 2	Test Project 3
A	110	127	122
B	101	132	115

Discussion of Results

Through preliminary study, this framework seems to be intuitive and approachable, providing assessors with a structured yet flexible approach to reviewing projects. The assessment appeared to lack specificity tailored to project types, scales, or climatic conditions, suggesting potential room for refinement and customization to better suit diverse project contexts. Despite this limitation, it was found that the framework adequately addressed the fundamental principles of ecological urbanism, effectively capturing the essence of sustainable and resilient design practices. Each metric included in the assessment provided valuable insights and reflections, contributing meaningfully to the overall evaluation process. None of the metrics were deemed redundant or unnecessary, highlighting the aptness of the assessment framework. Once any ambiguities in wording were clarified and assessors became familiarized with the projects, it became apparent that the assessment could be conducted efficiently, suggesting its potential for rapid and streamlined evaluation in future applications. These findings underscore both the strengths and areas for improvement of the assessment framework, providing valuable insights for enhancing its effectiveness and applicability in assessing landscape architecture projects through an ecological urbanism lens.

Categories exhibiting the largest discrepancies in assessment scores included Water Quality (EFx3), Habitat Quality (EFx5), Cultural Preservation (AFx4), and Form (AFm3). In the Water Quality category (EFx3), assessors noted a significant gap in experience related to understanding landform impacts on erosion and interpreting site plans effectively. Similarly, in the Habitat Quality category (EFx5), disparities were observed in assessors' levels of knowledge of the site or their ability to comprehend project materials thoroughly. It is worth noting that this category may be avoided if self-assessing a project. Cultural Preservation (AFx4) also exhibited notable discrepancies, with assessors varying in their understanding of site-specific cultural preservation requirements or their comprehension of relevant project materials. Again, this category may be avoided if assessing a project one was involved with. Lastly, the Form category (AFm3) showed significant variations in assessment scores, indicating discrepancies in assessors' evaluations of the aesthetic and formal qualities of the projects. This is likely the most subjective category, perhaps requiring supplemental description.

Limitations

This study of a proposed framework revealed its intuitive and approachable nature, offering assessors a structured yet adaptable method for project assessment. However, this initial version of the Ecological Urbanism Rapid Assessment lacked supporting information tailored to assessors unfamiliar with a given project or unable to conduct the assessment onsite, indicating a need for refinement.

Upon reflection, it became evident that each chosen project represented only a fraction of a larger green space network. Recognizing the significance of considering the broader context beyond the defined project boundary, as advocated in the conceptual frameworks of regenerative systems and ecological urbanism, the importance of addressing this aspect is acknowledged. As the assessments progressed, it became apparent that this is essential information for accurately responding to the metrics.

Discrepancies in assigned scores were largely attributed to differences in assessors' familiarity with the projects. This translates into ensuring a state of familiarity between assessors, whether by their role in the design process or post-development documentation. The supplemental materials may be further regulated rather than necessitating a change to the assessment metrics themselves.

Despite these limitations, assessors from the pilot study report the proposed Ecological Urbanism Rapid Assessment framework as being a usable format to address ecological urbanism fundamentals in landscape architecture projects. Each metric provided valuable insights and reflections, contributing meaningfully to the review process without redundancy.

The assessment framework demonstrated an intuitive and adaptable structure, offering assessors a rapid approach to review projects. Assessors report on its ease of use, consistently producing project reviews well within the objective time threshold of under 30 mins. While intentionally lacking specificity for varying project types, scales, or climates, this could indicate potential for refined, alternative approaches. Nevertheless, the framework effectively captured the core principles of ecological urbanism, providing valuable insights without redundancy. Once familiarized, assessors conducted evaluations efficiently, suggesting potential for rapid application. This procedural evaluation refrains from directly comparing projects to avoid premature determinations of which project best exemplifies ecological urbanism, leaving this task for future studies. These findings highlight both strengths and areas for improvement, informing future enhancements to optimize its effectiveness in assessing landscape projects promoting the compounding systems thinking encouraged by ecological urbanism.

With the objective of incorporating the rapid assessment in firm-based landscape architecture practice, the aim of future research is to collect long-term community satisfaction indicators and resilience data to further validate and promote the efficacy of this approach. This strategy is intended to enhance the validity of the framework throughout the entire project lifecycle. By continuously tracking performance over time, the accuracy of its forecasting capabilities might be verified for improved application.

CHAPTER 5

DISCUSSION & CONCLUSION

Aiming to explore the translation of key principles from the conceptual frameworks of regenerative design and ecological urbanism into a practical and efficient rapid assessment tool, the Ecological Urbanism Rapid Assessment was formed. Inspired by existing frameworks, 27 metrics were synthesized and organized into three themes, Ecological Functionality (EFx), Anthropocentric Functionality (AFx), and Anthropocentric Form (AFm). Utilizing a four-part rating system, projects could potentially gain up to 183 points under required metrics, with an additional 93 points available for optional or bonus metrics, resulting in a potential total of 276 combined points.

The creation of a matrix operationalizing ecological urbanism presents an opportunity for landscape architects to enhance their practice through systematic review. Beyond the creation of this ecological urbanism matrix, this rapid assessment process holds the potential to inform actionable steps within the field. Firstly, it allows practitioners to establish priorities by identifying areas for improvement based on ecological principles and then moves into anthropocentric requirements and values. Moreover, designers are asked to review the form-based design decisions of a project site through a consolidated rubric. Through a comprehensive review of interventions, practitioners can celebrate successes and pinpoint areas needing further attention to confidently claim a project is representative of ecological urbanism.

The Ecological Urbanism Rapid Assessment (EURA) tool offers flexibility in application throughout the design process—setting goals at the beginning of a project, iteratively checking in to see if the design is responding to the outlined goals, as well as post-implementation to review the degree of inclusion of each topic in application. Initially intended for post-implementation review, the supplemental prompt provided for each topic is written with the assumption that the project is built. With that said, the rubric could be a helpful tool throughout the design process. Leveraging this tool at the beginning of the design process encourages establishing goals aligned with ecological urbanism. Defining the trajectory in this way leverages the EURA tool as a guideline, effectively operationalizing the theoretical framework.

Regularly reviewing the incorporation of established values is a common design process. Doing so provides iterative feedback of how the evolving design might be responding to project goals. Utilizing the EURA tool throughout this process could provide a gauge for the degree of incorporation for the wide-spread principles of ecological urbanism. Many of the tools for systems-based design thinking are procedural and at this point, vague for the typical practitioner. The EURA tool can be used to assist in the practical application of theoretical principles.

Moreover, the assessment process facilitates the identification of gaps in understanding or implementation, prompting opportunities for ongoing education and skill development. Armed with preliminary data from the assessment, practitioners can effectively advocate for the integration of ecological urbanism considerations in landscape architecture projects, both within their organizations as well as in communication with external stakeholders. Additionally, the structured framework the assessment provides enhances practitioners' ability to explain the aspects of ecological urbanism within their projects, fostering clearer communication and understanding with clients, colleagues, and the public. Ultimately, by embedding ecological urbanism values into their design solutions, practitioners can advocate for sustainable and resilient landscapes.

Furthermore, the incorporation of form-based metrics represents a significant and innovative contribution to the knowledge base of landscape architecture. By integrating such metrics into both current and forthcoming evaluation frameworks, resides an opportunity to elevate the discipline. These form-based metrics offer a foundation for reflective discourse within the profession, fostering ongoing dialogue about the importance and impact of aesthetic and experiential design decisions. For landscape architects aspiring to create visionary and impactful work, it is imperative that discussions surrounding form-based design decisions persist and evolve over time.

These inquiries delve into the complexities at the intersection of ecological principles, aesthetic concerns, and practical considerations in landscape architecture. They offer avenues for investigating decision-making processes, challenges, and potential benefits by integrating and elevating priorities of ecological, anthropocentric, and even aesthetic considerations into landscape architecture projects.

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Appendix 1. EFx Scorecard

ECOLOGICAL FUNCTIONALITY			ASSESSMENT					
Topic	Metric	Description	P1	(pts possible)	P2	(pts possible)	P3	(pts possible)
Land Efficiency	EFx1.1 Land Efficiency	Developed land (hardscape and built structure) seems to take up no more than 70% of the site area, leaving roughly 30% of the site for vegetation. (Y:3; N:0)						
	If "Yes" to EFx1.1 then proceed to EFx1.2b. If not, skip to the next section.							
	EFx1.1b Land Efficiency	The proportion of developed land (hardscape and built structure) to available land is roughly less than or equal to a 70-30 proportion. (<5%:0; 5-15%:1; 15-30%:2; >30%: 3)						
	EFx1.2 Land Preservation	There are areas dedicated to native habitat and/or vegetation preservation. (Y:3; N:0)						
	If "Yes" to EFx1.2 then proceed to EFx1.2b. If not, skip to the next section.							
	EFx1.2b Land Preservation	The areas set aside for native habitat and/or vegetation preservation is roughly greater than or equal to 50% of vegetated areas. (<15%:0; 15-30%:1; 31-50%:2; >50%: 3)						
		SECTION TOTAL:	0	12	0	12	0	12
		BONUS:		0		0		0
Soil Health	EFx2.1 Soil Conservation	Appropriate vegetation is used, supporting regional soil type.						
	EFx2.2 Soil Restoration	Soils that may have been disturbed during construction seem to have been appropriately restored. Allowances for biological processes can commence (e.g. no use of gravel mulch or weed barrier).						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:		0		0		0
Water Quality	EFx3.1 Aquatic Habitat Intent	The site supports healthy aquatic habitat onsite and/or offsite through design features and/or maintenance practices.						
	EFx3.2 Aquatic Habitat	*Optional* : Reports of appropriate population levels of macro-invertibrates to support the aquatic ecosystem.						
	EFx3.3 Sediment Loading	The design of site infrastructure does not contribute to erosion likely to cause sediment loading in the hydrological system.						
	EFx3.4 Chemical Balance	*Optional* : Reports of the pH, temperature, salinity, nutrients, and presence of heavy metals are within appropriate thresholds.						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:	0	6	0	6	0	6
Waterbody & Groundwater Recharge	EFx4.1 Water Recharge	Water is slowed to sink, decreasing conveyance to offsite locations.						
	EFx4.2 Flooding	Hydrological fluctuations, such as flooding, are permissible onsite. This is made evident by the design of site infrastructure.						
	EFx4.3 Run-off	*Optional* : Site retains projected run-off. Reports of an appropriate soil infiltration rate exhibited onsite.						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:	0	3	0	3	0	3
Habitat Quality	EFx5.1 Habitat Preservation & Restoration	Native habitat dynamics seem to have been preserved or restored.						
	EFx5.2 Pollinator Habitat	Habitat area dedicated for pollinators. Or, plant palette supports local pollinator needs.						
	EFx5.3 Unnatural Light Mitigation	Low-light fixtures and/or policies implemented to maintain ecological habitat and migration dynamics.						
	EFx5.4 Reconnected Habitat	Increase in continuous habitat area, connecting corridors and/or patches beyond the project boundaries.						
	EFx5.5 Habitat Use	*Optional* : Reports of animals frequenting the area for nesting, mating, eating, drinking, bathing, etc.						
	EFx5.6 Species Richness	*Optional* : Reports of animal and insect populations and species richness onsite.						
		SECTION TOTAL:	0	12	0	12	0	12
		BONUS:	0	6	0	6	0	6
Carbon Sequestration	EFx6.1 Sequestering Habitats	Habitats known for carbon sequestration are preserved, improved, or created onsite (eg. wetlands, rainforest, bogs, etc.).						
	EFx6.2 Carbon Mitigation	Sufficient woody vegetation, appropriate for clarifying air, planted onsite.						
	EFx6.3 Carbon Sinks	*Optional* : Reports of carbon sink rates and/or clarified air post-implementation.						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:	0	3	0	3	0	3
		CATEGORY TOTAL:	0	66	0	66	0	66
		TOTAL GENERAL:	0	48	0	48	0	48
		TOTAL BONUS:	0	18	0	18	0	18

Appendix 2. AFx Scorecard

Topic	Metric	Description	P1	(pts possible)	P2	(pts possible)	P3	(pts possible)
ANTHROPOCENTRIC FUNCTIONALITY								
Stormwater Management	AFx1.1 Stormwater Management	Stormwater infrastructure (green, gray, blue, and/or hybrid) is evident onsite.						
	AFx1.2 Infrastructure Efficacy	*Optional* : Reports of utility infrastructure maintaining functionality during storm events.						
	AFx1.3 Flood Protection	*Optional* : Reports of built structures and critical infrastructure remain undamaged by flooding events.						
		SECTION TOTAL:	0	3	0	3	0	3
		BONUS:	0	6	0	6	0	6
Water Conservation	AFx2.1 Water-wise Plants	Onsite vegetation is appropriate for the climate type (eg. water-wise, etc.).						
	AFx2.2 Passive Collection	Passive forms of water collection for consumption is evident onsite (eg. rainwater harvesting).						
	AFx2.3 Water Support	*Optional* : Vegetation is unsupported by sprinkler systems after 3-5 years. Exception for drought conditions.						
	AFx2.4 Sprinklers	*Optional* : Low-flow water distribution systems are used in place of conventional sprinkler systems or watering techniques.						
	AFx2.5 Water Cycling	*Optional* : Water is recycled and vegetation is watered using gray water.						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:	0	9	0	9	0	9
Recreational and Social Value	AFx3.1 Gathering Spaces	Community gathering spaces are part of the onsite program, either indoor or outdoor. (Y:3; N:0)						
	AFx3.2 Identity of Place	The site maintains a unique identity, supporting the dynamic of the region (*"supporting" can include either similar identity for continuity, or different identity for depth*).						
	AFx3.3 Recreation	Support physical activity through multi-functional turf spaces, trails, water recreation, etc.						
	AFx3.4 Formal Sports	Formal sports have been factored into the project program. There are area(s) dedicated for field, court and/or spectator sports onsite or within a half-mile of the site. (Y:3; N:0)						
	If "Yes" to AFx3.4, then proceed to AFx3.4b. If not, skip to the next section.							
	AFx3.4b Formal Sports	*Optional* : The area(s) set aside for field, court and/or spectator sports consumes less than 50% of site area (>80%:0; 51-80%:1; 31-50%:2; >30%: 3).						
		SECTION TOTAL:	0	12	0	12	0	12
		BONUS:		3		3		3
Cultural Preservation	AFx4.1 Historic Structures	Buildings and structures of historic value are preserved onsite and accompanied by interpretive signage.						
	AFx4.2 Memorial	Pertinent history is appropriately memorialized onsite (e.g. interpretive signage, statues, etc.).						
	AFx4.3 Historical Preservation	*Optional* : A historic preservation society or other related governing body is present in the area to monitor and advocate for protected sites.						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:	0	3	0	3	0	3
Health and Wellbeing	AFx5.1 Human-scaled Design	The onsite design supports the human dimension for comfortable living and mobility (<15%:0; 15-30%:1; 31-75%:2; 76-100%: 3)						
	AFx5.1b Human-scaled Design	*Optional* : Human-scaled living and mobility promoted through local economy and design modalities.						
	AFx5.2 Healthy Demographics	*Optional* : The surrounding areas report healthy demographic data (ie. low rates of cancer, cardiovascular diseases, etc.).						
	AFx5.3 Satisfaction	*Optional* : Reports of community satisfaction.						
	AFx5.4 Air Quality	*Optional* : Reports of low particulate matter, and high air quality in the area.						
		SECTION TOTAL:	0	3	0	3	0	3
		BONUS:	0	12	0	12	0	12
Safety	AFx6.1 CPTED	Principles of Crime Prevention Through Environmental Design (CPTED) are evident onsite (Y:3; N:0).						
	If "Yes" to AFx6.1, then proceed to AFx6.1b. If not, skip to the next metric.							
	AFx6.1b CPTED	*Optional* : How well are the principles of Crime Prevention Through Environmental Design (CPTED) followed onsite? (<15%:0; 15-30%:1; 31-75%:2; 76-100%: 3)						
	AFx6.2 Low Crime	*Optional* : The immediate area exhibits data-based reports of crime below the national, state, and/or county average. Data should reflect an appropriate post-implementation time range.						
	AFx6.3 Building Safety	*Optional* : Onsite buildings and structures are code compliant.						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:	0	6	0	6	0	6
Noise Mitigation	AFx7.1 Offsite Noise Screening	Sources of offsite noise are screened appropriately to mitigate noise pollution.						
	AFx7.2 Onsite Sound Management	Onsite areas of conflicting programs are contained and separated appropriately.						
	AFx7.3 Onsite Soundscape	*Optional* : Reports of community satisfaction.						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:	0	3	0	3	0	3
Food Production	AFx8.1 Food Production	Area(s) dedicated to food production are evident onsite (Y:3; N:0).						
	AFx8.2 Edible Plants	*Optional* : Roughly 30% of vegetated materials are edible to humans. (<2%:0; 3-10%:1; 11-29%:2; >30%: 3)						
	AFx8.3 Urban Agriculture	*Optional* : Onsite food production is promoted. Initiatives are in place to harvest produce, maintain cleanliness, and maintain system functionality.						
		SECTION TOTAL:	0	3	0	3	0	3
		BONUS:	0	6	0	6	0	6

Transportation	AFx9.1 Multi-Modal	Multi-modal access to, from, and among site is evident. Micromobility is supported onsite.						
	AFx9.2 Micromobility	*Optional* : Data suggests non-vehicular transportation is effectively encouraged, supported, and available to, from, and among site amenities.						
	AFx9.3 Complete Streets	Onsite vehicular circulation uses tactics to slow cars down, and encourage pedestrian and cyclist activation.						
	AFx9.3b Complete Streets	*Optional*: Data-based reports of pedestrian and cyclist safety.						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:	0	6	0	6	0	6
Access & Equity	AFx10.1 Accessibility	Promote optimum site accessibility, safety, and wayfinding.						
	AFx10.2 Mental Restoration	Site design includes spaces for mental restoration.						
	AFx10.3 Interpretive Signage	Interpretive signage is evident onsite.						
	AFx10.4 Educational Value	*Optional* : Signage onsite promotes both active and passive education in a variety of communication modalities (visual, touch, sound, smell, various languages supported).						
	AFx10.5 Universal Access	*Optional* : Site design provides equitable access for those experiencing visual, physical, and/or auditory impairments through inclusion of design modalities (e.g. touch-based wayfinding indicators, etc).						
		SECTION TOTAL:	0	9	0	9	0	9
		BONUS:	0	6	0	6	0	6
Economic Development	AFx11.1 Local Economy	Local businesses are supported adjacent to and/or onsite.						
	AFx11.2 Property Value	*Optional* : Adjacent property values reflect the site as an amenity rather than a nuissance.						
	AFx11.3 Living Economy	*Optional* : The site serves as an anchor in broader economy, promoting a localized, living economy.						
		SECTION TOTAL:	0	3	0	3	0	3
		BONUS:	0	6	0	6	0	6
Energy Use	AFx12.1 Clean Energy	Site includes alternative forms of clean energy sources (eg. solar panels, wind turbines, etc.). (Y:3; N:0)						
	AFx12.2 Materials	*Optional* : Reports of sustainable materials resourcing and manufacturing through reused and recycled options.						
	AFx12.3 Net positive carbon	*Optional* : Reports of net positive carbon emissions.						
		SECTION TOTAL:	0	3	0	3	0	3
		BONUS:	0	6	0	6	0	6
Temperature & Urban Heat	EFx13.1 Canopy	A vegetated canopy roughly covers 40% of the site or more. (<15%:0; 10-24%:1; 25-39%:2; >40%: 3)						
	EFx13.2 Hardscape Mitigation	Areas of hardscape are lined and/or broken up with softscape areas.						
	EFx13.3 Softscape Proportion	The proportion of softscape to hardscape maintains a rough proportion of 70-30 or better. (Onsite Softscape %: <5%:0; 5-15%:1; 15-30%:2; >30%: 3)						
	EFx13.4 Shade Areas	Shaded areas (e.g. trees, structures, etc.) provide climatic comfort to site visitors.						
	EFx13.5 Regulating Vegetation	*Optional* : Reports of temperatures within human comfort thresholds.						
		SECTION TOTAL:	0	12	0	12	0	12
		BONUS:	0	3	0	3	0	3
		CATEGORY TOTAL:	0	120	0	120	0	120
		TOTAL GENERAL:	0	75	0	75	0	75
		TOTAL BONUS:	0	45	0	45	0	45

Appendix 3. AFm Scorecard

ANTHROPOCENTRIC FORM

Topic	Metric	Description	P1: JA	(pts possible)	P2: AMA	(pts possible)	P3: CF	(pts possible)
Line	AFm1.1 Line	Intentional lines evident in site design.						
	AFm1.2 Delineation	Delineation between shifts in the landscape is evident onsite. Shifts may include transitions in materiality, habitats, disturbance patters, and program.						
	AFm1.2b Delineation	*Optional* : Delineation between shifts are pleasantly perceptible. Uncover feedback through survey.						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:	0	3	0	3	0	3
Color	AFm2.1 Material Color Cohesion	Colors of materials (vegetated or imposed) evident onsite are cohesive, related, and balanced.						
	AFm2.2 Material Color Contrast	Intentionally contrasting colors in materials (vegetated or imposed) evident onsite.						
	AFm2.3 Regional Colors	*Optional* : Contextualized approach evident through use of a regionally-appropriate plant color palette.						
	AFm2.4 Color Spectrum	*Optional* : The color palette is discernible across spectrums of color-blindness.						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:	0	6	0	6	0	6
Form	AFm3.1 Formal Vernacular	A discernible formal style is used (e.g. curvilinear, arc-tangent, etc.).						
	AFm3.2 Forms	Use of supplemental forms provide structure (playful or formal) to the design (e.g. sculptures, benches, etc.).						
	AFm3.3 Vegetated Form	*Optional* : Vegetation in cross-section complements selected style. An appropriate selection of tree shape (e.g. columnar, vase, umbrella, etc.), massing techniques, and planting design.						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:	0	3	0	3	0	3
Texture	AFm4.1 Visual Texture	Cohesive and/or complementary textures are perceived in plan-view.						
	AFm4.1b Visual Texture	*Optional* : Cohesive and/or complementary textures are perceived 5-10ft away (evaluate cross-section or in-person onsite).						
	AFm4.2 Local Textures	Plant and man-made materials appropriately reflect the climatic conditions of the area.						
	AFm4.3 Tactile Texture	*Optional* : The texture of materials used in entourage and amenities is complementary to the design intent (evaluate close-up image or in-person onsite).						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:	0	6	0	6	0	6
Scenic	AFm5.1 Viewpoints	There is one or more dedicated viewpoint area(s). (Y:3; N:0)						
	AFm5.2 Expansive	Expansive views, either isolated or throughout the site, are evident in the site design.						
	AFm5.3 Lush	Vegetation is perceived as lush and lively.						
	AFm5.3b Lush	*Optional* : Reports of the perception of lush and/or lively vegetation.						
	AFm5.4 Hide and Reveal	In plan-view, a range of open and hidden spaces are evident in the site design.						
	AFm5.5 Perception of Protection	*Optional* : Reports of feeling protected through effective use of strategies based in prospect-refuge theory.						
	AFm5.6 Beauty	*Optional* : Reports of community satisfaction in terms of beauty.						
		SECTION TOTAL:	0	12	0	12	0	12
		BONUS:	0	9	0	9	0	9
Rhythm	AFm6.1 Rhythm	A cadence of components provides structure throughout the site design.						
	AFm6.2 Repetition	Periodically repeated elements define formal cohesion in site design.						
	AFm6.3 Unity	Components are repeated throughout the site design (color, line, texture, form, etc.).						
	AFm6.4 Balance	Components are balanced through symmetrical or asymmetrical compositions.						
	AFm6.5 Intuitiveness	*Optional* : Experiential reports of an intuitive structure, or trust in site design.						
		SECTION TOTAL:	0	12	0	12	0	12
		BONUS:	0	3	0	3	0	3
Emphasis	AFm7.1 Focus	At least one focal point is evident in site design. (Y:3; N:0)						
	AFm7.2 Framing	The focal point(s) seem to be framed well using vegetation and/or built modalities.						
	If "Yes" to AFm7.2, then proceed to AFm7.2b. If not, skip to the next metric.							
	AFm7.2b Framing	*Optional* : The focal point(s) are framed effectively using vegetation and/or built modalities (evaluate using cross-section, close-up image, or in-person onsite).						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:	0	3	0	3	0	3
Legibility	AFm8.1 Edges	Delineation between differing uses and/or areas is evident onsite.						
	AFm8.2 Intuitive Edges	*Optional* : Reports of intuitive differentiation between programmatic landscape uses (ie. spaces designated for tidy landscape and messy landscapes).						
	AFm8.3 Conventional Tidiness	A conventional balance of programs and landscape uses (ie. spaces designated for tidy landscape and messy landscapes) seems to be evident in the site design.						
	AFm8.4 Pleasant Legibility	*Optional* : Reports of spaces designated for tidy landscapes and messy landscapes as being separated in a satisfactory approach (ie. perception of "nature" in site design is not off-putting).						
		SECTION TOTAL:	0	6	0	6	0	6
		BONUS:	0	6	0	6	0	6
		CATEGORY TOTAL:	0	90	0	90	0	90
		TOTAL GENERAL:	0	60	0	60	0	60
		TOTAL BONUS:	0	30	0	30	0	30
		TOTAL COMPILED SCORE:	0	276	0	276	0	276
		TOTAL GENERAL SCORE:	0	183	0	183	0	183
		TOTAL BONUS:	0	93	0	93	0	93