THE WILDLIFE GALLERY: INTEGRATING WILDLIFE HABITAT INTO URBAN AREAS USING LAND AND ENVIRONMENTAL ART

by

LAUREN A. HOLMER

(Under the Direction of Doug Pardue)

ABSTRACT

Environmental concerns and worldwide population growth demonstrate the need for positive integration of human cultural practices with other ecological processes, including animal life cycles. This thesis proposes that fostering a sense of regional community within citizens for local wildlife will aid in the paradigm shift necessary for effective interspecies habitation in urbanized areas. Land and environmental art acts as a channel for cultural communication, often confronts localized problems which affect wildlife, and has been of interest to landscape architects for decades. With the development of eco-revelatory design practice, the procedural and ideological contributions of these artists remain relevant to our profession. This thesis will examine six case studies from within the outer periphery of Krauss’s 1979 Klein Group Diagram, using an evaluative framework to determine how well they provide for wildlife needs and human awareness of the animals, and then applies the information learned to a site in Charleston, SC.

INDEX WORDS: Landscape Architecture, Land Art, Environmental Art, Wildlife Habitat, Anthroecology, Eco-Revelatory Design, Place-Making
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To Jb, who carried me through graduate school with his love, support, laughter, and mad cooking skills.
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CHAPTER 1
INTRODUCTION AND THESIS PROBLEMATIC

Background

In 2008, a historically unprecedented population shift occurred—more people were living in urban areas than rural (WHO 2015). As we continue to expand our civilizations across the globe, and in particular the sprawling suburbs model common in the United States, intact wildlife habitat will be increasingly utilized for human purposes, and biodiversity will continue decreasing at what E. O. Wilson (1992) has termed “a rapid rate” (255). Landscape architects and urban planners have a unique opportunity to lead and participate in finding local and regional solutions to the problems of balancing development and sustainability, and are already being called upon to produce ecologically sensitive designs. This trend will only increase as the implications of global climate change, water shortages, and other pressing environmental concerns call for innovative land use plans and mitigation of negative human impacts on the landscape (McKinney 2002).

An integral part of any functioning ecosystem is the fauna that interact with the plants and inorganic components of that region. Designing urban areas to be more in sync with natural processes and resilient in the face of environmental changes, therefore, will require understanding and addressing the needs of local wildlife. Human competition for space and resources often pushes animal populations out and away from human-
dominated landscapes, however, and human activities often cause more harm to wildlife than good. Successfully integrating wildlife habitat with human habitat is a complex process, and in some cases may seem nearly impossible given the particular requirements of some species, such as those with large ranges, or particular behaviors, such as the propensity to hunt and eat small pets.

Our relationship with animals is in and of itself riddled with complexity and contradiction. Wildlife and nature documentaries and television shows abound, and the Association of Zoos and Aquariums reports that its member organizations collectively attract 181 million visitors annually—a higher attendance figure than that of all the major professional sporting events combined (AZA 2014). Human beings are clearly attracted to viewing animals. But as animal ethics and rights have increasingly entered the public consciousness, many have questioned the place of zoos in culture, and zoos in turn have adjusted and expanded their mission to include more conservation and education goals (Roe et al. 2014, 530). Their success in these areas has been questioned, however, and cannot address the inescapable irony inherent in viewing captive animals to feel a connection to wild nature (Fennell 2013, 7). The motivation for going to the zoo varies from person to person, but phenomenological researcher Erik Garrett (2014) identifies seven main reasons given by the many visitors he observed and talked with during his employment at Chicago’s Brookfield Zoo: entertainment, relaxation, aesthetics—to view the “beautiful animals,” education—to learn more about animals, social—to spend time with family and friends as well as the animals themselves, caring—to be near the animals which are objects of empathy, and conservation—to teach children about environmental issues and to support the conservation activities of the zoo (56-69). These motivations by
and large involve positive associations with animals, and Garrett postulates that zoos provide an arena in which humans perceive themselves as forming social bonds with other species. Another study performed by Australian researchers found that visitors emphasized education as the main priority of zoos, outweighing entertainment and relaxation (Roe et al. 2014).

The actual success of zoos in promoting learning and conservation values is questionable, however, as little quantitative data regarding behavioral changes inspired by zoo visits is available. One 2008 study interviewed 175 attendees of a Birds of Prey demonstration to find whether they could recall the conservation behaviors suggested by the staff presenter, and whether they felt inspired to commit to these actions in their daily lives. Ninety-five of the interviewees affirmed that they would either begin the behaviors, or increase their commitment to the behaviors if they were already doing them, and 51 of these visitors agreed to do a 6-month follow up interview. However, only 38 of the original 175 people actually responded to the second interview, and of these, only 26 had actually increased their conservation actions, which many of them affirmed was motivated by factors in addition to the Birds of Prey demonstration (Smith et al. 2008). In response to the claim zoos make that they benefit wild animal populations with captive breeding programs, a 2013 article in the *Journal of Ecotourism* pointed to ZooCheck statistics which demonstrated the poor statistical success rate of these breeding regimes, and the greater success rate of captive breeding when the endangered animals in question were raised in proximity to their native habitat (Fennell 2013, 4).

The ethical considerations of captive animals in zoos is further complicated by the lack of consensus regarding the exact nature of our relationship to animals, and what their
cognitive and emotional capacities are. Historically, scientists have been hesitant to ascribe emotions to non-human animals, but many field studies and observations of wild and domestic animals provide anecdotal evidence of a rich variety of animal feelings, from sadness to compassion (Masson and McCarthy 1995). In the New York Times bestseller, *When Elephants Weep*, the authors propose that rather than rejecting the idea that animals have emotions in order to avoid accusations of unscientific anthropomorphism, scientists ought to take the more humble approach of recognizing that animal emotions may exist and be expressed without being the same as human emotions and expressions. It is a non sequitur to assume that since an animal does not have the self-reflective ability to understand or communicate its emotions, it does not feel them at all (180, 221-225)

Acknowledging the emotional capacities of animals has poignant and even troubling implications for how we treat them, both directly—in the methods used to raise them for food or keep them captive in zoos, and indirectly—in the way we share space and natural resources with them. But it also begs the question of whether the scope of our interactions and relationships with them is too narrow. One University of London researcher, Matthew Fuller (2010), has suggested that the “rather mobile boundary line that performs the task of annihilating the animal in human and demarcating the human from animality” (17) should be probed further, due to the increasing discoveries by comparative psychologists that cognitive functions and skills are broader and less confined within species groupings than has commonly been believed (22-23). This may seem like a far-fetched proposition, but multiple artists have begun exploring the idea, including New York University researcher Natalie Jeremijenko, who combines art,
ecology, and engineering to produce installations encouraging non-physical interactions between animals and people. One such project featured floating buoys in the Bronx River that light up when fish swim past them, and can send information about the river’s conditions and inhabitants via text message to an individual’s phone. Jeremijenko also designed a special food that when distributed to the fish would bind the harmful pollutants in their digestive system and eliminate them, mitigating negative human impacts on the fish and making them safer for consumption (Boyers 2010). These projects and others incorporate what Jeremijenko has termed an “architecture of reciprocity,” meaning that the animals have the power to accept or reject any interaction initiated towards them from a human (New York University n.d.). Jeremijenko’s art suggests that rather than keep the public away from animals, under the assumption that human interactions always produce a negative effect on wildlife, we can meet animals on their biological and cognitive levels to interact with them in a mutually beneficial and respectful manner; in doing so, we may come to a truer understanding of our place on Fuller’s line of demarcation.

Interactions with local urban wildlife, such as those investigated by Jeremijenko, also have potential to address the desires for increased animal contact in the visitor experience expressed by 10% of interviewees in the Anthrozoösis study of zoo priorities (Roe et al. 2014, 538). Accomplishing these interactions will require a nuanced understanding of the particular animals involved, and may challenge the dichotomy that has traditionally defined “nature” as a pristine place best kept separate and safe from human touch. In his philosophical treatise on gardening, Second Nature, journalist Michael Pollan (1991) expounds on the inadvertent damage to the environment created
by the very ethic that was created to save it. He explains how romantics such as Henry David Thoreau historically have influenced Americans to think of “nature” as the unspoiled wilderness areas set aside as National Parks, places that provide relief from, and do not mix with, culture. He questions our assumptions about “nature’s ways” being always the “best ways,” and wonders why our impacts cannot be just as “natural” as those of the water, air, and trees. True, our impacts can, and often have been negative. But an either/or dichotomy has proven to be unhelpful in teaching us how to responsibly and positively live on and with the land. The wilderness ethic gave us permission to do whatever we wanted to areas already “ruined” by human use, provided that we left the small percentage of unspoiled wilderness alone. As Pollan so strikingly describes the situation we find ourselves in: “This old idea may have taught us how to worship nature, but it didn’t tell us how to live with her. It told us more than we needed to know about virginity and rape, and almost nothing about marriage” (Chapter 10, “The Idea of a Garden”). In contrast to the Nature/Culture dichotomy so prevalent in our current systems and ways of shaping the land, Pollan proposes that we look to the ways of the common gardener for guidance in our interactions with earth and its species. His “garden ethic” allows for unapologetically anthropocentric shaping of the environment, since by very definition we cannot escape viewing life through the lens of our humanity, yet also because we need not assume that our impact must necessarily be negative, or even neutral. Gardeners don’t fear making changes in the landscape, and they also recognize that our needs are inextricably intertwined and interdependent on the needs of other species—caring for the earth is also caring for ourselves. (Pollan 1991, Chapter 10)
Pollan’s focus in the garden ethic is not on animals—indeed, a garden is mainly a place for tending to plants—but the principles may apply to the entire scope of our environmental actions, including urban wildlife habitat design. In particular, recognizing that we can have a positive effect on nature expands the possibilities of our design motivations—do we design in nature? For nature? With nature? Or perhaps all three to varying degrees in varying times and places? One thing is clear; we can no longer see ourselves as totally separate entities from our environment and local ecologies. Besides the pragmatic concerns of environmental disasters such as sea level rise, we are now recognizing the more subtle negative effects on our minds and bodies that isolating ourselves from the outdoors can have. Richard Louv, author of *Last Child in the Woods* and *The Nature Principle* has surveyed numerous studies that have linked spending time in nature with increased intelligence and creativity, greater levels of focus and concentration, decreased symptoms of Attention Deficit Disorder in children, and decreases in mental health disorders such as anxiety and depression (Louv 2012, 27-30, 48). Scientific evidence points to nature as having many of the simple answers to our seemingly complex problems of overscheduling, workaholic tendencies, and general fatigue. Designing cities to incorporate more wildlife habitat, then, is not just beneficial to the environment—it is crucial for our collective health and quality of life.

**Inquiry**

The purpose of this thesis is to promote mutually beneficial interspecies habitation—to propose that human “biophilia” (Wilson 1984) can be addressed through the artful design of habitat in proximity to urban areas so that regional wildlife and their
life cycles are celebrated, highlighted, and even framed for the considerate viewer, contributing to a deeper and more intimate sense of place. While completely “naturalistic” settings and conservation parks are important design forms for habitat provision, particularly for animals with significant ranges, this thesis suggests that they are not the only valid solutions to spatial provision for wildlife. In fact, if Pollan’s “garden ethic” is to be taken seriously, we must not assume that a demarcation of our spaces from wildlife habitat is always necessary, desirable, or beneficial. Narrowing the gap between the Nature/Culture dichotomy is crucial to an increased understanding of, and empathy for, the ecologic communities of which we are members. In light of this idea, then, this thesis asks the following question:

- **How can designed landscapes (culture) increase human awareness of and connection to local biodiversity (nature)?**

As noted before, there are already many landscapes that have been set aside for management as wildlife areas and, often these tracts of habitat are designed to accommodate human recreation as well, such as mountain biking and hiking. Part and parcel of these activities is immersing one’s self in “nature” and potentially observing animals. However, without indications other than occasional didactic signage, which may easily be missed or ignored by the human visitor, wildlife are often missed, and ecologic processes passed by without comprehension. One may easily go to the woods, and come out again with little understanding of our relationship to nature except that it is a nice place to visit and then leave. In this way we may simply reinforce the faulty ideas of
pristine wilderness instead of developing a more holistic view of “nature” being all around us, and within us, all the time. This paradigm shift requires a deep exploration of our personal and cultural assumptions and behaviors, which many designers and artists have delved into. In particular, Land and Environmental artists have been blurring the lines between cultural artifacts and gestures and what we call “natural” objects and processes for decades, most notably since the 1960s. This thesis proposes then, that art, which has the power (and the injunction) to question, explore, invent, and create, is extremely relevant to reconfiguring the integration of our civilizations within their regional ecologies. This might be expressed as a second research question:

- **What themes and principles from Land and Environmental Art are helpful for increasing human awareness of and connection to local biodiversity?**

At this point it is necessary to point out that art and design are well-tested means for enriching human ideologies and lifestyles, yet their benefit to animals is questionable, particularly when animals are forced to interact with a cultural space, such as a zoo. To truly experience a holistic idea of community which includes wildlife, we must respect and balance their needs as well as our own within the shared spaces. Once again, this complex ethical conundrum invites creative exploration to find ways in which this happens on a practical basis, but it bears reminding that biodiversity is beneficial to environmental functioning, and as such is of benefit to human life. Hence, for both moral and practical reasons, this thesis also assumes that in designing spaces which connect people to their local wildlife, the wildlife themselves benefit—either indirectly, as more
people come to understand and advocate for them, or directly, through the functioning of the space itself. Essentially, this thesis is exploring the intersection of landscape architecture, art, and ecology, as illustrated in Figure 1.1, in order to demonstrate how design might conceive of an “interspecies space,” where human social and physical needs are integrated with ecologic functioning (Figure 1.2). Ultimately, the questions this thesis seeks to answer might be summarized as:

- **How can the intersection of ecology, art, and landscape architecture benefit wildlife while increasing human awareness of and connection to their local ecologic community?**

Methods

In pursuing answers to the above research questions, several research methods are employed. The second chapter consists of a literature review, which sets up a theoretical and historic context for the development of Land and Environmental Art and its indecisive relationship to landscape architecture, as well as the subsequent development of the design methodology known as eco-revelatory design. The purpose of this study is to understand the work that has gone before in exploring the boundary between nature and culture, particularly as it influences the human need and desire to physically modify the land. From this body of theory, guided by the research questions and intent, a set of criteria is developed to evaluate six case studies gleaned from a limited survey of
installations which address problems related to wildlife. The criteria frame each case study’s efficacy in addressing both human experience and benefits to wildlife in order to understand methodologies and ideas that reconcile these often disparate goals. The themes and patterns which emerge through this analysis are then incorporated into the design process for an installation proposed by the author for a site in a Charleston, SC, park near the author’s home. Following an analysis of the proposed design, this thesis concludes with a discussion of the complexities in designing for both wildlife and humans, and areas for future research.
CHAPTER 2
THEORETICAL CONTEXT

Literature Review

It will be of no surprise to a current practitioner or student in the field of landscape architecture that the profession is interested in ecology. From Ian McHarg’s 1969 work *Design with Nature* to Claudia West and Thomas Rainer’s 2015 *Planting in a Post-Wild World*, ecologically informed and alleged “sustainable” best management practices have been increasingly integrated into design practice, following the rise of environmentalism (Meyer 2000, 187). In a time when concerns such as population growth, water shortages, climate change, and biodiversity loss are calling into question our national and global economic and industrial practices, the profession is rightly adding its voice to the conversation in the areas of design, land management, and planning. Yet the landscape historian John Dixon Hunt (1999) has pointed out a resultant imbalance in the profession, a “fear of art, an anxiety that human ingenuity may jeopardize the earth’s unique equilibria…for stewardship over which modern landscape architects take particular pride” (6). Udo Weilacher (1999) confirms this appraisal, noting that in the early 1900s landscape design moved away from an emphasis on aesthetics to focus on social and environmental issues, resulting in a lack of visual presence and clarity, a “complete inarticulateness” (9). Prior to Hunt and Weilacher’s observations, Michael McDonough (1983) made similar complaints of architectural practice, describing it as
“dry, narrow, and unresponsive.” Feeling that their professions were in need of new blood and fresh ideas, they concluded that one answer lay within Environmental and/or Land art, submitting that these creative endeavors be embraced as the “avant-garde” side of design. (McDonough 1983; Weilacher 1999, 39). The logic of this association lies within art’s profound ability to act as a cultural communication tool, a channel through which public ideals and values can be publicly questioned and refined (Beardsley 1998, 14; Weilacher 1999, 39). As we continue to explore the complex relationship between “nature” and our built environments, Weilacher suggests that to effectively attend to ecological problems, we must first address underlying human perceptions of what nature is, and what our place is in it (9). In a profession that largely deals with the functional and experiential aspects of humans in the environment, art may be the philosopher—or at least conversational mediator—that keeps us asking, “why?”, and perhaps more importantly in this era, “why not?” To this end, Land and Environmental Art might be conceived of as a modern design language for landscape architecture (9).

Land and Environmental Art (hereafter referred to as LEA) inhabit an indistinct border dividing “pure” art and the traditional design fields, but the strength of affiliation lies in the tendency of land artists to concern themselves with place-making, and integrating the chosen space—the very elements it consists of—into the work so that the site itself is usually inextricable from the art (Beardsley 1998, 17; Bourdon 1995, 211; Carlson 2002, 150). One of the early pioneers of this theme, the minimalist sculptor Carl Andre, promoted a definition of sculpture as “place” instead of “structure” in the 1960’s and 70’s, as he created mainly horizontal works that related to the ground or floor (Figure 2.1) (Bourdon 1995, 210). This shift in definition is confirmed by some association of
LEA with probably the most deeply established spatial form of landscape architecture: the garden. Stephen Bann (1999), for instance, recounts the sundry and diverse backgrounds of landscape architects, past and present, to defend the proposition that land and environmental artists be considered as a different, but no less valuable, category of contemporary garden makers (8). Yet it is not necessarily a garden of order, beauty, and relaxation that these art works evoke, but a restless, activist garden, a garden that “prods us to look anew at the world around us—and possibly raises our anxiety level” (Bourdon 1995, 195). Jeffrey Kastner portrays LEA as a conflicted creator, “at once critical of and nostalgic for the notion of ‘the garden’; alternately aggressive and nurturing towards the landscape” (1998, 12).

A garden and an anti-garden—or anti-architecture, as LEA was known during the decades of its emergence (McDonough 1983). Kastner (1998, 11-12) and McDonough (1983) have pointed out that the development of LEA was directly related to the stifling aura of Modernism, during which time sculpture had moved ever further away from its traditional vocation as monument—representing and memorializing specific events, people, and places—in order to become what Rosalind Krauss (1979) called “functionally placeless and largely self-referential,” “abstraction,” and “essentially nomadic” (33-34). By the 1950’s and 60’s, sculpture was becoming very difficult to define in positive terms, instead being known as what it was not—not landscape, and not architecture (36). Krauss plotted a mathematical Klein group based on these opposing terms (Figure 2.2), concluding that the end of the 1960’s ushered in a postmodern exploration of a four-cornered conceptual field, which was often classified altogether under the umbrella term “sculpture,” when in fact “sculpture” was one of four differentiated creative realms (31,
Art,” therefore, encroached upon that space “site-construction” where landscape architecture resides, making a clear differentiation between the territories of the land artist and the land designer or planner difficult. Many LEA projects require similar construction methods to landscape architecture projects, and they often exist at a human scale, like gardens and plazas, able to be experienced by the entire body (Rogers 2001, 486). Catherine Howett (1985) points out that in addition to a desire to integrate art with life outside the enclosed gallery, the birth of LEA was also due to the interest of artists in a marriage of aesthetics and functionality; when these installations were applied in the outdoor environment, they could not help but resemble the work of landscape architects (53).

FIGURE 2.1: Photograph of Carl Andre’s 1977 Secant, Art © Carl Andre/Licensed by VAGA, New York, NY.
One aspect of LEA that is strongly associated with the art form is the tendency to use the natural materials found on the site itself, rearranged or reshaped, but generally not subjected to the changes wrought on natural resources by human manufacturing; if such constructed elements do occur, they are often used to frame other parts of the site which are occurring naturally, such as Nancy Holt’s *Sun Tunnels* (Figure 2.3), a set of concrete pipes which direct the viewer’s gaze to the points in space where the sun rises and sets on the solstices. The use of soil, stone or rocks, wood, snow, or even leaves from a site contributes to a sense of ecologic sensibility in many projects, particularly those associated with the more specific categories of Ecological Art and what is known in Germany as Natur-Kunst (Nature Art) (Weilacher 1999, 11). These works typically are considered to have a focus on ecology, environmentalist messages, or even reclamation, while Land and Environmental Art tend to be more over-arching terms referring to projects, often at a large scale, where the site is integral, and “nature” may or may not be
as important as the art itself (Bower 2010). A great deal of overlap and indistinctness occurs within the boundaries of these terms. However, it is important to recognize that despite what the names of these movements might suggest, not all projects and artists categorized within them profess lofty ecologic intentions. Dennis Oppenheim’s 1969 *Branded Mountain*, for example, involved pouring tar in the shape of a ranching symbol onto the side of a grassy hill (Carlson 2002, 155); Michael Heizer’s 1969 *Double Negative* bulldozed 240,000 tons of desert substrate (152); and Christo’s 1983 *Surrounded Islands* introduced 5.5 million square feet of plastic into Florida’s Biscayne Bay (151). These questionable displays of environmental ethics, or the lack thereof, have prompted observations such as David Bourdon’s (1995) that some land artists “[regard] the great outdoors as nothing more than a colossal sketch pad on which to impose their artistic egos” (223). Indeed, when offered the opportunity to produce *Effigy Tumuli*, a reclamation work in an Illinois coal mine, Michael Heizer made it known that the project was only interesting to him for its artistic merit, not its possible ecologic implications (226). Quite a few LEA works were installed on already disturbed cultural sites, such as Robert Smithson’s 1969 *Asphalt Rundown*, for which the artist poured a dump truck load of asphalt into a quarry (Carlson 2002, 152), and Herbert Bayer’s 1979 *Mill Creek Canyon Earthworks*, which slowed rainwater runoff in an eroded Washington creek corridor with large grassy rings and mounds (Bourdon 1995, 225). Yet even reclamation projects, which appear to have positive environmental intentions, have presented troubling ethical implications; Robert Morris once referred to the practice as “[wiping] away technological guilt,” and wondered, “Will it be a little easier in the future to rip up the landscape for one last shovelful of a nonrenewable energy source if an artist can be
found…to transform the devastation into an inspiring and modern work of art?” (quoted in Bourdon 1995, 225)

FIGURE 2.3: Photograph of Nancy Holt’s *Sun Tunnels*, Calvin Chu, 2006.

In addition to questions of ethics, scholars have also considered whether LEA is an “aesthetic affront to nature” (Carlson 2002, 151). This critique is based on the idea that aesthetic appreciation of objects or environments necessarily means appreciating them for “what they in fact are and in light of knowledge of their real natures”; thus to appreciate nature, one must appreciate it as “natural” and an “environment” (6). In the very act of calling itself “art,” LEA, no matter how little it may seem to change the site or materials with which it integrates, changes the “kind of thing” the site and materials are, thereby changing its aesthetic qualities, and thus becoming an aesthetic affront. Carlson
provides a metaphor for this idea by recollecting Duchamp’s version of the *Mona Lisa*, in which he added facial hair to a copy of the famous Renaissance portrait, changing it with a few marks to a Dada work which many critics considered an affront to the original masterpiece (154). Of course, if humans are a part of nature, then one might argue that art is in fact “natural” and therefore cannot be any more of an affront to nature than other natural phenomena, even earthquakes and storms (157-158). Carlson responds to this claim by pointing out that while Duchamp’s piece is also technically art, this definition does not constitute a satisfactory rebuttal to its being offensive (158). He concedes, however, that if LEA is considered as a frame to nature, a means to highlight and “make more evident” the existing qualities of a natural environment, then the art is not changing the thing that nature is, but instead clarifying and sharpening the image for our appreciation, much like illuminating the *Mona Lisa* for museum visitors. Whether this indeed is accomplished by LEA, however, may only be determined on a case by case basis (159).

Critiques of ethical and aesthetic qualities notwithstanding, there are, nevertheless, several themes which emerge from the nebulous body of work LEA comprises which Weilacher (1999) has proposed are particularly relevant to landscape design: first, creating with minimalist archetypal forms which accent nature rather than compete with it; second, the exploration of such elements of time as transience, cycles, evolution, and decay, rather than the stoic permanence usually assumed and pursued in design proposals; and finally, a modest and careful rediscovery of the Romantic in the natural world, an emotive enjoyment of its complexity that yet does not ignore a factual understanding of its powers and vulnerabilities (40). This idea, that nature should be
brought to the foreground, curated, framed, and celebrated—which necessarily involves emotion and layers of human interpretation—is increasingly found in emerging modes of practice within the landscape architecture profession. In her 1988 article “The Poetics of City and Nature: Towards a New Aesthetic for Urban Design,” Anne Whiston Spirn outlines a design aesthetic which is a “discourse” between culture and nature, between our internal desires and beliefs and the external ways in which we shape the land to address those desires as well as our physical needs (108-109). This dialogue is achieved through an intentional framing of nature which allows us to “experience…a sense of unity with a larger whole”—both our regional community, and on a grander scale, our universe (109). Like Weilacher, Spirn identifies the importance of time and its many facets in developing this connection to place. She notes the deeply physical and sometimes unconscious connection of our bodies to daily and seasonal changes in the environment; we are physically and cognitively centered by slow, rhythmic, and repetitive changes in nature (110). Natural forms and patterns, too, “connect us to scales of space and time beyond our grasp” (112); on the surface these fractal geometries are more complex than the Euclidean geometries which we associate with human markings, and more unpredictable, as they are the result both of intrinsic processes and external circumstantial effects. When the more abstract Euclidean geometries are strategically designed as a foil for nature, however, the resultant design may actually “heighten our perceptions” of the latter (112-113)—an example of the poetics of a dialogue between culture and nature, “an intricate pattern, punctuated here and there by high points of nature and art” (114).
As she concludes her article, Spirn declares: “Design is a mode of storytelling” (124), and in 1998, a landscape architecture exhibition debuted that made story-telling about nature and its processes its central goal. Eco-revelatory design, as it was named, proposed to reconcile the more scientific and analytical side of design with the more purely artistic and aesthetic in order to assist the general public in achieving a deeper awareness and understanding of ecology (Liverman 2007, 1). This awareness was assumed to occur when landscape architecture projects “reveal[ed] and interpret[ed] ecological phenomena, processes, and relationships” (France 2000, 36). A variety of projects were introduced at the official exhibition, also documented in a special issue of *Landscape Journal*, and they were organized into six categories which all shared two overarching goals of making nature and its processes more legible to site visitors, and attempting to address an ecological problem (37). The exhibition’s critics varied in the severity of their reactions to the projects’ success in meeting these objectives; Robert Thayer (1998) concludes his article in the same issue of *Landscape Journal* by stating that the exhibition “provides us with the rudimentary beginnings of an ecologically revealing landscape language. We must now forthright develop its vocabulary...and especially its poetics and purpose” (129). Two years later, Robert France (2000) suggested that “most of these eco-revelatory projects reveal little beyond the sensibility of their designers....nature’s subtleties remain opaque, masked behind a smoke screen of artistic abstractions complicated by technological gadgetry, and clouded by self-important, flowery, and frequently vapid prose” (37-38). In other words, the projects may have looked good on paper, or in photographs and models, but in reality accomplished little of substance for ecology. One of France’s main criticisms is directed at what he
views as a misconception among designers that ecology and natural history are the same profession, and the subsequent application of this misconception to so-called “sustainable” or “green” projects. He points out that ecology is a rigorous science guided by tests, measurements, and quantitative facts, while natural history is an art that tells stories about the “perceptions of the individual appreciator of nature” (39). Ecologists he conferred with regarding the eco-revelatory projects questioned their ecological validity, an observation which was also one of the main themes in Susan Galatowitsch’s (1998) critique of the exhibition, also published in the special issue of Landscape Journal. She describes a vagueness in some of the project statements where the “narratives relied on inventive language that was not defined sufficiently” (100) as well as a lack of realism in designer’s intentions and understandings of ecological outcomes. One frequent example of the latter was the depiction of healthy and high-functioning ecosystems in the context of heavily-impacted human spaces full of environmental stressors, such as a stormwater wetland burgeoning with sensitive native species that do not adapt well to urban toxins and extreme changes in water levels (100-101). She also questions the conclusions by some of the designers that since their project had been implemented and its programming generally approved by ecologists, it must be functioning well, and could immediately be considered a model of good ecological design. In reality, Galatowitsch points out, time is the ultimate judge of a project’s success, as ecologic complexity reveals itself within the site context (101).

It is important to note, however, that despite her critiques of its actual results, Galatowitsch nevertheless seems supportive of the basic idea behind eco-revelatory design. Towards the beginning of her article, she points out that incentives may often
work more effectively than regulations for encouraging environmentally sustainable practices, particularly the incentive of an appreciation for nature developed from positive experiences with it. “Ecological design,” she offers, “is, in large part, about creating the places to think about, appreciate, and advance environmental quality” (99). She points out that while large-scale ecological planning and remediation is absolutely vital to truly solving environmental problems, this does not mean that designers should negate attention to the small scale, where the minutia of habitat needs for species exist, and the human scale, where people can interact with nature, learn about it, and ultimately develop appreciation for it (106). Furthermore, she acknowledges that the inherent weaknesses in ecological design for cultural landscapes are due not solely to a lack of knowledge among designers, but also significantly to the lack of scientific data about ecology in these areas (99). In response, she suggests that sites purporting to demonstrate ecologic design be frank in their uncertainty about the ecological results, and leverage this uncertainty as part of the design programming; rather than making assumptions about the exact outcome of the site’s evolving ecology, the site and its designers could participate in rigorous ecologic testing and study with scientists to increase understanding of urban ecologic processes (101-102).

France (2003) comes to some similar conclusions as Galatowitsch; while pointing out that designers have very little impact on large scale ecological problems when they design small sites—he compares these interventions to rearranging deck chairs on a doomed Titanic—he nevertheless agrees with Robert Thayer that teaching the public about environmentalism happens at a smaller, experiential scale, quoting Thayer as saying, “The small steps taken to build sustainability into the local landscape in discreet,
manageable chunks which people can observe, try out, experience, and improve are actually large steps for humankind” (Thayer, quoted in France 2003). France refers to these “manageable chunks” as “functional art” that successfully meets the goals of eco-revelatory design. Using multifunctional stormwater wetland parks as an example, he praises their ability to serve an ecologic function while also utilizing aesthetics (art) to provoke feelings of enjoyment and, potentially, care for other, natural, wetlands. He refers to these projects as a combination of “environmental management and ecotourism” (2003), hinting at yet another facet of ecological design—preserving nature using economic development. While ecotourism, like LEA, has many definitions emphasizing different aspects of its operations, one common definition describes it as follows:

Traveling to relatively undisturbed or uncontaminated natural areas with the specific objective of studying, admiring, and enjoying the scenery and its wild plants and animals, as well as any existing cultural manifestations (both past and present) found in these areas. (Ceballos-Lascuráin 1987, quoted in Boley and Green 2015, 6).

The relationship between ecotourism and nature conservation efforts has become more interwoven due to their mutual interest in preserving the quality of a given natural area which also functions as a tourist destination. While tourism has often had negative and destructive effects on wilderness area through overuse and exploitation, ecotourism products that seek to maintain a high quality and unique experience require that the nature in question remain as unsullied and pristine as possible, which is the same goal, albeit with different motivations, as that of conservationists (Boley and Green 2015, 3). On the other hand, conservation organizations are learning to appeal to more extrinsic political motivations, such as economic benefits from tourism, to support their cause, as opposed to messages that speak solely to the intrinsic value of nature (3-4). For example,
they may demonstrate through economic data that the long-term benefits of preserving an area has greater value than using the land for other purposes, such as urban development. Natural resource and tourism researchers Bynum Boley and Gary Green argue that ecotourism can be one of these “market-based incentives” (4), and in some cases may be the only winning argument for not using the land for more immediate and destructive anthropocentric reasons. For some threatened ecosystems, ecotourism may be the only positive option, despite the fact that tourism in and of itself may cause degradation of these areas (5). In addressing this intrinsic underlying threat, however, there are different strategies—some more sustainable than others—for cultivating a given tourism destination’s competitive edge. Namely, Boley and Green describe the “cost leadership approach,” whereby tourism destinations compete by offering the same product at the cheapest price, versus the “differentiation strategy,” which highlights and promotes the most unique products and experiences the destination has to offer. The first method tends to lead to generally unsustainable practices which disempower locals and tourism workers, and exceed the social and environmental carrying capacities (8-9). The second strategy can prove to be far more sustainable in the long term; since the tourism sector’s lifeblood is those qualities that are unique, such as rare biodiversity or a pristine ecosystem, the tourism sector will be highly motivated to protect those resources. Furthermore, the more rare, unique, or high quality the given tourism product is, the more people will pay to see or experience it. Thus, pristine wilderness areas can become “status areas” where tourism businesses charge more money and can afford to host fewer people (9).
Boley and Green acknowledge the limitations of ecotourism in benefitting preservation efforts: namely, that tourists may cause harm to wildlife by scaring them, degrading habitat through travel and interaction with the landscape, or by introducing invasive species via their clothing and luggage; that ecotourism is by nature a capitalistic enterprise that seeks to grow indefinitely, which is ultimately at odds with preserving sensitive wilderness areas; and finally, that it is difficult to ensure that the economic benefits of ecotourism products are equitably shared within the local communities which host them (18-20). Yet their major point remains—that ecotourism is often the best of a set of less-than-desirable anthropocentric uses for a given natural area. Furthermore, the authors point out that humans, too, may benefit from ecotourism in that “many cultural traditions are embedded within and tied directly to the natural resources of the community, and would be in jeopardy with land management decisions favouring converting land away from natural settings into more urban, suburban, and agricultural uses” (15).

**Discussion**

Thus we are confronted with an extensive spectrum of ways in which human beings seek to actively interact with the “environment,” from bold and possibly arrogant artistic cuts in the desert sediment, to complex political maneuverings which use outdoor recreation and entertainment to save entire habitats. Given that some scholars such as Udo Weilacher see too little artistic sensibility in the profession of landscape architecture, and scholars like Robert France and Susan Galtowitsch see too much, one might wonder where, if anywhere, an ethical, meaningful, and balanced dialogue between nature and
culture such as that which Anne Whiston Spirn proposes actually exists. One common thread emerging from within the literature is the idea of framing nature—highlighting and drawing attention to its forms and processes so that the visiting public is brought into contact with ecosystems and given the opportunity to sense and experience its realities for themselves. Within LEA, this sometimes occurs when art objects and constructs interact with the landscape, bringing it into what Allen Carlson (2002) calls the “obtrusive foreground,” where we are able to properly comprehend something because it has entered the forefront of our perception, rather than passing by unnoticed in the periphery of sensory intake (48). For Carlson, LEA was best defended from charges of aesthetic offense towards nature when it functioned in this curatorial manner, leading the eye and body into a position from which to appreciate nature (159). Weilacher (1999) and Spirn (1988) both speak of using geometric, humanized forms to provide a foil for nature, thus bringing nature into our perception via contrast (though one might point out that such contrast does not automatically indicate equal notice of both forms), and integrating processes of time into the experience, or experiences, of nature which are facilitated. One notable example of this within LEA is Patricia Johanson’s Cyrus Field (Figure 2.4), in which a miles-long series of blocks in sections of marble, cement, and wood weaves though the woods behind Johanson’s New York residence. Essentially a series of narrow paths, the piece immerses a human visitor within the forest, orienting them within its boundaries. In Caffyn Kelley’s words, “The lines frame the natural world. They mediate between human and nature, without distorting or displacing anything” (Kelley 2006, 70). This is precisely Johanson’s intention: “Most of my plans simply frame intact or recreated ecosystems” (Johanson, quoted in Kelley 2006, 70). This project incorporates
time by requiring the visitor to travel, moving through an “almost infinite series of ever-changing compositions” (Johanson, quoted in Kelley 2006, 65), and through the seasonal build-up of the forest litter on the sculpture, which varies by species composition and color as the year cycles on (66-67). *Cyrus Field* exemplifies the idea of art being artistic and unapologetically cultural in its framing, while respecting the ecological nature of what is being framed.

FIGURE 2.4: Photograph of Patricia Johanson’s *Cyrus Field*, Patricia Johanson, 1970, image downloaded from gf.org.
As the literature has shown, eco-revelatory design and ecotourism also seek to benefit nature by framing it as an object of enjoyment for human beings, thus (in theory) winning for nature human understanding, admiration, and compassion. But while ecotourism seeks to preserve nature as “wilderness”—as untouched and unaffected by humans as possible, eco-revelatory design begins to acknowledge and embrace a more bold juxtaposition—and intertwining—of nature and culture, exploring the middle spaces of what John Beardsley (1998) described as a continuum of human intervention in the environment (13). Ecotourism is, intrinsically, about drawing outsiders in to appreciate an out-of-doors product outside of their home range, for the economic benefit of the local human residents. Yet, as Boley and Green (2015) have pointed out, the opportunity exists to sustain and celebrate local traditions which are valuable first to the locals, and secondly to interested visitors, not solely (or even primarily) in an economic sense, but in a cultural sense. Hence, an ecotourism activity may not simply be hiking on an overgrown dirt path in the rainforest, but participating in a local festival which celebrates the community’s ties to their native wildlife and landscape. This entails a more nuanced relationship between “nature” and “culture” than the usual sharp dichotomy between these terms suggests. But these relationships, between human beings and their natural environments, are not very well understood, as Marina Alberti (2008) of the University of Washington has noted: “We do not know how urban ecosystems evolve through the interactions between human and ecological processes, nor do we know what factors control their dynamics” (4). As Susan Galatowitsch (1998) noted in her critique of eco-revelatory design, we need to learn more—more about urban ecology, and the development of functioning ecosystem networks in an anthropocentric environment.
Framing nature to better understand it is valuable as a learning experience and a way to facilitate human care for unfamiliar species and natural systems, but inasmuch as it promotes nature as something still “outside” and “other” than humans and our culture, it is not sufficient. In terms of ecology, some researchers are beginning to probe the inadequacies of a scientific discipline which, stringently quantitative as it may be, mostly examines earth’s processes to discover how they function in the absence of humanity.

While ecological research in this sense is vital, Alberti (2008) offers an additional option:

“….I argue that we can achieve a new understanding of the relationship between cities and the natural environment by looking at cities as hybrid phenomena that emerge from the interactions between human and ecological processes….Instead of asking: ‘How do humans affect ecological systems?’ the question should be: ‘How do humans interacting with their biophysical environment generate emergent collective behaviors (of humans, other species, and the systems themselves) in urbanizing landscapes?’” (6-7)

The emerging study of anthroecology is answering this question, fusing theory from both social and biological sciences to “[generate] empirically testable hypotheses on the forms and trajectories of long-term anthropogenic ecological change” (Ellis 2015, 287).

Anthroecologist Erle Ellis has pointed out that more than 75% of earth’s terrestrial landscape has evolved from what would traditionally be referred to as an ecological biome to an anthrome—a biome dominated by the human species and its systems—and thus a discipline is required that will examine the underlying causal factors of anthropologic change in the environment, and not simply the effects (288). Ellis claims that these causal factors are rooted in sociocultural ideologies and practices (290)—once again challenging any black and white portrayal of the nature/culture continuum.

Within a design profession such as landscape architecture then, it is not only important to frame “nature” as a set of species and systems that we are strangers to—for
indeed, in many ways the processes of nature are infinitely complex and mysterious to
us—but also, to cultivate experiences in which we view more clearly and provocatively
our role within nature—for we are, in fact, constituents of this physical world. It is not
enough to maintain a “tourist gaze” on nature—in order to develop a productive
relationship with our environment—and to truly learn how it works—we have to
respectfully join in. This will require laying aside any hubris we may cherish about our
scientific understanding, but it will also mean that we lay aside fear of engagement with
the natural world, lest we impact it. Design could become, as Galatowitsch (1998)
suggested, a means to explore with humility the integration of our cultural practices with
those of the environment—a nurturing approach, rather than one of dominion (Beardsley
1998, 27). Putting these ideas into the context of our relationship with wildlife,
specifically, we see a framework for our interactions with other species emerge that
resembles Natalie Jeremijenko’s “architecture of reciprocity” (OOZ Projects). If we
attempt to integrate cultural systems with natural systems, inevitably we must ask
questions about how we integrate our lives with those of the other species inhabiting our
anthromes. This thesis suggests that the design of anthroecologic systems and
infrastructure, which invite wildlife into our lives by creating shared spaces, may
constitute an exploratory and adaptive design focus that combines rigorous scientific
knowledge with creative cultural vision. In the next chapter, six such creative
installations are analyzed for emerging patterns in how design might address both the
needs of wildlife in spaces impacted and inhabited by humans, and the needs of humans
in beginning to cultivate a sense of community that includes not just other humans, but
other species living in our environments. They reveal a different approach to bringing
awareness to wildlife than that of the zoo—a dynamic framing of the spaces in which animals make their homes, rather than a static display of the animals within an artificial environment (Figure 2.5).

FIGURE 2.5: Approaches to Viewing Wildlife, Lauren Holmer-Boyd, 2017.
CHAPTER 3

CASE STUDIES ANALYSIS

Introduction to Case Study Selection and Evaluation

The intersection of landscape architecture, art, and ecology is a fluid field of inquiry. In classifying and understanding creative works within the overlap of these fields, then, it is first necessary to define each field separately, parsing out their intellectual and practical characteristics and pursuits. Points of intersection and commonalities between fields may then be determined, and from here it becomes clearer where individual case studies may be categorized, though not with exact precision. This thesis does not intend to establish black and white classifications of creative projects falling within indistinct boundaries; rather, it intends to understand their unique and varied qualities through the lens of standard bodies of theory in order to discover ways of shaping landscape that are successful in addressing the human need for community and sense of place, and the ecological needs of species to thrive and reproduce. Six case studies were chosen based on two basic criteria: first, that they referred to themselves as art, even if they seemed more like a designed and constructed landscape architecture project, and second, that they intended to address wildlife in some way, whether by bringing awareness to their existence, or meeting a specific ecologic need. The author acknowledges that the process of choosing these case studies, while guided by general terms, was necessarily subjective, and this thesis does not intend to provide an exhaustive
survey of all such projects in existence. Rather, the case studies were chosen because they represented a variety of scales, technologies, and aesthetics in achieving a purpose or solving a problem, and they inhabited different points within the intersections of landscape architecture, art, and ecology.

Each case study is represented within this chapter by a brief biography, after which it is analyzed through the application of an evaluative rubric created by the author based on the literature review and current theory regarding what is “good” (i.e., healthy, beneficial, productive) for wildlife and for people, in the context of the overarching purpose of this thesis. Thus, what is considered “good” for people in the evaluative rubric is not a complete list of all that humans need to survive and thrive. Instead, the rubric judges the success of the case studies in addressing human awareness of their regional ecologic systems (including wildlife), and ultimately, the creation and expansion of diverse local community which includes human and non-human biota.

In regards to what is considered “good” for wildlife, standard ecologic principles were enlisted, with some ideas from research in ecologic restoration, novel ecosystems theory (Hobbs et al. 2009), and anthroecology theory (Ellis 2015). Put another way, what is considered “good” for wildlife is that their physical needs, health, and ability to complete their life cycles is protected and enhanced, in the context of urban ecosystems which have been heavily modified by anthropocentric processes. It may be pointed out that given our ever-expanding understanding of animal intelligence and emotional capability, it might be, in a sense, short-sighted to ignore the possibility that animals could benefit cognitively from an art installation, similar to the ways in which animals in zoos and aquariums benefit from “enrichment” activities. However, it must be
remembered that the animals in question are, in fact, wild, and therefore probably not in need of additional stimulation, given that they are living in an already complex and risk-filled environment. The purpose of enrichment activities is to bolster cognitive functioning in captive animals that are prevented from carrying out normal feeding, hunting, and mating behaviors—therefore, an installation which, through habitat restoration, provides means for these natural behaviors to be achieved is already, albeit indirectly, providing cognitive stimulation for wildlife. However, the possibility that a human installation could stimulate aesthetic appreciation in an animal is yet to be fully explored. Field researchers studying bears and primates have observed these animals sitting still, with eyes directed at sunsets which the human observer would consider beautiful (Masson and McCarthy 1995, 192-193). And to ascribe logical reasoning to female birds impressed by the colorful plumage of male birds—i.e., the idea that a female could know that bright, long plumage means clean feathers and good genes—is perhaps less sensible than the idea that the female bird simply finds the male aesthetically attractive, an emotional adaptation which allows for strong healthy genes to be passed on (194-195). As Masson and McCarthy have stated:

It would be odd if humpback whales did not appreciate their own songs or if wolves did not like the sound of their howling. For this to be true one must imagine that all the care with which a humpback composes, performs, and alters its song has no positive or negative import, only a communicative function toward which the whale feels nothing and that whales listen to other whale songs only to extract data from them. This view paints whales as far more cerebral creatures than people, all mind and no heart. (196)

Thus, a case may be made for at least some non-human animals demonstrating aesthetic appreciation of their environment or physical characteristics within their species. But can an animal find beauty in a human artifact? Primates have demonstrated listening behavior
towards human music that indicate fascination, if not pleasure, and male bowerbirds have been known to collect both natural and human artifacts in constructing a den to attract a mate (197, 199). It is not impossible, then, that some animals do indeed find human objects and activities interesting or beautiful. For the purposes of this thesis, however, such complex and little understood phenomena will not be measured or expected from the case studies examined. Instead, this thesis leaves it to the exploratory and provocative nature of art to help reveal areas, such as animal intelligence and emotion, which merit further quantitative study.

The Intersection of Landscape Architecture, Art, and Ecology

In Chapter 1, the thesis problematic was presented as searching for ways to benefit wildlife and increase human connection to their regional ecology via the intersection of landscape architecture, art, and ecology. The following diagram was introduced (Figure 3.1):

![Venn Diagram of Thesis Inquiry, Lauren Holmer-Boyd, 2017.](image-url)
Understanding the space at the center of this Venn diagram requires first understanding the definitions and characteristics of the individual fields which contribute to its formulation. To begin, landscape architecture is defined by the ability of landscape architects to “analyze, plan, design, manage, and nurture the built and natural environments” (American Society of Landscape Architects 2017, “About…”). Landscape architects have a “significant impact on communities and quality of life” and shape environments and physical spaces that “help define a community” (ASLA 2017, “About…”). Thus, the landscape architecture profession could be said to be concerned with spatial design and the shaping of physical environments which then go on to create various physical, psychological, emotional, and social responses in the human beings which inhabit them. While landscape architects often design spaces that include natural elements, and are ethically bound to “make every effort…to enhance, respect, and restore the life-sustaining integrity of the landscape for all living things” (ASLA 2017, “Ethics”), the profession is primarily concerned with human needs and interests. The Code of Professional Ethics requires landscape architects to design for the “health, safety, and welfare” of the public (ASLA 2017, “Ethics”), which may often conflict with purely environmental interests, particularly within structures of law and conventional building technologies. Nevertheless, many landscape architects continually seek to discover that mutually beneficial balance between client programs and stewardship of the land, and the profession has produced a great deal of design philosophy, including eco-revelatory design, expanding on this idea. It is an analytical profession which uses measurements, engineering formulas, and fact-based observation of a site’s qualities to determine how design and construction should and can occur in that particular location, yet it is also a
profession which incorporates feeling and aesthetic considerations of beauty. It is a
profession which is alternately concerned with how a site “looks” to people, and how
well it functions for human use—whatever that use may be. Ultimately, it is a
profession—bound by laws, codes of ethics, and cultural conventions, and every project
begins with a vision, a purpose, and a problem to solve. It is, in a word, design. These
descriptors of landscape architecture are graphically represented in Figure 3.2.

Landscape architecture

![Diagram](image)


If landscape architecture is a “diverse, not to say fractured” profession (Hunt
1999, 6), art is even more difficult to define with any consensus. The art historians H.W.
and Anthony Janson (2004) depict art as “an object and a word,” and admit that “it is
impossible to come up with a universally valid definition of art” (22-23). In fact, while
“object” is one of the words associated with art, in three texts of art history examined by
the author, it is done so briefly at the beginning of the text introduction with hesitation
and delimitations, or not at all (Janson and Janson 2004; Johnson 2003; Stokstad 1999).
Rather, art is more defined by what its creator is attempting to express, and how this is accomplished. Given that art tends to deal with some form of image-making reflective of the personality, skill, and cultural context of its creator, Janson and Janson suggest that art is strongly defined by the “urge of human beings to understand themselves and the universe” and provides a means for “[communicating] our understanding in ways that cannot be expressed otherwise” (23, 26). However, while they acknowledge that art is “inseparable” from ideas of aesthetic forms, styles, shapes, and materials (26), they are quick to point out that a skillfully rendered aesthetic object is not in and of itself “art” (25). Rather, they make a distinction between artisans and artists, claiming that the former produce what they are certain is “possible,” while the latter attempt to create the “impossible,” “improbable,” and “seemingly unimaginable” (24). Here, then, is where Janson and Janson see the quintessence of art emerge. It is not what art is as a physical reality that defines it so much as what ideas it represents and communicates—“what it says and how it says it” (26). Art is about pushing boundaries, exploration, experimentation, originality, change, and imagination (24-25). It is “defined by the artist’s willingness to take risks in the quest for bold new ideas” (24). Paul Johnson (2003) agrees, suggesting that art is birthed in and from “the moments of tension before a creative innovator rejects the present and shapes a new future” (5). Yet art need not necessarily express a new idea; sometimes art simply finds a new way to express or reveal an old or current idea. Stokstad (1999) describes artists as “interpreters of their times” (24) and a “record of the world as seen by the artist” (21). The following diagram (Figure 3.3) graphically represents the varied descriptors of art:
The final component of the Venn diagram to be defined is the field of ecology. In *The Ecological World View*, Charles Krebs (2008) defines ecology as “the scientific study of the interactions that determine the distribution and abundance of organisms” (2) and “the science that examines the relationships between all the animals, plants, fungi and microbes on Earth” (4). More generally, he describes it as a discipline “concerned with the workings of the biological world within the framework of the world’s environments” (xvii) which “make[s] the most progress in answering ecological questions when we use experimental techniques” (xvii). Johnson and Hill (2002) also include the methodologies of ecology in their description, calling it “a science founded on keen observation and measurement of the natural world” (25) as well as “the study of interactions between organisms and their environment” (1). Thus the discipline of ecology is defined both by its subject: non-human systems and their composite relationships, and the means by which knowledge is gained about those systems: objective, logical observation and experimentation. A summary of these descriptors for
ecology are found in Figure 3.4, with two additions: first, the phrase “changes within
time,” to incorporate the idea that all interactions between organisms and their
environment occur in the context of time, whether it be seasonal, cyclical, panarchal, or
linear, and second, the word “function,” to recognize the fundamental purpose of ecology
as understanding the component niches of various biota, and the purpose they ultimately
serve in the larger picture of a natural system and/or the ecosystem services on which
human systems rely as well.

While scientific disciplines may often be thought of as bastions of fact-based
certainty and formulaic accuracy, they can also be thought of as “creative endeavors”
which begin with inductively developing theories based on many specific data
(Galatowitsch 1998, 102), and go on to deductively apply these theories to other study
scenarios. These processes of analyzing factual information to come to a conclusion or
find a solution to a problem are also found in the iterative process of design-based
problem solving, requiring the ability to synthesize discrete pieces of information and intuit gaps in knowledge. Thus, we begin to see areas of overlap emerge between the disciplines in question. Art and ecology, for example, both seek to reveal new ideas or truths through processes of experimentation, though the formats of these experiments—and their objectives—may vastly differ. Art, for example, is associated more with subjectivity—the opinions and ideas of the artist—whereas science is generally considered highly objective in its pursuit of knowledge. Yet these contrary approaches may in some cases be equally useful in solving a problem, and in others, the non-standard approach may unexpectedly prove more effective than the conventional. A prime example of this may be seen in the anecdote of the artists Helen and Newton Harrison’s experiments in the 1970s with *Scylla serrata* crabs native to lagoons in Sri Lanka. After recreating the crabs’ native habitat in their laboratory, including plants and even other animals, the Harrisons eventually observed that the crabs seemed depressed. To solve the mystery, the artists “wondered what might make a crab depressed” (quoted in Hall 1983), and decided it might be the lack of monsoon conditions present in their native region. They mimicked the monsoon rains for the crabs using a hose, which stimulated the crabs to mate, a behavior that scientists had been unable to encourage from their own laboratory specimens. Eventually the Harrisons applied for a grant to study the breeding cycle of the crabs, of which they remarked, “The scientists themselves wondered about us and were somewhat amused by the exotic interests of artists but we received the grant” (quoted in Hall 1983). The crabs were eventually displayed in a gallery so that the public could observe their lifecycle (Hall 1983). So it was that the biologists, using the objective lens of tests and measurements, were unable to address a problem that a pair of artists
solved intuitively, by putting themselves “in the crabs’ shoes” and coming at the dilemma from an emotional and subjective perspective. This is not to say that such an approach should replace rigorous scientific observation and testing; however, it does reveal how different approaches may complement each other in the experimental process.

There are, of course, many facets of landscape architecture, art, and ecology which may be deemed to coincide, and this thesis will not expound specifically on all of them. Notable, of course, is the shared focus on environments and spatial qualities which both ecology and landscape architecture possess; the former traditionally focused on what these environments are like without modern humanity, and the latter mainly focused on environments in which humanity is the main benefactor. Landscape architecture and art, as depicted in Chapter 2, have often occupied an obscure shared space as both involve a focus on cultural expression and aesthetic forms which change the natural environment and/or place cultural objects within it. A generalization of the ways in which these three fields may intersect is depicted in Figure 3.5, though it is not meant to be a complete or detailed depiction, and is necessarily subject to the author’s opinion of where the intersections occur. Upon introducing each of the six case studies, the project will be classified on this Venn diagram, utilizing the descriptors from each field as reference points. While these classifications are subject to the author’s interpretation, they are helpful for visualizing the range of works that are categorized under Land and Environmental Art, and illustrate the inherent difficulty in attempting to classify interdisciplinary endeavors that defy standard identifications.
Introduction to the Evaluation Rubric

In evaluating the six case studies, a rubric was applied which grouped criteria based on whether they measured benefits to wildlife and ecosystem functioning, or benefits to humans in terms of creating awareness of wildlife and ecosystem functioning in the context of regional community and place-making. Each of the eight criteria are discussed here.
The first criterion under the “good for wildlife” section of the evaluative rubric is Purpose (Figure 3.6). This continuum analyzes the goals and objectives of the case studies to understand how they intend to help wildlife—either indirectly, by providing a frame to highlight wildlife for human viewing, or directly, through active remediation and restoration efforts of the habitat or ecosystem itself. Between these poles is a category for those projects which sought to provide some sort of physical benefit to a specific species or some individual animals, without addressing larger scale systems issues. This continuum seeks to address that warning regarding eco-revelatory design by Robert Thayer (1998):

“[T]he transparent exposure of the truths of any landscape is a necessary step, but mere revelation does not go far enough. Art may be content only to comment on unstable, unsustainable, or consumptive conditions; responsible design should remedy them. This dimension of healing—the deliberate manifestation of a normative, corrective process in the landscape—is to me the obvious ‘end’ of the revelatory process.” (118)

Of course, this commentary assumes that all the eco-revelatory design projects were revealing human-impacted ecologic conditions, and in the case of a project which is framing healthy, functioning nature, then perhaps restorative action is not necessary.
However, given that, particularly in urban or urban fringe areas, most natural systems have been impacted in some way by human activity, Thayer’s point is relevant and valid to the case studies included in this thesis.

In his book *The Sunflower Forest* (2003), William Jordan III, one of the founding members of the Society for Ecological Restoration, describes another reason for which active restoration is important—the process of attempting to bring an ecosystem to a historic status where it functioned more effectively requires an incredible amount of study and understanding of how that ecosystem works—thus, the restoration ecologist learns by doing rather than by objective observation alone (82-83). Jordan suggests, much like Susan Galatowitsch (1998), that restoration of an ecologic system can be very useful for research purposes when it is embraced as an “ongoing experiment” rather than a project with a static, assumed endgame (Jordan 2003, 79).

2. **EFFECT**: How do humans affect wildlife via the installation?

![FIGURE 3.7: Effect Criterion, Lauren Holmer-Boyd, 2017.](figure)

The second rubric criterion categorized under “good for wildlife” is *Effect* (Figure 3.7). The purpose of this criterion is to take into account how visitors, rather than the
artist or designer, will interact with the wildlife at a given installation. There is a great deal of research and anecdotal evidence that human beings tend to have a disruptive effect on wildlife—hence the innumerable signs in nature parks warning against feeding or touching the animals. One study in *Urban Ecosystems* found that even the ubiquitous gray squirrel is more “vigilant” in urbanized versus rural areas, contrary to the researchers’ hypothesis (Sarno et al. 2014, 517). Within zoo environments, where animals are limited in their ability to escape exposure to human notice, it is well documented that many animals, particularly mammals such as primates, become increasingly stressed or vigilant with increases in noise caused by human visitors (Fernandez et al. 2009, 2; Quadros et al. 2014, 78). At best, many park managers hope for a neutral, or “leave no trace” effect on the local wildlife from hikers and campers, yet in an increasingly urbanized world, it is inevitable that human/animal contact will increase. A new paradigm may be required for how we view and interact with the other species we come into contact—and sometimes conflict—with, particularly as we all compete for similar natural resources. Much like Michael Pollan’s (1991) criticism of the wilderness ethic as being unable to teach us how to maintain a healthy and thriving relationship with nature, William Jordan III (2003) cites Richard White in warning that “modern environmentalism has failed to provide means of connecting with nature through work…the result is an attenuated relationship, not grounded in an ecological transaction” (78). Similarly, we could say that many of the environmentalist messages we receive have taught us how to leave wildlife alone, but are inadequate in addressing how we integrate our urban systems with their ecosystems in a mutually beneficial manner. Many of Jordan’s ideas about ecologic restoration are a helpful starting point, demonstrating
how we might begin to work with nature, as a productive member of ecologic “society,” to restore areas that we have previously damaged. But even in this sense, it is difficult to imagine how we could positively contribute to nature in areas where it already functions well. One interesting example of a positive, almost symbiotic association between humans and animals comes from a study of Irrawaddy dolphins in India and their influence on the fishing quotas of local fishers in the Chilika Lagoon. The study found that the dolphins used the long stake nets of the fishers to corner and capture fish; in turn, the fishers associated the dolphins’ hunting behavior with increased fish quotas (D’Lima et al. 2013, 614, 616). In reality, the dolphins’ hunting was found to have no overall effect on the total amount of fish caught, though they did increase the amount of one particular species of fish (618). Nevertheless, the presence of the stake nets provided an interface where both animal and human could share resources, and each could have some positive effect on the other species. The case studies for this thesis were analyzed for similarly positive interactions, whereby the installations provided the interface for these interactions to occur.

3. ADAPTIVITY: How will the installation interact with the site over time?

The third criterion under “good for wildlife,” Adaptivity (Figure 3.8), addresses the vital fact that nature is constantly changing. Thus, a truly effective remediating installation which benefits wildlife will be flexible and adaptive to those changes. The lower end of this continuum addresses those installations which are not intended to change or adapt much, in a physical sense, on the site where they are located. The middle of the continuum addresses installations which act as a catalyst for a change which is needed on that site, but the higher end of this continuum addresses installations which become an integral part of the ecosystem in which they are located.

As Pulliam and Johnson (2002) have noted, ecology theory did always recognize how integral adaptive change is to ecosystem composition and function. For some time, ecologists believed that biota (plants and animals) existed in an equilibrium with the non-living resources they depended on, and any disturbance which interrupted the stability of these processes would only do so temporarily (52). However, we now recognize that this view of ecologic systems is far too simple and static. Areas of habitat are open systems, with flows of biotic and non-biotic components moving in, out, and around them (53-54). Disturbances can have a profound effect on the direction in which a given ecosystem patch evolves, depending on the severity of the disturbance. Where disturbances are limited or lacking, some species may eventually gain adaptive advantages, outcompeting other species and thereby reducing biodiversity; similarly, too much disturbance can limit the species inhabiting a given area to only those which are adapted to the type of disturbance in question (58-59). The Intermediate Disturbance Hypothesis suggests that some amount of periodic disturbance facilitates the greatest amount of biodiversity (58); thus it is change and disruption which sets the stage for new or adjusted species networks.
This change may very well come from the introduction of human systems or activities; thus Pulliam and Johnson advise architects and planners to identify the species and resource flows on their sites and consider the effects of their designs on these flows, both immediately on the site, and along a flow’s “upstream” and “downstream” (55).

Another ecologic theory which is changing the way in which designers view the interactions between their site designs and the larger world, is panarchy theory. Primarily associated with the researcher C.S. Holling (2001), panarchy theory posits that the nature of systems change is self-organization, with points of stability and points of reinvention, driven at smaller scales by faster cycles of change, which cumulatively nudge larger scale systems at a slower pace of evolution (390-391). Thus, there really is no ultimate “stable state,” either within natural or human systems, and it is vital that designers plan accordingly. In evaluating the case studies, the author looked for built-in flexibility that allowed the installation to respond to the changing needs of its site and attendant wildlife.

4. SCALE: What is the extent of the installation’s impact?

The final criterion under “good for wildlife,” Scale (Figure 3.9) evaluates the spatial impact of the case studies. At the lower end of the continuum is the individual organism(s) which may happen to benefit from the installation in relative isolation from their species counterparts, or the ecosystem as a whole. Moving higher on the continuum, the middle metric addresses the potential for a relatively isolated community of wildlife to benefit from the installation’s presence, and finally, the high end of the continuum represents those ways in which a case study’s purpose and objectives deal with larger scale ecologic processes that trickle down in their influence to communities and individual wildlife. As with the Adaptivity criterion, panarchy theory is relevant here—interventions at small scales may see their effects compounded at larger ones; conversely, changes made at larger scales will have some effect on the scales below, whether freeing or disruptive (Holling 2001, 404). Thus, an installation’s impact may come about by intervening at an ecosystem level and addressing some significant constraining factor there, or at an organism level that promotes changes in successively higher scales, eventually at the level of the ecosystem. The decision of whether to address a smaller scale, organism problem versus a larger scale, ecosystem problem is challenging. Susan Galatowitsch (1998) has pointed out that while regional landscape matrices are vital to addressing the range needs of many species, site design cannot be neglected, as it is within this scale that many other species operate and require specific natural resources (106), formulating local networks and food chains that expand outward and blend into neighboring biomes and biotic communities. What is clear, however, is that organisms cannot be viewed outside the context of their greater ecosystem and its flows of resources. For example, Pulliam and Johnson (2002) advise ecologic designers to
consider the keystone species within their site—those organisms which form the lynchpin of their food webs; addressing the needs of keystone species may have exponentially positive effects as the entire food web is strengthened (55-56). Dramstad et al. (1996) have described the importance of individual areas of habitat in maintaining landscape connectivity and biodiversity; larger patches with significant interior habitat, convoluted edges, and corridors connecting them to other patches will maintain more robust wildlife communities than small, isolated patches surrounded by urban development (Figure 3.10). Hence, designers should be aware of the effects that their changes to a site, however small it may seem, will have on the greater landscape connectivity matrix.

The first criterion which examines the success of a given case study in addressing what is “good for people,” in the sense of human engagement with their local wildlife and an expanded sense of community, is *Interaction* (Figure 3.11). The lower end of this continuum describes the least involved method by which a person can engage a structure or installation—indirectly, via photographs, text, or other media which do not require the person to be present at the actual site. A more direct way to engage an installation would be to go and visit it in situ, but still maintain a spatial separation from it—taking in information mostly by sight. The difference between these first two options is much like the difference between viewing a painting on the internet, versus in the gallery. While the latter option will reveal more information in terms of the scale, texture, and color of a given painting, and probably provide a more meaningful experience, the act of viewing a painting in a gallery is, nevertheless, primarily visual. The third option on the *Interaction* continuum, therefore, accounts for those experiences with an installation which are immersive and experiential, requiring multiple physical senses to be engaged, and perhaps giving the participant an action to carry out. Manfred Schneckenburger refers to
this way of experiencing art and sculpture as “living” the art, whereby “‘the whole body is an organ of spatial experience,’” (quoted in Weilacher 1999, 22); thus bodily sensations are an inextricable part of the work, and the participation of a human completes the installation’s meaning. Regarding installations which integrate or frame nature for our cultural and aesthetic appreciation, Allen Carlson (2002) has pointed out that since true appreciation of anything requires appreciation “in light of knowledge of [its] real [nature]” (6), then appreciation of nature means experiencing and appreciating it as “natural” and an “environment” (6); thus to fully experience nature as an environment, we are required to be immersed in it, engaging all our sensory intakes (48). In addition to aesthetic concerns, however, any potential learning about wildlife or ecology which may occur via the interaction of a visitor with an installation will be more likely to happen in the context of multisensory experiences. The evolution of the human brain occurred within a vastly complex surrounding environment full of multisensory stimulation, and research has demonstrated that engaging multiple senses in information processing is the brain’s default modus operandi (Shams and Seitz 2008, 1). Thus, using more than one sensory modality (for example, visual and auditory) in the perception of information and phenomena is more effective for memory retention and learning than only using one (1-2).

The second criterion addressing the “good for people” section of the rubric is Legibility (Figure 3.12). To perceive one’s surroundings via multisensory modalities is but the first part of comprehension; as Kevin Lynch (1960) states in his book The Image of the City: “By [‘legibility’] of the cityscape we mean the ease with which its parts can be recognized and can be organized into a coherent pattern” (2-3). Comprehending the
structure of one’s environment is vital to survival—one must be able to avoid danger, find food and water and shelter, etc. Thus, it is a natural part of our biological being to feel unsettled in an unfamiliar environment, and one of the advantages of a clearly legible landscape is the real and perceived security it offers to a visitor (4-5). However, legibility provides more than simply security—it also empowers an individual to launch into cultural activities and creativity more confidently and efficiently; it “gives the individual a possibility of choice and a starting-point for the acquisition of further information” (4). A legible city assists in place-making by creating a unique image in the minds of residents and visitors, and it becomes a binding force for community with shared activities, symbols, and meaning (4). Some of the facets of a city which Lynch addresses in his book as needing clarity and cohesiveness are the circulation, districts/land-uses, landmarks, and transition spaces (3, 91, 95). While a smaller-scale installation will not necessarily contain all of these elements, many of them do apply, particularly as they symbolize and communicate meaning and way-finding. Furthermore, installations incorporating nature may easily prove confusing or illegible to a visitor who has little knowledge of ecology, or maintains a socially conditioned predisposition towards it. Joan Nassauer (1995) addressed the latter posture in particular with her essay “Messy Ecosystems, Orderly Frames,” in which she questioned designers’ hesitation to “present” nature in any way, lest they falsely misrepresent or anthropomorphize it (161). She promoted the use of “cues to care,” design strategies which “frame ecological function within a recognizable system of form” (162) that communicates order, care, and intentionality to the public. Examples of these strategies were mowed edges along planted areas, the inclusion of flowering plants in naturalized areas, architecture for
animals such as bird houses, and the integration of Euclidean patterns into the design (167-168). Many of these strategies are essentially foils to “nature,” and can be subtle and unobtrusive; in the case of an art installation, where subtlety is not the intention, they may be more obvious and bold gestures in the landscape.


2. **LEGBIBLE**: How well does the installation reveal wildlife?

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<th>ABSTRACT</th>
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<th>Symbolic Devices Aid Comprehension of Wildlife</th>
<th>Symbolic Devices Aid Comprehension of Ecologic Systems</th>
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<td>LEGIBLE</td>
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Of course, not all ecological processes are “legible,” in a purely visual sense, to even an ecologist, and some processes only leave secondary hints as visual record of their existence—wind, for example, is visible by means of the other objects which it sets in motion. Robert Thayer (1998) commented on this inherent challenge in critiquing the eco-revelatory design exhibit, noting that “many…ecological phenomena are either too large, too small, too extensive, too complex, too fast, or too slow to be revealed by direct perceptual means” (129). He pointed out that for many of the eco-revelatory projects, visible surface water was a significant component (129)—probably because it is both visible and active, exhibiting processes at work in human “real time.” Thus, one of the challenges to designers honing the theory and practice of eco-revelatory methods will be
to tease out ways in which to accurately—and alluringly—bring attention to less obvious facets of ecology. Technology, with its ability to measure complex phenomena and then abstract it with computerized symbology, represents an intriguing and useful opportunity on this front, as will be discussed more in depth in a later section of this chapter.

The third criterion addressing “good for people” is Engagement (Figure 3.13). The purpose of this category is to measure the potential for human attraction to and enjoyment of an installation. To comprehend a legible set of information may be useful, and enjoyable in the sense of the emotional security to which Lynch referred, but its scope for creating pleasure is limited. It must be clarified that in the context of this analysis, enjoyment is mainly associated with cognitive stimulation, and not necessarily physical comfort, though bodily and mental sensations often coincide. This continuum moves from “certainty” on the lower end to “uncertainty” on the higher end, which could very well be interpreted as moving from “safety” to “danger,” but this is not the author’s intention. As Catherine Howett (1985) has observed, art pieces which purposely evoke a
sense of danger, threat, or discomfort do not lend themselves to the public sphere, where it is the landscape architect’s duty to protect the health, safety, and welfare of the public (55-56). However, as Lynch (1960) has pointed out, some uncertainty, in the form of informational puzzles and mystery, is pleasurable, so long as it does not stray too far from known structures, and there is an answer and resolution to the mystery (5-6).

Psychologist Stephen Kaplan (1987) found that mystery, which he and his colleagues defined as “implied…information that could be acquired by going deeper into the scene” (9), in this case, two dimensional photographs of nature, was a key indicator of environmental preference in study participants (8). Kaplan and his associates formulated a matrix (Figure 3.14) demonstrating the four environmental preferences which they found study participants to favor; “coherence” and “legibility,” which closely resembled Lynch’s definition and description of the latter, referred to elements of a natural scene which assisted humans in making sense of that scene, while “mystery” and “complexity” referred to elements within a scene which allured and intrigued a human viewer and invited them to explore the scene further (10-11).

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Mystery can be a nebulous term; however, other researchers have built on Kaplan’s above model and its predecessors. Gimblett et al. (1985) conducted a study to determine elements of mystery in nature scenes more specifically, finding five which were predictive of high, moderate, or low correlations of mystery to specific rural scenes (87). They found that the photographs most evocative of mystery to participants were those with significant screening, “the degree to which views of the larger landscape are visually obstructed or obscured” (90); limited site lines and a close-up view of the scene, i.e., a photograph taken right at the forest edge; a sense of enclosure, especially with vertical surrounding elements such as trees or deep shade; a path or other indication of space for moving into a scene; and contrasting light where the sunlight is in the background (90-92). In contrast, a scene which included long spans of distance with little to no screening or enclosure, or no indication of accessibility via a path, scored as less mysterious (90-91). These elements were taken into account when analyzing the six case studies in this chapter, along with elements of surprise (such as highly contrasting forms which would not be expected in their surroundings) and complexity (such as multiple ways to orient within an installation). Together, these qualities of mystery, complexity, and surprise were used to associate a relative amount of uncertainty to each case study.

The final criterion categorized under “good for people” in the evaluative rubric is Community (Figure 3.15). In particular, this thesis is interested in how installations amalgamating art, ecology, and landscape design can invoke and facilitate an expansion of community to include not just all the humans within a defined region—though this in and of itself can be challenge enough—but also the other living organisms which exist there. At the lower end of this continuum is the individual experience which an
installation might provide, similar to the personal experience one might have in viewing a painting in a gallery. This experience is not invalid—after all, it is unique individual experiences and personal expression which contribute to cultural diversity and interest. But if an installation is to foster connections between people and their local wildlife which have lasting impact for the benefit of biodiversity, then it will take more than a few enthusiastic naturalists and bird watchers to shift the paradigms of our relationships with other species. Additionally, shared experiences of a local ecologic context can provide a framework for communal activities. William Jordan III (2003) speaks to the value of ecologic restoration as a means for connecting more deeply with nature, and the potential of restoration work for providing community binding rituals. Jordan proposes that an in-depth knowledge of, and relationship to, nature can be developed through processes of ecologic restoration, which require repeated attempts to recreate nature’s processes until, having learned what to do and not to do, and how much intervention is helpful (75-77), the restorationist finds that they have entered into an “intimate dialogue with an ecosystem, in the course of which the restorationist can learn from it as from a close friend” (77). But these opportunities to partner with and physically expend energy and time in nature should not be reserved only for the ecologists; rather than being the audience within a theatre, Jordan stresses, citizens should be more like a “congregation that actively participates in the performance” (164). Through this participation, people are “not merely informed or even edified, but [are]…transformed” (164). Jordan goes on to propose various ways in which restoration activities can be integrated into already existing categories of rituals, some of which he claims are lacking or weakened in our modern society: celebrations or festivals of life and fertility relating to the growing and
nurturing activities of ecologic restoration (165); coming-of-age initiations whereby young adults ritualistically accept responsibilities via a restoration project and learn to sacrifice for the good of the community (168-169); and symbolic renewal rituals which force humans to come to terms with the damage they have already done to the environment, and in the very process of restoration, perform new damage, much like a sacrifice, in order to ultimately bring about a positive change (i.e., clearing out invasive species to make way for native ones) (171-172). These ritualistic activities need not be complicated or glamorous—in fact, the most basic and repetitive actions lend themselves to finding a cooperative group rhythm (193). Some of the practical examples which Jordan mentions are prescribed burning (76), replanting native species guilds (79), species inventorying (160), culling within wildlife populations (172), and harvesting brush (193). For the purposes of this thesis, the case studies will be analyzed for examples of rituals which involve community members, not just the artists, performing collective behaviors within—and together with—the ecosystem that celebrate and/or benefit the ecosystem and its wildlife.

4. **COMMUNITY**: Does the installation foster community solidarity?

![FIGURE 3.15: Community Criterion, Lauren Holmer-Boyd, 2017.](image-url)
The Case Studies

In this section, each case study is introduced, described, and analyzed using the evaluative rubric described in the previous section.

Fair Park Lagoon, Patricia Johanson, 1981

Patricia Johanson’s redesign of Dallas’ Fair Park Lagoon, known on site more specifically as the Leonhardt Lagoon, came at the request of the Dallas Museum of Art; at that point the pond was devoid of a healthy food web and covered in algae that fed off the excess nutrients washing in with stormwater (Kelley 2006, 20). Johanson acquired a list of native wetland species and consulted with scientists as she decided what ecologic goals her installation should have (Kelley 2006, 20; Wu 2013, 141). The resultant two
sculptures, *Pteris multifida* and *Sagittaria platyphylla* (Figures 3.17, 3.18, 3.19), were inspired by the native Texas plants which share their names, commonly known as the Spider Fern and Delta Duckpotato, respectively. Constructed of red-dyed gunite which has since faded to a dull salmon color, the sculptures transformed the lagoon’s ecologic and social character. The long, sinuous shapes were built along the bank to control erosion, and the sheltered niches along their curves provided microhabitats for the establishment of both ornamental and native wetland plants, such as water lilies, arrowhead, soft-stem bulrush, and pickerelweed (Kelley 2006, 20-21; Patricia Johanson, personal communication). The turbidity of the water was reduced, and a healthy littoral layer built up on the lagoon bottom (Wu 2013, 141). A food web established with multiple trophic layers, allowing visitors to observe sunfish spawning (Largent 2008), kingfishers diving for fish (Kelley 2006, 25), and snapping turtles swimming (Patricia Johanson, personal communication). The water quality of the lagoon vastly improved, contributing to cleaner water downstream where it links up via stormwater infrastructure to the Trinity River.

In addition to rebuilding the wildlife community, the redesign made the lagoon much more welcoming to people as well. It allows visitors to get close to the water and observe the plant and animal communities, providing multiple path trajectories with its complex structure; these paths are further complicated by the water level fluctuation which covers portions of the sculpture when it has been inundated by rain runoff (Patricia Johanson, quoted in Kelley 2006, 25). Xin Wu (2013) calls it “a landscape of arches, causeways, and islands” (145) and explains the mysterious pull of the sculptures in this way:
“Even from a distance, their undulating and colorful appearances arrest attention, adding spatial variations to an otherwise mundane lagoon. Something other than nature! The sculptural forms remain articulated in their artificiality—vibrant color, rough texture and large scale. Yet, the closer one approaches, the more one perceives nature all around. The reason is simple. These sculptures are not there to display themselves, but to act as baits, enticing people to walk on them and, in repose, to immerse in their observation of nature—all in a state of total forgetfulness of the artwork.” (147)

Many of the photos of Fair Park Lagoon depict children playing on the gunite paths, immersed in the wetland environment, able to touch the plants and the water (Figures 3.20 and 3.21).


FIGURE 3.21: Children on *Sagittaria platyphylla*, in *Art and Survival: Patricia Johanson’s Environmental Projects*. 
The evaluative rubric for *Fair Park Lagoon* is depicted in Table 3.1. The installation scores high on several criteria in the “good for wildlife” section, as it holistically addresses habitat regeneration and improves water quality for connecting water bodies. It does score low in the *Effect* category, however, as people entering the space will most likely disrupt wildlife temporarily as they move through it. In the “good for people” section, the installation scores well, as it provides a highly immersive and pleasingly mysterious environment in which humans may observe a functioning wetland environment. Signage informs lagoon visitors about the local wildlife (Fairpark.org 2017), and the lagoon is located in a district of museums and recreational areas, contributing to the Dallas community. Figure 3.22 illustrates the rubric evaluation of *Sagittaria platyphylla*. 
TABLE 3.1: Case Study Analysis of *Fair Park Lagoon*.

**GOOD FOR WILDLIFE: Contributes to Ecosystems**

1. **PURPOSE**: How does the installation intend to help wildlife?

<table>
<thead>
<tr>
<th>PASSIVE</th>
<th>Informs About Wildlife</th>
<th>Provides Specific Physical Benefit to Wildlife</th>
<th>Remediates Regional Ecologic Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Controls erosion and reduces turbidity, restores littoral layer and food webs.</td>
<td>ACTIVE</td>
</tr>
</tbody>
</table>

2. **EFFECT**: How do humans affect wildlife via the installation?

<table>
<thead>
<tr>
<th>DISRUPTIVE</th>
<th>Humans Temporarily Disrupt Wildlife Activities</th>
<th>Human Presence Neutral/“Leave No Trace”</th>
<th>Humans Produce Beneficial Effect or Modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>When entering the space, humans may initially frighten wildlife.</td>
<td></td>
<td>PRODUCIVE</td>
<td></td>
</tr>
</tbody>
</table>

3. **ADAPTIVITY**: How will the installation interact with the site over time?

<table>
<thead>
<tr>
<th>STATIC</th>
<th>Installation’s Form and Function Static, Inflexible</th>
<th>Installation Catalyzes a Needed Change</th>
<th>Installation Adapts With Site Ecology Over Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Form is fixed, but serves as infrastructure for bank stabilization and revegetation.</td>
<td>DYNAMIC</td>
<td></td>
</tr>
</tbody>
</table>

4. **SCALE**: What is the extent of the installation’s impact?

<table>
<thead>
<tr>
<th>ORGANISM</th>
<th>Specific Organism Benefits</th>
<th>Habitat/Community Benefits</th>
<th>Ecologic Region Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisms live on site, use installation for hunting, nesting, and perching.</td>
<td>Provides a habitat patch for birds, facilitates functioning lagoon food web, filters stormwater.</td>
<td>Improves water quality before connecting to local hydrology, improves habitat connectivity.</td>
<td>ECOSYSTEM</td>
</tr>
</tbody>
</table>
GOOD FOR PEOPLE: Building Awareness of Anthroecologic Community

1. INTERACTION: How do people interact with the installation?

- DISTANT: Superficial, Distant, Indirect
- Mainly Visual
- Immersive, Experiential, Haptic
  - Humans immersed in a wetland environment, can play and explore the sculpture paths.

2. LEGIBILITY: How well does the installation reveal wildlife?

- ABSTRUSE: Symbolic Devices Absent or Ambiguous
- Symbolic Devices Aid Comprehension of Wildlife
- Symbolic Devices Aid Comprehension of Ecologic Systems
  - Paths lead humans into proximity with wildlife; signs educate about wildlife.

3. ENGAGEMENT: Does the installation facilitate experiences of complexity/mystery?

- CERTAINTY: Installation Contains No or Few Elements of Uncertainty
- Installation Provokes Moderate Degree of Uncertainty
- Installation Provokes High Degree of Uncertainty
  - Striking color and form, complex and varied paths, water level fluctuation create uncertainty.

4. COMMUNITY: Does the installation foster community solidarity?

- INDIVIDUAL: Individually Experienced, Small Target Audience
- Fosters Human Community
  - Located in urban educational/recreational district where community events are held.
- Fosters Anthroecologic Community Through Shared Rituals
  - Fosters Anthroecologic Community Through Shared Rituals
FIGURE 3.22: Attributes Diagram for *Fair Park Lagoon* (*Sagittaria platyphylla*),
This project was designed for Charleston’s annual Spoleto Festival, U.S.A., and located in the Cypress Gardens park, about 45 minutes outside of Charleston. The installation consisted of a boardwalk leading to a shelter-like structure, approximately 30’ by 60’ in area, with 20’ high “walls” made of laterally strung wire hung with native Spanish moss (Beardsley 1998, 153). The installation thus provided a semi-enclosed room, with rough wooden benches and boardwalk overlooks, to encourage visitors to sit and immerse themselves in the Lowcountry cypress swamp environment (Figures 3.24, 3.25, and 3.26). Geuze intended Swamp Garden to be a “contemplative space” which “[intensified] a visitor’s experience of the natural constituents of the swamp environment” (153). The mystery of the semi-transparent pavilion in the middle of the
water was heightened by the way the Spanish moss interacted with the light and humidity, creating patterns of shadow and changing colors from gray to green after rain (Beardsley 1998, 153; West 8 n.d.). The approach to the installation was artfully purposeful, too; the boardwalk meandered to prolong the journey and present the structure from different views, and excluded railings in order to diminish the feeling of separation from the swamp (155). Within the pavilion were cypress trees, growing out of the “black” water full of leaf tannins which characterizes these swamps. A small ramp was installed to encourage turtles, birds, and alligators to sun themselves where they could be observed; according to John Beardsley, one of the curators of the exhibition, alligators didn’t come into the installation’s space, but did come near enough to the structure outside of it to be seen (155). According to Heather McDowell, the Director of Cypress Gardens as of this writing, the installation’s boardwalk still exists, but the Spanish moss walls have not been permanently maintained (Personal communication).

The evaluative rubric for Swamp Garden is depicted in Table 3.2. Overall, this installation scored higher in the “good for people” category than under “good for wildlife.” While it did provide some tangible benefit to the wildlife in the form of a sunning ramp, and the intangible benefit of focused awareness and attention on the blackwater swamp environment from human visitors, this project had no ecologic-scale remediating intention. It also scored low under the Community criterion, since it was located far from the urban core of Charleston, and provided more of a solitary, meditative experience than an experience in social bonding. However, it did score high under the Interaction and Engagement criteria, due to its artfully intriguing and minimalist beauty which set the pace and tone for a quiet, and indeed “contemplative” experience in the swamp. Figure 3.27 illustrates Swamp Garden’s attributes as evaluated in the rubric.

TABLE 3.2: Case Study Analysis of Swamp Garden.

**GOOD FOR WILDLIFE:** Contributes to Ecosystems

1. **PURPOSE:** How does the installation intend to help wildlife?

   - **PASSIVE**
     - Informs About Wildlife
     - Provides Specific Physical Benefit to Wildlife
     - Remediates Regional Ecologic Problem
     - Provides space for observation of the Lowcountry cypress swamp.
     - Provides sunning space for reptiles.

2. **EFFECT:** How do humans affect wildlife via the installation?

   - **DISRUPTIVE**
     - Humans Temporarily Disrupt Wildlife Activities
     - Human Presence Neutral/"Leave No Trace"
     - Humans Produce Beneficial Effect or Modification
     - When entering the space, humans may initially frighten wildlife.

3. **ADAPTIVITY:** How will the installation interact with the site over time?

   - **STATIC**
     - Installation’s Form and Function Static, Inflexible
     - Installation Catalyzes a Needed Change
     - Installation Adapts With Site Ecology Over Time
     - Installation form and function is fixed; some materials human-constructed.

4. **SCALE:** What is the extent of the installation’s impact?

   - **ORGANISM**
     - Specific Organism Benefits
     - Habitat/Community Benefits
     - Ecologic Region Benefits
     - Individual alligators, turtles, and birds may use installation for sunning and perching.
     - Lowcountry cypress swamp habitat benefits from increased human awareness.
### GOOD FOR PEOPLE: Building Awareness of Anthroecologic Community

1. **INTERACTION:** How do people interact with the installation?

<table>
<thead>
<tr>
<th>DISTANT</th>
<th>Mainly Visual</th>
<th>Immersive, Experiential, Haptic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial, Distant, Indirect</td>
<td></td>
<td>Humans immersed in the sights, sounds, and smells of the swamp environment.</td>
</tr>
</tbody>
</table>

2. **LEGIBILITY:** How well does the installation reveal wildlife?

<table>
<thead>
<tr>
<th>ABSTRUSE</th>
<th>Symbolic Devices Aid Comprehension of Wildlife</th>
<th>Symbolic Devices Aid Comprehension of Ecologic Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent or Ambiguous</td>
<td>Boardwalks, benches, ramp, and overlook signal observation of potential wildlife visitors.</td>
<td></td>
</tr>
</tbody>
</table>

3. **ENGAGEMENT:** Does the installation facilitate experiences of complexity/mystery?

<table>
<thead>
<tr>
<th>CERTAINTY</th>
<th>Installation Contains No or Few Elements of Uncertainty</th>
<th>Installation Provokes Moderate Degree of Uncertainty</th>
<th>Installation Provokes High Degree of Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>No or Few Elements of Uncertainty</td>
<td>Installation Provokes Moderate Degree of Uncertainty</td>
<td>Enclosed form, screening and light play, and long access path create a sense of mystery.</td>
<td></td>
</tr>
</tbody>
</table>

4. **COMMUNITY:** Does the installation foster community solidarity?

<table>
<thead>
<tr>
<th>INDIVIDUAL</th>
<th>Fosters Human Community</th>
<th>Fosters Anthroecologic Community Through Shared Rituals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individually Experienced, Small Target Audience</td>
<td>Installation located away from urban core; experienced individually or in small groups.</td>
<td>Fosters Anthroecologic Community Through Shared Rituals</td>
</tr>
</tbody>
</table>
Amphibious Architecture, Natalie Jeremijenko (NYU Environmental Health Clinic) and David Benjamin (The Living), 2009

Amphibious Architecture (Figures 3.29, 3.30, and 3.31) was a prototype installation invented by artist Natalie Jeremijenko and architect David Benjamin to interface between New York City citizens and the East River. It consisted of a grid of sixteen six-foot-long glowing buoys that measured the levels of dissolved oxygen in the water, changing colors between red and blue to indicate low and high water quality, respectively. The lights had two other purposes as well—each one could flash when a fish swam underneath it, and the whole set would blink if they were texted by a human observer standing on the shore. Texting the installation code phrases resulted in the installation texting back to explain the water quality status and number of fish currently
present. Jeremijenko hoped that multiple interactions by a person with the project would lead to associations of the water quality level with the presence of the wildlife—the higher the levels of dissolved oxygen, the more fish would be present. (Not an Alternative 2010)

People could also interact with the fish at certain times by feeding them with a fish food (Figure 3.32) containing chelating agents that bind to toxic metals in the fish digestive systems, allowing them to rid their bodies of the harmful pollutants (Weiner 2013; The Architectural League 2014). In this way the installation allowed people to interact with the river inhabitants in a positive way, and “imagine[ed] a dynamic, participatory city in which static architecture is replaced by a kinetic and responsive built environment” (SpontaneousInterventions 2017). Rather than discouraging people from feeding the wild animals, the installation facilitates a healthy interaction between humans and fish, empowering the former to do something about the pollution in the river (The Architectural League 2014). In Jeremijenko’s words: “‘As an environmental mantra, “leave no trace” is a bit pathetic. It assumes that we can extract ourselves from our ecosystem — and that we are only capable of negative impact. Can’t we interact with our environment in a way that has a positive effect?’” (quoted in Twilley 2013).

Table 3.3 depicts the evaluative rubric for Amphibious Architecture. The installation scores well overall in both categories; under “good for wildlife” it scores high in the Purpose and Effect criteria, as it addresses the systemic issue of pollution in the East River, and empowers humans to play a small role in mitigating this problem. Under the “good for people” section it scores high under Legibility, as it provides people with a real-time interface for learning about the river; the blinking lights make visible the
normally invisible presence of the fish. The grid of lights which change colors and blink at seemingly random moments also provide a sense of mystery and initiate questions about a habitat that is constantly present in the midst of a busy metropolis, thus giving Amphibious Architecture a high score in the Engagement category. And finally, the project also scores well under Community, since it allows the wildlife to draw people into a citizen-driven data accumulation; in a sense, humans can communicate with the fish and the river, and their inquiries lead to data inputs collected by the artists/engineers (The Architectural League 2014). Figure 3.33 illustrates the attributes of Amphibious Architecture.

FIGURE 3.29: Close-up View of Amphibious Architecture Buoys, courtesy of Chris Woebken.
FIGURE 3.30: Diagram of *Amphibious Architecture* Buoy Construction, courtesy of Chris Woebken.
FIGURE 3.31: View of *Amphibious Architecture* from Shore, courtesy of Natalie Jeremijenko, downloaded from animalarchitecure.org.

FIGURE 3.32: Example of Engineered Fish Treat, photo from the Cross[x] Species Adventure Club, downloaded from ediblegeography.com.
TABLE 3.3: Case Study Analysis of *Amphibious Architecture*.

**GOOD FOR WILDLIFE: Contributes to Ecosystems**

1. **PURPOSE:** How does the installation intend to help wildlife?

<table>
<thead>
<tr>
<th>PASSIVE</th>
<th>Informs About Wildlife</th>
<th>Provides Specific Physical Benefit to Wildlife</th>
<th>Remediates Regional Ecologic Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brings awareness of fish presence and its connection to water quality.</td>
<td>“Fish food” is healthy and binds harmful metals in fish digestive systems.</td>
<td>Chelating agents in fish food binds metals from the greater watershed, improves water quality.</td>
<td></td>
</tr>
</tbody>
</table>

2. **EFFECT:** How do humans affect wildlife via the installation?

<table>
<thead>
<tr>
<th>DISRUPTIVE</th>
<th>Humans Temporarily Disrupt Wildlife Activities</th>
<th>Human Presence Neutral/“Leave No Trace”</th>
<th>Humans Produce Beneficial Effect or Modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visitors interact indirectly with fish from the shore.</td>
<td>Visitors may help feed the fish.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. **ADAPTIVITY:** How will the installation interact with the site over time?

<table>
<thead>
<tr>
<th>STATIC</th>
<th>Installation’s Form and Function Static, Inflexible</th>
<th>Installation Catalyzes a Needed Change</th>
<th>Installation Adapts With Site Ecology Over Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation temporary, incorporates highly engineered technologies.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. **SCALE:** What is the extent of the installation’s impact?

<table>
<thead>
<tr>
<th>ORGANISM</th>
<th>Specific Organism Benefits</th>
<th>Habitat/Community Benefits</th>
<th>Ecologic Region Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>River system benefits from increased human interest and decreased toxicity from heavy metals.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
GOOD FOR PEOPLE: Building Awareness of Anthroecologic Community

1. INTERACTION: How do people interact with the installation?

- DISTANT: Superficial, Distant, Indirect
  - Humans interact with the installation indirectly via cell phones/text messages.

- MAINLY VISUAL: Visually Encourages Interactions
  - Visitors see the installation in the river from the shore, see blinking lights.

- IMMERSE: Immersive, Experiential, Haptic
  - Blinking buoys indicate when fish are present.

2. LEGIBILITY: How well does the installation reveal wildlife?

- ABSTRACT: Symbolic Devices Absent or Ambiguous
  - Blinking buoys indicate when fish are present.

- SYMBOLIC: Symbolic Devices Aid Comprehension of Wildlife
  - Texting the buoys gives real-time information about the river ecosystem.

- LEGIBLE: Symbolic Devices Aid Comprehension of Ecologic Systems
  - Texting the buoys gives real-time information about the river ecosystem.

3. ENGAGEMENT: Does the installation facilitate experiences of complexity/mystery?

- CERTAIN: Installation Contains No or Few Elements of Uncertainty
  - Grid of blinking lights in the river encourage questions, especially with multiple experiences.

- MODERATE: Installation Provokes Moderate Degree of Uncertainty
  - Blinking buoys indicate when fish are present.

- UNCERTAIN: Installation Provokes High Degree of Uncertainty
  - Grid of blinking lights in the river encourage questions, especially with multiple experiences.

4. COMMUNITY: Does the installation foster community solidarity?

- INDIVIDUAL: Individually Experienced, Small Target Audience
  - Reveals interaction with river inhabitants and shared human interest, fosters citizen data collection.

- COLLECTIVE: Fosters Human Community
  - Fosters Anthroecologic Community Through Shared Rituals

- COMMUNAL: Fosters Anthroecologic Community Through Shared Rituals
  - Reveals interaction with river inhabitants and shared human interest, fosters citizen data collection.
The *Bat House* (Figures 3.35 and 3.36) was designed for the London Wetland Centre by architecture students Jorgen Tandberg and Yo Murata for a competition organized by artist Jeremy Deller. Standing in stark contrast to its naturalistic settings, the white rectangular house straddles the bank edge of a lagoon, its exterior made of Hemcrete, a hemp and lime based construction material that gives the walls breathability (Alter 2009). The interior space of the house contains roosting boxes and panels, with entrances both underneath, and at the top, of the layered fretwork which covers two exterior sides of the structure (Figures 3.37 and 3.38). These two different access points address the specific behaviors of two different bat species—the pipistrelle (*Pipistrellus*...
*pipistrellus* and the Daubenton's bat (*Myotis daubentonii*) (Tandberg, personal communication).

FIGURE 3.35: *Bat House* Viewed Over the Lagoon, courtesy of Jeremy Deller.
FIGURE 3.36: *Bat House* Viewed from Path, Johanna Payton, downloaded from fashiondetective.co.uk.

FIGURE 3.38: Excerpts from *Bat House* Construction Details, Jorgen Tandberg and Yo Murata, 2008, courtesy of Jorgen Tandberg.
There are multiple species of bats in London, many of which are known to occupy building roofs and trees while sleeping; however, as redevelopment of buildings occur, preferred roosting habitat for the bats is often eliminated (Alter 2007). Thus, the Bat House provides safe haven for some of the local London bats. Table 3.4 depicts the evaluative rubric for Bat House. In the “good for wildlife” section of the rubric, the installation scores mainly in the middle metrics of the criteria. It successfully provides a necessary physical benefit to the bats in the proximity of the London Wetlands Centre. It does not necessarily facilitate significant change at an ecosystem level, however, particularly since the pipistrelle is the most widespread bat species in the United Kingdom (Bat Conservation Trust 2017, “UK Bats”), and both pipistrelle and Daubenton’s bat populations are on the rise in England (BCT 2017, “Common pipistrelle…”; “Daubenton’s bat…”). Under the “good for people” section, the Bat House scores highest on the Engagement criteria, due its striking white geometric form which nestles in the trees on the water, providing an intriguing foil to the surrounding park. While it is mainly an object in the landscape which can only be viewed from the outside, it does help visitors learn more about their local bat species, particularly if they participate in one of the Centre’s “Bat Walk” programs held at sunset in late summer to view the bats hunting (Wildfowl and Wetlands Trust Limited 2012). The author scored the Bat House low in the Community criterion, as access to the installation is not open to all the public; visitors must pay the admission fees of the Wetlands Centre, and thus the target audience of the project is limited. Figure 3.39 illustrates the attributes of the Bat House as evaluated in the rubric.
TABLE 3.4: Case Study Analysis of *Bat House*.

**GOOD FOR WILDLIFE: Contributes to Ecosystems**

1. **PURPOSE**: How does the installation intend to help wildlife?

   **PASSIVE**
   - Informs About Wildlife
   - Brings awareness to London bat species and their habitat needs.

   **ACTIVE**
   - Provides Specific Physical Benefit to Wildlife
   - Provides roosting habitat for Pipistrelle and Daubenton’s bats.
   - Remediates Regional Ecologic Problem

2. **EFFECT**: How do humans affect wildlife via the installation?

   **DISRUPTIVE**
   - Humans Temporarily Disrupt Wildlife Activities
   - Visitors primarily walk by the house during the day, and active bats are aerial.

   **PRODUCTIVE**
   - Human Presence Neutral/“Leave No Trace”
   - Humans Produce Beneficial Effect or Modification

3. **ADAPTIVITY**: How will the installation interact with the site over time?

   **STATIC**
   - Installation’s Form and Function Static, Inflexible
   - Provides roosting space in lieu of old buildings which formerly provided habitat.

   **DYNAMIC**
   - Installation Catalyzes a Needed Change
   - Installation Adapts With Site Ecology Over Time

4. **SCALE**: What is the extent of the installation’s impact?

   **ORGANISM**
   - Specific Organism Benefits
   - Bats provided with habitat.

   **ECOSYSTEM**
   - Habitat/Community Benefits
   - Ecologic Region Benefits
GOOD FOR PEOPLE: Building Awareness of Anthroecologic Community

1. INTERACTION: How do people interact with the installation?

- **DISTANT**: Superficial, Distant, Indirect
- **Mainly Visual**
  - Visitors pass the bat house on trail walks and during “bat walk” programs.
- **Immersive, Experiential, Haptic**

2. LEGIBILITY: How well does the installation reveal wildlife?

- **ABSTRUSE**: Symbolic Devices Absent or Ambiguous
- **Symbolic Devices Aid Comprehension of Wildlife**
  - Trail with interpretive signage leads visitors directly past the Bat House.
- **Symbolic Devices Aid Comprehension of Ecologic Systems**

3. ENGAGEMENT: Does the installation facilitate experiences of complexity/mystery?

- **CERTAINTY**: Installation Contains No or Few Elements of Uncertainty
- **Installation Provokes Moderate Degree of Uncertainty**
  - Bright white geometric form contrasts with natural surroundings, has complex pattern.
- **Installation Provokes High Degree of Uncertainty**

4. COMMUNITY: Does the installation foster community solidarity?

- **INDIVIDUAL**: Individually Experienced, Small Target Audience
  - Park charges admission fee, bat walks also a paid program.
- **Fosters Human Community**
- **Fosters Anthroecologic Community Through Shared Rituals**
Watershed Sculpture, Daniel McCormick and Mary O’Brien, 2014


Watershed Sculpture (Figures 3.41, 3.42, and 3.43) was designed by Daniel McCormick and Mary O’Brien in partnership with the Nature Conservancy at its 800-acre River Fork Ranch location in Nevada’s Carson Valley. The 360’ long sculpture is woven mostly from native Coyote Willow saplings, and live staked with over 1200 willow saplings. Its long, sinuous form lies within the floodplain of the Carson River, where it slows water movement from upstream, capturing sediments and reducing turbidity and flood risk downstream. Eventually, this sediment deposition and the establishment of the saplings will facilitate the growth of riparian habitat along this section of the river, providing a willow grove suitable for attracting the indigenous willow flycatcher, among other species (Mary O’Brien; Duane Petite, personal...
communication). The sculpture allows the river to flood naturally, which assists local aquifer recharging (The Nature Conservancy 2017, “River Fork Ranch”), but it also redirects receding floodwater back into the main river channel. This slowing and directing function stabilizes the river banks, protecting the riparian habitat which includes milkweed patches that attract vulnerable monarch butterflies. The sculpture itself contains wood pieces within the weave closer to the shore, allowing the endangered Western Pond Turtle to burrow into the sculpture and nest (Figure 3.44). (Mary O’Brien, personal communication)

FIGURE 3.41: Aerial View of Watershed Sculpture, Martin Swinehart of Tinderbox LLC, courtesy of Mary O’Brien.
FIGURE 3.42: *Watershed Sculpture* in Flood Conditions, Mary O’Brien.

The fabrication of this sculpture required a great deal of volunteer hours; over 400 people contributed to the sculpture’s creation over the course of fourteen work events (Duane Petite, personal communication). The majority of visitors to the sculpture will see it from one of the trails, or learn about it in the River Fork Ranch interpretive center. Over time, the sculpture will become invisible, as the willow saplings mature and become a grove of trees. Duane Petite, Director of the Carson River Project, states that this was an integral purpose for the art: “[I]t was always our shared intention that as natural cycles are established, the artist’s presence and the human hand will fade until they are no longer be apparent….this project evokes the ever changing qualities of the natural world” (Personal communication).
Table 3.5 depicts the evaluative rubric for *Watershed Sculpture*. The installation scored very high under the “good for wildlife” section, as it both addresses the needs of individual species while simultaneously remediating larger scale watershed issues by capturing sediment and pollution from agricultural processes such as cattle grazing and dredging upstream, thus improving water quality for river inhabitants downstream (The Nature Conservancy 2017, “River Fork Ranch”). The installation is entirely adaptable to its site, and will evolve with the river channel over time, and, though the majority of visitors to the ranch will not participate directly in benefitting wildlife via the sculpture, they also will be able to view it without disrupting wildlife nesting or foraging. Under the “good for people” section, *Watershed Sculpture* scores mainly in the middle metrics; its natural materials and organic form allow it to blend in well with its surroundings, while still providing a measure of mystery and contrast, particularly as it appears and disappears with the river’s fluctuations. The sculpture scores high in the *Community* criterion, due to its significant involvement of regular citizens in its fabrication, which speaks to William Jordan III’s (2003) views on the power and potential of ecologic restoration projects to bring communities together for the benefit of their shared environment. Figure 3.45 illustrates the attributes of *Watershed Sculpture*. 
TABLE 3.5: Case Study Analysis of *Watershed Sculpture.*

**GOOD FOR WILDLIFE: Contributes to Ecosystems**

1. **PURPOSE:** How does the installation intend to help wildlife?

   - **PASSIVE**
     - Informs About Wildlife
     - Provides Specific Physical Benefit to Wildlife
     - Remediates Regional Ecologic Problem

   - **ACTIVE**
     - Creates riparian habitat for willow flycatchers, western pond turtles, and monarch butterflies.
     - Promotes floodplain functioning, restores local aquifer, filters sediments, controls bank erosion.

2. **EFFECT:** How do humans affect wildlife via the installation?

   - **DISRUPTIVE**
     - Humans Temporarily Disrupt Wildlife Activities
     - Human Presence Neutral/"Leave No Trace"
     - Humans Produce Beneficial Effect or Modification

   - **PRODUCTIVE**
     - Visitors view the installation from the trail across the Carson River.

3. **ADAPTIVITY:** How will the installation interact with the site over time?

   - **STATIC**
     - Installation’s Form and Function Static, Inflexible
     - Installation Catalyzes a Needed Change
     - Installation Adapts With Site Ecology Over Time

   - **DYNAMIC**
     - Sculpture staked with live willows which will become a grove, transforming the sculpture over time.

4. **SCALE:** What is the extent of the installation’s impact?

   - **ORGANISM**
     - Specific Organism Benefits
     - Provides nesting and foraging areas for endangered/vulnerable turtles and birds.

   - **ECOSYSTEM**
     - Ecologic Region Benefits
     - Filters sediments and pollutants from upstream agricultural practices; helps recharge aquifer.

   - **Habitat/Community Benefits**
     - Restores native riparian habitat in the sculpture’s proximity.
## GOOD FOR PEOPLE: Building Awareness of Anthroecologic Community

1. **INTERACTION**: How do people interact with the installation?

<table>
<thead>
<tr>
<th>DISTANT</th>
<th>Mainly Visual</th>
<th>Immersive, Experiential, Haptic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial, Distant, Indirect</td>
<td>Visitors see the installation in/across the river from the shore.</td>
<td>IMMERSE</td>
</tr>
</tbody>
</table>

2. **LEGIBILITY**: How well does the installation reveal wildlife?

<table>
<thead>
<tr>
<th>ABSTRUSE</th>
<th>Symbolic Devices Aid Comprehension of Wildlife</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbolic Devices Absent or Ambiguous</td>
<td>Patterned weave and linear, sinuous form draw attention to sculpture and attending wildlife.</td>
</tr>
</tbody>
</table>

3. **ENGAGEMENT**: Does the installation facilitate experiences of complexity/mystery?

<table>
<thead>
<tr>
<th>CERTAINTY</th>
<th>Installation Provokes High Degree of Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation Contains No or Few Elements of Uncertainty</td>
<td>Sculpture is at a distance, appears and disappears with rising/receding floodwaters.</td>
</tr>
</tbody>
</table>

4. **COMMUNITY**: Does the installation foster community solidarity?

<table>
<thead>
<tr>
<th>INDIVIDUAL</th>
<th>Fosters Anthroecologic Community Through Shared Rituals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individually Experienced, Small Target Audience</td>
<td>Involved 408 volunteers from the public in 14 work events to create the installation.</td>
</tr>
</tbody>
</table>
Owens Lake Trails, Perry Cardoza (NUVIS Landscape Architecture), 2016


Owens Lake Trails (Figure 3.47) is part of a much larger project of the Los Angeles Department of Water and Power that is mitigating the production and aerial suspension of dust particles from the Owens Valley in California, bordered on the west by the Sierra Nevada Mountains. The glacial Owens Lake once kept the area watered and vegetated, but after the Los Angeles aqueduct opened in 1913, water was quickly diverted away from the lake, and it dried up in less than a decade (Langley 2016, “Perry Cardoza’s…”; “A Land Art…”). The addition of groundwater pumping mechanisms is believed by many to have further exacerbated water shortages in the valley, which is now so dry that hazardous dust storms occur (Knudson 2014). The LADWP has been charged with controlling the dust, and in recent years had been wetting the lakebed with
approximately 80,000 acre-feet of water annually (LADWP n.d., 2). Other methods to mitigate the dust have been implemented in order to conserve water, while still providing wildlife habitat for multiple species guilds, particularly birds; these guilds include resident waterfowl and shorebirds, diving birds, migrating waterfowl and shorebirds, and species that inhabit alkali meadows, including reptiles and small mammals (NUVIS 2013).

FIGURE 3.47: Plan View of Owens Lake Trails, courtesy of NUVIS Landscape Architecture.
In addition to three public hiking trails, an installation that included a plaza (Figure 3.48), seating areas, and land art formations that act as “habitat islands” (Figure 3.49) were designed by landscape architect Perry Cardoza. The habitat islands are dune-shaped to represent the whitecaps which once formed on the lake’s surface prior to the aqueduct, and they are constructed of piles of rock with concrete footers at their base (Langley 2016, “Perry Cardoza’s…”; Linda Forde [NUVIS], personal communication). Some are located in the shallow flood zone and were left as bare rock; others on land were vegetated with native grass. They are anticipated to change somewhat over time as forces of wind and water shape them, and plants establish in the nooks and crannies between the stones. These habitat islands provide places for reptiles and small mammals to hide, and provide shelter from the wind for birds (Linda Forde [NUVIS], personal communication). Their diverse sizes assist in breaking up wind patterns, which is one of the methods used to lessen the aerial movement of dust (Langley 2016, “Perry Cardoza’s…”; NUVIS 2013). The plaza is shaped like abstracted wings of the snowy plover, one of the native birds, and its materials reflect the colors of the playa with stone and Corten steel. Cut-outs shaped like birds in flight project their shapes from the steel canopy onto the plaza hardscape below. Other symbology such as material banding leading the eye to specific mountain peaks was incorporated to increase legibility of the site’s natural history and context (Langley 2016, “A Land Art…”). Interpretive signage throughout the public space educate visitors more explicitly about the site and its remediation efforts (Linda Forde [NUVIS], personal communication).

Table 3.6 depicts the evaluative rubric for Owens Lake Trails. The project scores high under the “good for wildlife” section, as it provides for the needs of organisms and
species, and mitigates the environmental health issue of aerial dust. It reestablishes historic habitat regimes and landscape connectivity, which is vital to resident native species, as well as thousands of migratory birds. During migration season, over 75,000 birds a day have been known to use Owens Lake, where they feed on tiny organisms such as flies and brine shrimp that live in the shallow water (LADWP n.d., 9). The installation also scores in the medium to high metrics of the “good for people” section. Signage, visual symbology, and trails assists in making the landscape and its wildlife legible, and it is a prime location for bird watching clubs, artists, and naturalists to organize an outing (LADWP n.d., 11). Overall, the project brought together many people and organizations from the local and regional community, including indigenous tribe members, whose input was sought for the protection of Native American cultural sites in the project area, and the incorporation of Native artistry into the plaza symbolism (NUVIS 2013; Linda Forde [NUVIS], personal communication). Figure 3.50 illustrates the attributes of Watershed Sculpture.
FIGURE 3.48: View of the Plaza, Christopher Langley, downloaded from kcet.org.

FIGURE 3.49: Views of the Habitat Islands, courtesy of NUVIS Landscape Architecture.
### TABLE 3.6: Case Study Analysis of Owens Lake Trails.

#### GOOD FOR WILDLIFE: Contributes to Ecosystems

1. **PURPOSE:** How does the installation intend to help wildlife?

   **PASSIVE**
   - **Informs About Wildlife**
   - Provides Specific Physical Benefit to Wildlife
   - Remediates Regional Ecologic Problem

   **ACTIVE**
   - Restores multiple habitat zones for six guilds of migrating and resident birds/animals.
   - Provides dust mitigation, creates a stopover for migrating birds.

2. **EFFECT:** How do humans affect wildlife via the installation?

   **DISRUPTIVE**
   - Humans Temporarily Disrupt Wildlife Activities
   - Human Presence Neutral/“Leave No Trace”
   - Humans Produce Beneficial Effect or Modification

   **PRODUCTIVE**
   - Due to its vast scale, visitors can come and go with minimal disturbance to wildlife.

3. **ADAPTIVITY:** How will the installation interact with the site over time?

   **STATIC**
   - Installation’s Form and Function Static, Inflexible
   - Installation Catalyzes a Needed Change
   - Installation Adapts With Site Ecology Over Time

   **DYNAMIC**
   - Installation restores a portion of the playa to more historic ecologic conditions.
   - Over time, whitecaps will evolve with inputs from wind, water, and vegetation.

4. **SCALE:** What is the extent of the installation’s impact?

   **ORGANISM**
   - Specific Organism Benefits
     - Whitecaps provide shelter from wind for birds, habitat for small reptiles and mammals.
   - Habitat/Community Benefits
     - Restores historic habitat for multiple species guilds.
   - Ecologic Region Benefits
     - Provides landscape connectivity, a vital stopover for migrating birds.
GOOD FOR PEOPLE: Building Awareness of Anthroecologic Community

1. INTERACTION: How do people interact with the installation?

DISTANT: Superficial, Distant, Indirect
Mainly Visual
Immersive, Experiential, Haptic
Humans immersed in the vast playa environment, can walk four miles of trails.

2. LEGIBILITY: How well does the installation reveal wildlife?

ABSTRUSE: Symbolic Devices Absent or Ambiguous
Symbolic Devices Aid Comprehension of Wildlife
Symbolic Devices Aid Comprehension of Ecologic Systems
Paths lead humans into proximity with wildlife; plaza incorporates bird symbology.
Signs educate about dust mitigation/habitat restoration, and wildlife.

3. ENGAGEMENT: Does the installation facilitate experiences of complexity/mystery?

CERTAINTY: Installation Contains No or Few Elements of Uncertainty
Installation Provokes Moderate Degree of Uncertainty
Installation Provokes High Degree of Uncertainty
Vast open space, with water and whitecaps, provides a moderate amount of uncertainty.

4. COMMUNITY: Does the installation foster community solidarity?

INDIVIDUAL: Individually Experienced, Small Target Audience
Fosters Human Community
Fosters Anthroecologic Community Through Shared Rituals
Encourages groups such as bird watching clubs; includes input from indigenous tribes.
CHAPTER 4

FINDINGS FROM CASE STUDIES ANALYSIS

**Summary of Case Study Scoring**

After evaluation with the rubric, each of the six case studies was assigned a score by which it can be compared to the others. Installations which score high in both the “good for wildlife” and “good for people” criteria are considered most successful in terms of this thesis and its intention to uncover useful information in creating cultural spaces which also function ecologically. However, this is not to say that an installation which scores high in one category and not the other is objectively unsuccessful. It may be found that such an installation achieved its own stated purposes with great success, and based on its own merit is an extremely valuable contribution to the public, or the ecosystem in which it functions. Therefore, it must be emphasized that the scoring system which the rubric upholds is for comparative purposes only in the context of this thesis.

Figure 4.1 depicts the scoring of the case studies, which are each represented by the icon used in the attributes illustrations found at the end of each case study’s description and evaluation. To the right of each icon, a set of colored dots corresponds to the metrics on the evaluative rubric, with the filled-in dots representing the highest metric achieved under each criterion. The score for each of the two rubric sections is recorded under the set of dots associated with that section, and the total score is located directly to the right of both sets of dots. Figure 4.2 illustrates the comparative standing of each case
study on two separate continuums—the top (pink) continuum represents the “good for wildlife” rubric, while the bottom (green) continuum represents the “good for people” rubric. In this way, we can determine the relative strength of each installation in each of the two categories. We find that there is greater variation in how the case studies scored under “good for wildlife” than under “good for people,” possibly attesting to the inherent bias a cultural object, particularly one labelled as art, already has toward achieving human goals.

In Figure 4.3, the case studies have been located on the “interspecies space” diagram introduced in Chapter 1. The graph depicts Watershed Sculpture and Owens Lake Trails as firmly in the realm of interspecies space, but leaning slightly towards the ecocentric edge. Amphibious Architecture and Fair Park Lagoon score similarly high, but lean slightly towards the anthropocentric edge as they seek to achieve balance between people and nature. Finally, Bat House and Swamp Garden score lower overall than the other projects, though Bat House achieves balance between ecocentric and anthropocentric goals, while Swamp Garden leans significantly toward the latter.

In Figures 4.4 and 4.5, the case studies are located on the Venn diagram of landscape architecture, art, and ecology along with their scores under “good for wildlife” and “good for people,” respectively. No overall patterns emerge, although Swamp Garden, which primarily reflected qualities of art and landscape architecture, scored the lowest overall in achieving mutual benefits for humans and wildlife, while Owens Lake Trails, which scored the highest, exhibits primarily qualities of ecology and landscape architecture.
FIGURE 4.1: Comparative Scores of the Six Case Studies.
FIGURE 4.2: Comparative Scores of the Six Case Studies by Section.
FIGURE 4.3: Location of Case Studies on Interspecies Space Diagram.

FIGURE 4.5: Case Studies with “Good for People” Scores on Venn Diagram of Thesis Inquiry, Lauren Holmer-Boyd, 2017.
Discussion of Themes Emerging from the Case Studies Analysis

Tables 4.1 and 4.2 catalogue and summarize the strategies used by the six case studies in addressing the eight criteria in the evaluative rubric. Strategies listed with the magenta dot scored in the highest metric under each criterion, while those with the pink dot scored in the middle metrics. Under Purpose, two particular themes emerged: addressing water quality and habitat restoration. The former was specifically accomplished by pollution control (capturing sediments to reduce turbidity, using fish food to neutralize toxins, stabilizing banks) and the latter by revegetating, improving water quality, or introducing a physical structure (such as a bat roost). The Effect criterion was met mainly by the traditional “leave no trace” approach, whereby visitors were kept at a distance from sensitive wildlife roosting and nesting areas, though in some cases, such as the Bat House, this was mainly unnecessary since the bats are nocturnal and fly out of the reach of humans. The Adaptivity criterion was met most successfully by strategies that allowed for the installation to be gradually reshaped by natural forces such as wind, water, and the growth of plants, particularly the use of natural and/or on-site materials in the installation, such as the willow saplings in Watershed Sculpture. Installation functions that were less adaptive but still catalyzed needed changes at the site did so primarily by acting as functional infrastructure; examples include the Fair Park Lagoon sculptures stabilizing the pond banks, the Watershed Sculpture filtering sediments from the river, and the Bat House providing surfaces for bats to hang from and hide between. Finally, installations addressed issues at an ecologic Scale by addressing watershed functions such as the flow of sediments downstream and the recharging of...
aquifers, and by improving landscape connectivity for large scale movements of animals such as migrating birds and butterflies.

Under the *Interaction* criterion, experiences of immersion were accomplished by installations that provided a sense of spatial enclosure, such as *Swamp Garden* with its “walls” and “floor” punctuated by areas of water and sky; included linear structures or paths to lead humans into the natural environment, such as *Fair Park Lagoon*’s gunite sculptures; or simply existed at a very large scale, such as *Owens Lake Trails*’ system of trails, plaza, and large stone habitat islands that integrated with the playa and its surrounding mountain ranges. While not involving as many senses, *Amphibious Architecture* also uniquely addressed *Interaction* through the use of technological interfaces, including the device which most city residents carry: a cell phone. The changing colors and blinking of the buoys allowed humans to have an abstract conversation with the river, albeit through silent visual means. The *Legibility* of ecologic systems was mainly through explicitly language/text-based means—either interpretive signage or even a text message. Making wildlife more legible to humans was accomplished with a variety of strategies; interpretive signage was a literal means of conveying information, while blinking lights, the presence of specifically-placed paths and overlooks, and contrasting “natural” and “human-made” patterns directed human focus more subtly. *Owens Lake Trails* also used a great deal of symbology to communicate, such as the plaza canopy perforated with the shapes of flocking birds, reminiscent of the migratory swarms that visit the lake every year. Strategies that scored well under the *Engagement* criterion were varied, but included the integration of a “journey” via paths through a site, the use of natural cycles such as water or oxygen level
fluctuation to periodically change the installation’s appearance and function, and stark contrasts of color and form between the installation and its natural setting. *Amphibious Architecture* instigates an atmosphere of serial questioning, as it operates like a public science experiment which anyone can learn about and contribute to by requesting data. This communal experiment also involves data inputs by the presence of fish, thus making the strategy successful under the *Community* criterion; *Watershed Sculpture* scores high in this category as well, involving a vast number of public volunteers to perform ecologic restoration—coming together to create a framework which nature takes over to rejuvenate itself. Other installations scored in the middle metric of this criterion by providing free public access, involving minority groups in its design, and bringing together established social clubs.

Out of these case study strategies, some notable and useful summations may be made, listed below.

- **The use of water as a focus for restoration goals and the creation of an attractive environment for humans is a winning combination.** As Robert Thayer (1998) noted in his evaluation of eco-revelatory design, water is a common theme in projects that try to draw human attention to nature (129). The six case studies in this thesis are no exception, as each one incorporates water in some fashion. There is some very pragmatic logic behind this—most organisms need to drink water, and fresh water shortages are a global environmental concern. However, non-drinking water is also a key feature in many urban public spaces due to the infinite human fascination with water. In addition to the need for
oxygen and light, the need for water represents a great commonality between humans and other species, and thus contains great potential to act as a mediating structure within an interspecies space.

- **Interdisciplinary collaboration is vital to experimenting with creative ways of interacting with natural systems and addressing site-specific problems.** Each of the six case studies was made possible by teams of professionals, not simply one artist or designer. Sources on Patricia Johanson, Daniel McCormick and Mary O’Brien, and Perry Cardoza of NUVIS Landscape Architecture mentioned specifically that they consulted with biologists and ecologists to inform their design goals and increase their knowledge of the specific wildlife on their sites (Wu 2013, 141; Averett 2015; Linda Forde [NUVIS], personal communication). Hence, in addressing concerns such as Robert France (2000) and Susan Galatowitsch’s (1998) critiques of eco-revelatory design, designers and artists will likely increase their project’s scientific integrity by partnering with science professionals throughout the project. This does not negate the role of artistic experimentation, however, as Galatowitsch also pointed out in her article (101-102). In fact, the partnership between artists/designers and scientists may very well produce a factually informed, creative, and unique solution to a given problem.

- **Incorporating process and a “journey” can create a compelling story that draws humans into the natural environment.** Ecosystems and habitat patches
are often highly heterogeneous in composition, particularly as you move up in scale to regions, or down in scale to microclimates, where even minute temperature changes make a difference in resource availability for a given species. Additionally, wildlife that are not held in static captivity for the audience eye are often constantly on the move throughout their designated range. Creating an interspecies space, then, where ecosystems are made more legible to people, should demonstrate this diversity of forms and functions. Incorporating a “journey,” where people are encouraged to move throughout a space, not only gives people an activity to accomplish, but also facilitates immersion in the habitat, and increases human chances of coming into contact with local wildlife.

- **Art can also be functional.** Most of the case study projects were intended not only to be aesthetic objects in the landscape that would be enjoyable or interesting to see from a distance—they were also functional. This should come as no surprise, given that nature itself, while it is beautiful, is essentially functional. Even the loveliest of flowers exists for the practical purpose of attracting the right pollinators. Thus, artists and designers working to achieve ecologic goals should neglect neither considerations of aesthetics, nor practical purpose. Robert France has indicated that this is one of landscape architecture’s potential strengths:

  “Motivation [for environmental reform] will come from people’s experiences of relatively undisturbed, protected green spaces far from cities, but also from educating and directly engaging people in the recognition and repair of damaged landscapes. Whereas the former is the purview of conservation biologists and nature writers, the latter is very much the business of restoration ecologists and landscape architects. Through melding engineering and aesthetics, developing what might be called ‘functional art,’ landscape architects can contribute to sustaining
nature. The reason for this is that neither art and design nor science and engineering alone have done much to instill love of and motivate action for the natural world." (France 2003)

- **Technological interfacing has potential for providing ecologic legibility.** As Robert Thayer (1998) pointed out, many ecologic processes are vastly too complicated to be understood at a glimpse (129). We simply cannot see many of the processes playing out in the environment around us every day, particularly when they occur over imperceptibly slow timelines. Thayer writes that “there may be an unrecognized need to reveal and interpret ecosystems where we humans have yet to intervene and where the challenges of bringing hidden realities to the surface are much greater (e.g., genetic structure, atmospheric chemistry, ozone depletion, and the environmental effects of globalization)” (129). As Amphibious Architecture demonstrated, the use of commonly available technologies such as text messaging may very well be useful in expanding the public awareness about less visible ecologic processes. Already there are “apps” for cell phones that identify plants and constellations the user may come across, provide field guides for any of the National Parks, map out the locations of geologic mines, and even simulate wildlife activities in a gaming format (albeit in a highly pseudoscientific and even outright unscientific manner). The sheer number of possibilities for using media devices to record and share site-specific information makes this an intriguing area for continual future research, and it coincides well with developing interest in “citizen science” models, where “participants collect data following prescribed protocols and then submit their data to a central location where the information is accessible to researchers who analyze and publish the results”
(Cooper et al. 2007, “The Citizen Science Tool”). The citizen science model has the advantage over traditional scientific data collecting methods in that it employs the efforts of much larger numbers of people spread out over a greater sample area. Studies have found that involvement in citizen science studies increases the overall ecologic knowledge of participants; long-term participants contribute a depth of experience and knowledge to the process that can be passed on to new volunteers and increase the validity of the data collection. (Cooper et al. 2007)
TABLE 4.1: Summary of Case Study Successes for “Good for Wildlife” Criteria.

**ACTIVE PURPOSE**
- Filters toxins and suspended sediments introduced by human systems from hydrologic systems using woven materials, fish bodies, and revegetation.
- Militates bank erosion in water bodies using long/linear/sinuous forms.
- Restores floodplain functioning and aquifer recharge by slowing river flow.
- Stabilizes soil by restoring hydrologic functioning and creating wind breaks.
- Creates a “patch” that provides landscape connectivity for resident and/or migrating birds.
- Feeds the animals a healthy snack engineered for their diet.
- Provides roosting/resting/nesting/foraging space for the animals.
- Re-links food webs by facilitating revegetation through stabilizing littoral/sediment layers and restoring native plant guilds.

**PRODUCTIVE EFFECT**
- Installation visitors provide the nutritional snack for the animals which remediates amassed toxins.
- Humans interact with or view animals and/or the installation from a distance or during a time when animals are inactive to avoid disturbance.

**DYNAMIC ADAPTIVITY**
- Evolves as wind, water, soil, and plant movements or growth reshape the installation, or cover it up.
- Natural materials which are integral to the installation’s form grow, change, and reproduce.
- Replaces an important function or element of habitat that is being depleted elsewhere in the landscape.
- Installation’s form serves as infrastructure which blocks soil movement, stabilizing it for revegetation and slowing erosion from water movement; eventually the soil and/or vegetation may build up around the installation.
- Recreates historic conditions in order to restore historic ecologic processes and food webs.

**ECOSYSTEM SCALE**
- Improves landscape connectivity, especially in an urbanized area, by improving a habitat patch or corridor.
- Improves water quality downstream through filtration of nutrients/metal by plants or materials that trap sediments.
- Contributes to recharging a local aquifer.
- Specific point in the hydrologic system receives mediating treatment, such as fish food binding toxic metals, or the restoration of riparian habitat.
- Habitat benefits indirectly from increased human awareness and experience of its appearance and functions, which may cultivate familiarity and sense of ownership.
- Restores food web within a habitat patch by creating conditions, sometimes historic, preferred by native plant guilds and revegetating with those plants.
TABLE 4.2: Summary of Case Study Successes for “Good for People” Criteria.

**IMMERSIVE INTERACTION**
- Encloses a space permeated by the surrounding environment into which humans enter.
- Includes or consists of paths which lead humans into the environment and into proximity with wildlife.
- Exists at a large scale which engulfs human visitors.
- Lights blink in response to digital inputs from humans via cell phones and the movements of the animals.
- Located in the water, seen by humans from the shore.
- Located along a trail/path where humans walk.

**LEGIBLE LEGIBILITY**
- Texting interface gives real-time information about the river to humans if requested.
- Interpretive signage communicates about ecologic remediation.
- Lights blink when fish swim by, signaling wildlife presence to humans.
- Leads humans into proximity with wildlife or signs of wildlife via a trail, boardwalk, or path.
- Interpretive signage communicates to humans about wildlife.
- Bench or overlook encourages humans to pause and observe, increases chances for viewing wildlife.
- “Human-made” pattern in contrast with natural surroundings cues human attention, increasing chances for viewing wildlife at the installation.
- Symbology using an animal “poster child” brings attention to species of importance.

**UNCERTAINTY ENGAGEMENT**
- Informational text messages continuously change as ecosystem conditions change.
- Fish presence made known but cannot be seen.
- Provides a foil to natural surroundings via highly contrasting form, geometry, and/or color.
- Sense of enclosure/screening, play of light and shadow from foliage and/or trees create sense of mystery.
- Long and winding access path through trees creates process and an unfolding story.
- Creates uncertainty by offering complex and varied paths.
- Hides and reveals installation via natural water level fluctuation.
- Unusual form made of natural materials in a natural setting draws attention.
- Tall form in a vast, mainly flat landscape draws attention.

**COMMUNAL COMMUNITY**
- Facilitates collective data gathering through a commonly shared human technology which also partly depends on wildlife presence.
- Involves participation from large numbers of public volunteers to create the installation and directly assist with ecologic remediation.
- Located in a highly accessible public area where other community events take place.
- Design process and symbology includes input from local indigenous tribe members.
- Encourages community groups such as birdwatching clubs to participate.
CHAPTER 5
SITE DESIGN FOR BRITTLEBANK PARK, CHARLESTON, SC

Introduction to the Site

The city of Charleston is located on a peninsula where two of South Carolina’s rivers, the Cooper and the Ashley, reach the ocean. It is located in what is known as the Lowcountry, the low lying Coastal Plain of South Carolina that begins at the fall line—an ancient shoreline—and ends at the Atlantic. The immense power of force exerted by shifts in sea level shaped this shoreline, distributing sediments along the coast from the very old and eroded Appalachian Mountains (Barrier Island…n.d., “Let’s Sea,” 2). The Lowcountry is a very flat region, but nearer to the beach it may also be somewhat rolling, as forest succession takes place on former sand dunes. There are multiple ways to delineate the major ecosystems immediately surrounding Charleston, but generally, it consists of the Atlantic Ocean, estuaries, intertidal beaches and dunes, salt marshes, and the maritime forest.

Charleston is located between two estuaries, which are vitally important to the life cycles of many aquatic species. They contain brackish water, which can have a salinity anywhere between 0.5 and 30 ppt, a large gradient when considering the physiologic needs of living organisms. The various species which inhabit the constantly fluxing boundary between fresh water and ocean must have ways to either excrete accumulated salt, or maintain the proper amount, depending on the surrounding salinity (5). Salt marsh
cord grass (*Spartina alterniflora*), for example, has a higher concentration of salt within its cells, so that water molecules move into them, maintaining turgidity, and the plant has the ability to secrete salt out of its stem and leaves if needed (15). Estuaries are also rich in nutrients, due to the fact that the river brings organic material downstream with it, and the ocean tides move detritus in and out as well. The combination of a concentrated food source with the added benefit of a slower moving, more protected aquatic habitat makes estuaries prime breeding and spawning grounds. Many fish and invertebrate species begin their lives in the estuary (4).

The salt marsh forms the zone buffering the estuaries and tidal creeks from dry land. In the Lowcountry, the dominant plant by far is the *Spartina* grass, which survives in the anoxic “pluff mud” by absorbing oxygen through its leaves instead of its roots, as most plants do (15). The immense amount of biomass produced by the salt marsh, which greatly exceeds the number of animals that eat it directly, breaks down into detritus that forms the basis of local food webs, and washes up on shore to form the wrack line—the pile of debris on the high tide line of the beach that captures sand particles and forms the base of a new line of sand dunes (15-17). Both sand dunes and salt marshes protect inland areas from the influx of high tides and storm surges, but the marshes also perform another major service for humans—they can mitigate, to a limited extent, some of the toxic pollution inputs that have been introduced into the environment by anthropogenic systems. Because marshes slow the flow of water, the sediments and other particulates settle out, forming “pluff mud” which can bury harmful chemicals. In some cases bacteria can eventually break the toxins down (Barrier Island…n.d., “Wild Wetlands,” 5).
The maritime forest contains species which are adapted to extremely sandy and nutrient poor soils. The succession of plant communities has much to do with relative tolerance of wind, salt spray, and sun (Barrier Island…n.d., “Forest Ecology,” 1). Trees near the edge of the forest often develop a dead side, as the salt spray eventually kills those branches (2). Three of the most common upper story species found in the maritime forest are live oaks, cabbage palmetto, and loblolly pines. The first two, especially, are highly associated with the aesthetic of the Lowcountry, and romantic images of lives oaks dripping with Spanish moss contribute to the *genius loci* of Charleston.

Viewing the historic maps of Charleston dating to the late 1700s and early 1800s (Figure 5.1), it seems that the Charleston peninsula was covered in salt marshes, maritime forest, and old sand dunes when the colonists began settling there, which is not surprising given the regional ecologic context. Very quickly, though, the peninsula was converted to a thriving city (Figure 5.2), the fourth largest in the colonies as of 1742 (South Carolina Genealogical Society 2015). From Charleston Harbor was exported the most important crops of the region: rice, indigo, and cotton. Rice in particular was well suited for being grown in the Lowcountry because of the multitude of waterways and tidal inundation. Most of the settlements in the region were located near a water source that connected to Charleston’s port, while inland areas were generally avoided (Lewis 1999, 6).

Agricultural practices of the time were very ecologically insensitive, however, and estuaries in particular were vulnerable to negative human impact. Wetlands were drained to combat overwhelming mosquito populations and create more pasture, and growing rice using riverine tidal flux for freshwater irrigation led to the construction of complex systems of dams, levees, and tide gates that disrupted the normal function of the riverine
floodplains (Barrier Island…n.d., “Let’s Sea,” 17; South Carolina Dept. of Archives and History 2011, 2).

FIGURE 5.2: Map of Charleston in 1872, downloaded from kroll-antique-maps.com.
Following the end of the Civil War, the shipping industry became especially important to Charleston. Having lost the war, the economies of Confederate states such as South Carolina declined, particularly agriculture sectors that had previously been dependent on slave labor. One of the resulting consequences from this situation was the need for the city of Charleston to save money by repairing and reusing its existing buildings instead of replacing them with more modern ones (South Carolina Genealogical Society 2015; Charleston, SC 2017). Today, these historic structures and urban composition contribute to Charleston’s unique charm, and draw a significant number of tourists. However, the integrity of Charleston’s downtown fabric will be affected by future sea level rise. According to the EPA’s 2014 report on climate change indicators, the South Carolina coast saw between 6-8 inches of relative sea level change from 1960 to 2013 (51). The city currently experiences copious amounts of flooding in its downtown areas during especially high spring tides, but this inconvenience could increase if sea level change outpaces the infrastructural improvements the city is currently implementing. Additional problems resulting from sea level rise are shore erosion, higher salinity in the estuaries—which affects fish and other species populations—and greater storm surges (50). Currently, the Southeastern Coast is experiencing loss of land to open sea water, particularly tidal wetlands (52-53). Because of the aforementioned importance of the marsh both for the coastal food chain and flood protection, this is a concerning situation, which will require intelligent land use planning, and resilient design, especially as the city continues growing. In 2013, the greater tri-county area including Charleston was the 12th fastest growing metropolitan area in the country (Slade 2013), and in 2017, Charleston became the largest city in South Carolina (Slade 2017).
The site chosen for this design is Brittlebank Park, located on the western edge of the Charleston peninsula on the bank of the Ashley River. The 10-acre parcel of land on which the park was built was originally marsh and tidal creeks, until it was filled to become part of an operating landfill in the mid-1900s. The landfill was shut down in 1970 when the United States Army Corps of Engineers proclaimed it an environmental hazard that was leaching pollutants into the river. In 1975, the riverside portion of the capped landfill was established as the park with funds dedicated to the institution of a public green space from the wealthy Charleston miller, Julius Brittlebank (Charleston-SC.com 2016). Figures 5.3 to 5.7 depict the transformation of Brittlebank Park from marsh to landfill to park. An approximate boundary line has been added to the historic photos to clarify the site’s location.

FIGURE 5.3: Brittlebank Park 1939, courtesy of the WestEdge Foundation.
FIGURE 5.4: Brittlebank Park 1957, courtesy of the WestEdge Foundation.

FIGURE 5.5: Brittlebank Park 1963, courtesy of the WestEdge Foundation.
FIGURE 5.6: Brittlebank Park 1968, courtesy of the WestEdge Foundation.

FIGURE 5.7: Brittlebank Park 1989, courtesy of the WestEdge Foundation.
FIGURE 5.8: Current Site Context of Brittlebank Park.
FIGURE 5.9: Hydrologic Connectivity of Brittlebank Park.
Today, Brittlebank Park is mainly open lawn with some shade trees, including mature live oaks; a boardwalk leading out to a floating dock and fishing pavilion, a playground, and an off-leash dog area are some other features of the park. An old network of sidewalks can still be seen in some places winding around the grounds, but they are mostly dilapidated and overgrown. Because of the large amount of open space the park provides, it is often used for community events such as festivals and demonstrations; the Reggae Music Festival, Southeastern Wildlife Exposition DockDogs competition, and Walk for Water fundraiser are examples of events which make use of the park’s lawns. To the east and southeast, a major mixed use development is currently under construction; known as the WestEdge project, it will include apartment, office space, and retail units, improve the walkability of the area, and most likely increase the use of Brittlebank Park (WestEdge 2017, “The Plan”). Figure 5.8 illustrates the current site context of Brittlebank Park, including approximate high and low tide lines, and rough estimates of on-site contour elevations.

Moving outward from its immediate surroundings, Figure 5.9 shows the location of Brittlebank Park in the context of its habitat connectivity. The marsh which once existed in the park’s location is all but gone. There is a relatively thin strip of it growing at the park/river interface, however, which provides some habitat to native salt marsh wildlife guilds. This remnant of marsh connects to a larger undeveloped patch of marsh to the north/northeast, where there is an active dredge spoil. In addition to being bordered on the northwest and southeast edge by tidal creeks, the park is hydrologically connected via the Ashley River to a significant number of habitat corridors, including Wappoo Creek which runs to the Stono River west of James Island, and the Charleston Harbor,
which connects to the Cooper and Wando Rivers to the north, and the Atlantic Ocean to the southeast. All of these waterways are bordered with salt marsh for at least some of their length; measured from the tip of the Charleston peninsula, the salt marsh ecoregion can extend more than fifteen miles inland on the Ashley and Cooper Rivers (See Figure 5.10 for a complete map of South Carolina’s ecoregions.).

The Charleston Harbor estuary is estimated to support “more than 80 species of plants, 250 species of birds, 570 species of invertebrates and finfish and 67 species of mammals” (Charleston Waterkeeper 2014, 1) The estuary and tidal creek corridors are valued by people as well as wildlife, for their scenic beauty, seafood production (fish, shellfish, and crabs), and recreational opportunities (boating, paddleboarding, swimming) among others. They also play an important role in buffering the mainland from tidal inundation and storm surges. Currently at Brittlebank Park, during particularly high tidal events the estuary washes up into the park, pooling in the low areas near the southeast parking lot. Figures 5.11 through 5.13 show the potential effects of high-tide flooding (indicated by the light blue color) at the park after one, two, and three feet of sea level rise, respectively. An approximate park boundary line has been added by the author.

FIGURE 5.11: Flooding at Brittlebank Park After 1’ Sea Level Rise, screenshot from climate-explorer.nemac.org.
FIGURE 5.12: Flooding at Brittlebank Park After 2’ Sea Level Rise, screenshot from climate-explorer.nemac.org.

FIGURE 5.13: Flooding at Brittlebank Park After 3’ Sea Level Rise, screenshot from climate-explorer.nemac.org.
FIGURE 5.14: Site Analysis of Brittlebank Park.

**P4 community**
Park hosts local community events, such as the Southeastern Wildlife Exposition and Walk for Water.

**W4 scale**
Representative organisms benefit from habitat remnants and patches on site, provides some connectivity to adjacent marsh.

**P2 legibility**
Benches and dock signal observation of potential wildlife visitors, and allow visitors to interact with the river.

**W2 affect**
When entering the space, humans may initially frighten wildlife, and humans may harvest fish and crabs from the dock.

**W1 purpose**
Provides tree cover and marsh edge habitat for wildlife, space for observation of wildlife by visitors.

**P1 interaction**
Visitors can play, run, bike, fish in the park.

**W3 adaptivity**
Park’s design and programming primarily maintained for traditional human use, e.g., large areas of lawn for recreation and events.

**P3 engagement**
Patches of trees screen some program elements; boardwalk out to dock contributes to a moderate sense of mystery.
**Analysis of the Site**

The same evaluative rubric which was used to analyze the six case studies was applied to Brittlebank Park as it currently functions. Its score in each category can be read in the dot diagram in the lower left hand corner of Figure 5.14, which describes the park’s attributes in terms of the rubric criteria. Overall, the park scored in the low to middle metrics of the “good for wildlife” categories, and mostly in the middle metrics of the “good for people” categories. While the park does provide some remnant habitat in the form of tree canopy and a thin line of salt marsh, it does not attempt to improve the overall ecologic functioning of the site, as it is maintained primarily for the use of people, and large scale cultural events that require the open space a traditional lawn can provide. Thus, while some wildlife are present at the park, the park does not function primarily as wildlife habitat. In addition to the potential for people to frighten wildlife (such as foraging birds) while they walk along the water’s edge, the other way in which humans can currently interact with animals at Brittlebank Park is to fish for them off the dock—while this is by no means an inherently wrong or even negative affect on wildlife (in the sense of population balance), it does further affirm the current bias in favor of humans which the park maintains. In addressing human engagement, the park scores fairly well; it provides space for a variety of recreational activities, such as running, cycling, playing with pets or on the playground, fishing, and bird-watching. The walk out to the dock provides a “journey” which people can take out to the pavilion, where they can get close to the water and touch it. The trees provide shade and light play in certain areas of the park, creating some sense of mystery, but overall the “journey” within the main park boundary is lacking, as the sidewalks are mostly overgrown, and wind about somewhat
randomly across the lawn. There are a couple of benches at the water’s edge, which may help to direct human attention to wildlife, such as diving brown pelicans, but overall the legibility of a functioning marsh and estuarine ecosystem is lacking, due to the degraded nature of Brittlebank’s marsh edge. Because of the number of social events which are hosted in the park, it scores in the middle metric for Community; however, there is great potential for a more profound and inclusive anthroecologic identity to develop at this site. Figures 5.15 through 5.23 present various views of the park; all photos were taken by the author in May, 2017.

FIGURE 5.15: View of the Marsh and Fishing Pavilion.
FIGURE 5.16: Close-up View of the Marsh, Looking Northeast.

FIGURE 5.17: Shaded Area at South End of the Park.
FIGURE 5.18: Looking Northwest, View of Old Sidewalk.

FIGURE 5.19: Looking Northwest, View of Playground.
FIGURE 5.20: Looking Southeast.

FIGURE 5.21: View of the High Tide Line with Old Sidewalk.
FIGURE 5.22: Off-leash Dog Park at Northwest End of Site.

FIGURE 5.23: View of Marsh at Northwest End of Site.
**Goals and Design**

Analysis of the site’s context, natural and cultural history, and current functioning led to the formation of the following goals for a proposed park design:

- Restore and reinforce wildlife habitat in the park, namely the salt marsh and maritime forest biomes which historically existed on the peninsula.
- Prepare for sea level rise by reinforcing natural buffers to flooding.
- Highlight the salt marsh community for human visitors and integrate public celebratory rituals into the park’s programming.

In achieving these goals, the following objectives were formulated:

- Expand the width of the marsh along the park’s edge to increase habitat resources for wildlife and strengthen the buffer between the river and the landfill.
- Restore a tidal creek similar to those which once penetrated the interior of the park in order to restore habitat for local species, but also mitigate flooding in undesired areas by directing the water into the creek.
- Reinforce the tree canopy cover at the northwest end of the park by planting more native maritime forest species.
- Strengthen the food web and sedimentation processes using an art installation and oyster reef restoration in the intertidal zone of the park.
- Highlight and celebrate the wildlife community that is associated with oyster reefs by creating an experimental art installation and boardwalk extension to the proposed Ashley Riverwalk, which is currently slated to end at the park’s southeast boundary.
FIGURE 5.24: Plan View of Brittlebank Park Proposed.
FIGURE 5.25: Tidal Creek Restoration Detail.
Like the tabby walls, 100 tabby poles will disrupt and disperse wave energy, while also providing substrate for colonizing animals such as oysters.

The flexible rods imitate marsh grass by flexing in the wind, causing turbulence which assists sediment accretion necessary for marsh expansion. They also slow wave action near the marsh edge, where oyster reef development occurs.
FIGURE 5.27: Tabby Wall Installation Detail.
Figures 5.24 through 5.27 illustrate the proposed changes to Brittlebank Park, which are explained in greater depth in this section.

**Maritime Forest Habitat**

The northwest end of Brittlebank Park contains tree cover, mainly native pines and oaks (Figure 5.28). These trees border the tidal creek that forms the park’s northern border, and are contiguous with the trees growing on the small fill peninsula adjacent to the park and the minor league baseball stadium. This peninsula and the surrounding patch of marsh is currently owned by The Citadel-Military College of South Carolina, and hence is also under state jurisdiction. There is an active dredge spoil within the marsh where dredged sediments from the Ashley River channel are displaced. Strengthening the connections between Brittlebank Park and this adjoining parcel would be beneficial for habitat connectivity; this design proposal suggests that managing the high ground of the small fill peninsula along with the northwest end of the current park as a patch of maritime forest would benefit many species of native birds, mammals, and reptiles, and possibly migratory birds which travel along the coast. Additionally, creating a new path through the forest would increase the legibility of this zone of coastal habitat for park visitors. Analyzing this parcel as a potential annexation for the park is an area for future research; if placed under a conservation easement or similar legal structure, this significant patch of marsh could be maintained as an integral link in the corridor of marsh which runs along the western edge of the Charleston peninsula (See Figure 5.29, where the pink line represents the marsh corridor running along the Charleston peninsula’s
western edge, and the large and small yellow circles indicate the location of the Citadel parcel and Brittlebank Park, respectively.

FIGURE 5.28: Tree Cover at the Northwest End of the Park, Lauren Holmer-Boyd, 2017.

FIGURE 5.29: Corridor of Marsh Along Charleston’s Western Edge, diagram by the author, 2017.
Tidal Creek and Salt Marsh Regeneration

Prior to landfill operations in and near Brittlebank Park, the site was occupied by the salt marsh and tidal creeks. The salt marsh primarily consists of smooth cordgrass, *Spartina alterniflora*, which has a broad range of salinity tolerance. Twice a day, the salt marsh is flooded by high-salinity ocean water, nearly covering the cordgrass in the low marsh, and twice a day the cordgrass is left in the open air at low tide (Wiegert and Freeman 1990, 4). While cordgrass prefers lower-salinity environments, it is one of the few plants in the South Carolina marshes that are adapted to living in high-salinity intertidal conditions, allowing it to outcompete other plants in that environment (2). If wave amplitude and duration is too high, however, the cordgrass cannot survive; thus salt marshes are mostly found on the inland side of barrier islands and along estuaries (2).

The productivity of the cordgrass changes with its location in the marsh relative to the tidal creeks that punctuate it. Along the creek banks, the grass is the tallest, as this is where the most sediment deposition occurs. Moving higher into the marsh, there is usually a broader band of cordgrass of an intermediate height; this grass is reached by high tides every day, but only for a few hours. The shortest cordgrass occurs in the high marsh, and only receives one to two hours of tidal inundation in a day (5). The highest edge of the marsh, where tidal inundation doesn’t happen every day, is a variable zone where the plant community composition depends greatly on the interstitial salinity of the soil. Where the salinity is too high, barren “salt pans” occur, inhabited by algae; where the salinity is a little lower, other transitional plants will grow, such as glasswort (*Salicornia* spp.), salt grass (*Distichlis spicata*), and sea oxeye daisy (*Borrichia frutescens*) (6-7).
Smooth cordgrass colonizes open soil by seeding and the spreading of rhizomes (10). Generally the “pluff mud” which characterizes the marsh has a high organic content (from decomposing cordgrass), with parts sand, silt, and clay; the soil in the high marsh has a higher sand content than the low marsh (10). Sediment deposition in the marsh occurs for multiple reasons. First, the submerged stems and leaves of the cordgrass slow the velocity of the water flowing into them, causing sediments to drop out of the water column. Once settled on the substrate, benthic organisms such as algae and bacteria tend to hold the sediments in place; the roots and rhizomes of the cordgrass perform this function as well. Secondly, as the cordgrass stems pivot in the wind, they create turbulence, slowing water velocity and allowing sediments to sink. In addition to the cordgrass, invertebrate animals also affect soil accretion by slowing wave flows, holding soil in place, or filtering detritus that is later deposited as excrement (12). In general, young salt marshes expand both outwards in area and vertically in sediment deposition (9); as they age, marshes are thought to “fill in,” beginning with the inland points of the tidal creeks. This process may eventually move the tide line closer to the water, and allow truly terrestrial plants to colonize the high marsh. However, there are many limiting factors to marsh maturation, including tidal amplitude and growth rates at the marsh/water interface (10).

The design proposal for Brittlebank Park includes the restoration of a tidal creek in the center of the park, with a boardwalk that traverses back and forth over the creek to give multiple views of the various zones within the marsh (refer to Figure 5.25). A floating dock in the widest part of the creek could allow people to get down closer to the water regardless of the tide. Currently, school classes in the Charleston area raise
Spartina alterniflora seedlings to be planted in oyster restoration sites (Jason Ayers [U.S. Fish and Wildlife Service], personal communication). These students and other public volunteers could be involved in the restoration process for the creek, giving the public a sense of ownership for the park, and increasing their knowledge of marsh ecosystem functioning. Soil removed from the marsh could be placed in low lying areas that currently flood so that rain runoff is directed into the creek, improving site drainage. As sea level rises, the marsh could be allowed to naturally expand.

The former use of the site as a landfill raises concerns about pollutants leaching out of the ground, which currently occurs in Gadsen Creek further inland to the east of Lockwood Drive (refer back to Figure 5.8). However, piecing together information both from the old aerial photographs of the landfill and the anecdotal evidence from a neighborhood resident living near the park, it is unclear whether the area directly under the proposed creek actually contains trash, or only fill dirt. At one point the city installed an underground drainage pipe in that same location, temporarily creating a large open hole in the ground; according to one local resident, no trash was visible. To recreate a tidal creek in this space, approximately two feet of dirt would need to be removed for the central channel (See Figure 5.25 for a diagram of the approximate elevations of the tidal creek.). If trash were to be found underneath the site, then a layer of clay could be inserted beneath the introduced marsh soil to prevent trash from moving to the surface. Because smooth cordgrass has relatively short roots (Figure 5.30), spreads laterally by rhizomes, and is already adapted to anaerobic soils, good drainage would not be a limiting factor to its establishment.

Restoring a tidal creek in the park would require active grading and replanting of the site. Reinforcing and growing the marsh along the park/river border, however, could potentially be accomplished by providing artistic infrastructure that facilitates processes of sediment deposition, and slows wave action so that the marsh can expand from the current standing stock. Boats running along waterways such as the Ashley River create wave action that erodes intertidal shorelines. This erosion begins with dislodging oyster reefs that typically form between the marsh edge and the subtidal zone of the water (SC Department of Natural Resources 2013). The design for Brittlebank Park proposes that by providing a buffer between the shoreline of the park and the navigable channel of the river, wave energy could be interrupted and slowed, allowing for increased sedimentation to occur, and oyster reefs to reestablish. Figure 5.24 shows the location of this proposed buffer in plan view, while Figure 5.26 illustrates the installation in detail. The design proposes 100 poles, approximately twelve feet tall and constructed of tabby concrete,
placed along the shore in and just outside the intertidal zone. Randomly positioned, these poles would create interference for wave action, and serve as cultch for oyster spat to colonize on. Additionally, smaller flexible rods installed right at the marsh edge could imitate the movement of cordgrass stems in the wind, creating turbulence that filters sediments out of the water column. These poles and rods would also double as an art installation to arrest human attention and create interest in the ecologic processes at work.

A boardwalk circuit connecting to the proposed Ashley Riverwalk could run among the tabby poles and along the park edge, allowing visitors to view the invertebrate “fouling” communities which build up on the poles at low tide. Volunteers could also be involved in installing bags of oyster shell near the shoreline to provide substrate for oyster spat to establish on; this would catalyze the recolonization of oyster reefs at the marsh edge.

**Tabby Wall Installation**

Figure 5.27 details the final part of the proposed design for Brittlebank Park. Two 115’ long tabby concrete walls, perforated in multiple places along their length, will stand between erosive wave action and the point on shore where landfill pollutants once spilled into the Ashley River, and create an artificial reef on which organisms of the tidal “fouling” community can colonize. “Fouling” organisms are invertebrates, usually sessile, that colonize human structures in the water, such as boats and docks, and thus are often considered a nuisance (Barrier Island… n.d., “Claws and Fouling.” 9). These communities are highly variable in their composition even within a relatively small area, due to their different tolerances of factors such as light, temperature, and exposure during low tide (10). One of the pioneer organisms of this habitat guild is the eastern oyster,
*Crassostrea virginica* (Figure 5.31), an extremely tolerant keystone species (SC Oyster Restoration and Enhancement n.d.) found in the tidal estuaries and creeks of the Lowcountry. Although the oysters can be found in deep water, they mainly inhabit the intertidal zone of the southeastern shore, as their subtidal predators are limited in their own ranges by low salinities and periodic exposure to air (Wiegert and Freeman 1990, 2-3), while oysters can tolerate exposure, salinities from 5-35 ppt, low dissolved oxygen levels, and high turbidity (SCORE n.d.). The eastern oyster forms intertidal reefs on the salt marsh edge and along the creek banks (Figures 5.32 and 5.33); they are considered colonizing organisms as well as “ecosystem engineers” that shape their environment in a significant way (NOAA 2007, 9), providing substrate that stabilizes the soil, disperses wave action, and creates convoluted niches for other organisms to hide in or colonize on (SCORE n.d.).

FIGURE 5.31: Oysters on Dock Post at Brittlebank Park, Lauren Holmer-Boyd, 2017.
FIGURE 5.32: Oysters in Tidal Creek on Northwest Boundary of Brittlebank Park, Lauren Holmer-Boyd, 2017.
Oyster reefs can sustain communities of over 300 different organisms, and they continuously build on their own structure (NOAA 2007, 11). The larvae are free-swimming for several weeks to a couple of months, at which point they settle on a suitable substrate, such as a mature oyster, or another complexly textured surface (7). Once they have cemented themselves to a surface, they remain there, filtering plankton and detritus from the water flowing by. Their extensive filtering capabilities have made them a viable candidate of study for bioremediation use in polluted estuaries and marshes (10).
The proposed tabby walls would support the poles and rods installation in their function of dispersing wave action from boats in the Ashley River channel, and would be positioned to block the small headland extending out from the bank where runoff from the landfill once entered the river (refer back to Figure 5.5). However, they would also provide a frame for park visitors to view the establishment, growth, and adaption of the “fouling” and oyster reef community, which includes bivalves such as oysters and mussels, crustaceans such as barnacles and small crabs, colonial organisms such as algae, sponges, whip coral, and bryozoans, and gastropods such as the Cayenne keyhole limpet snail. Floating docks that follow the movements of the tide would allow people to have multiple experiences with the walls over time and space; the composition of organisms at lower levels of the walls which are always or usually submerged would be revealed for comparison with those higher in the water column. From an ecologic standpoint, the walls could become a public experiment in the colonization preferences of these organisms, including oysters, which once formed reefs of “high relief” that brought the oysters closer to the plankton inhabiting higher regions of the water column, but now maintain a much lower profile due to heavy harvesting by humans (NOAA 2007, 11). Several niches cut into the walls would allow water to flow through at a slower velocity, give fish multiple places to move through the barrier, and provide space directly in the current, with its accompanying flow of detritus, on which filter feeders could establish colonies. Over time, the wildlife community on the walls could potentially be compared to the community building on the restored oyster reefs at the marsh edge, thus giving both scientists and the general public an opportunity to observe the interactions between the same or similar genera and species occurring in two different habitat situations. As more
coastal cities respond to sea level rise and the need for space to accommodate increasing populations, infrastructure that protects against erosion and flooding such as sea walls, piers, dykes, and jetties will also increase, affecting natural ecologic communities on these shores. Studies suggest that these infrastructure cannot effectively replace natural substrates such as rock, and that they are typically dominated by invasive and highly opportunistic species, lowering biodiversity (Airoldi and Bulleri 2011, “Introduction”). More research is needed to understand the effect that high levels of disturbance have on these community compositions, particularly from human causes such as structure maintenance (Airoldi and Bulleri 2011, “Introduction”). Thus, the tabby wall installation could become a sort of living laboratory allowing biologists and ecologists the opportunity to study the ecology of anthropogenic infrastructure.

**Analysis of Brittlebank Park Proposed**

Table 5.1 applies the evaluative rubric to the proposed design for Brittlebank Park. The *Purpose* of the design would be to inform people about the salt marsh and tidal creek community by creating opportunities for wildlife encounters; restore marsh habitat for wildlife, particularly oyster reefs, by increasing processes of sediment deposition; and increasing the buffer between the Ashley River and the park’s underground landfill, thus protecting the local watershed from leachate and garbage contamination, particularly as sea level rises and greater tidal inundation of the shore occurs. The *Effect* which human visitors to the park would have on the local wildlife will vary; in the tidal creek they may scare some wildlife such as birds, but the fouling community on the tabby wall will be little disturbed by human presence. Incorporating local school classrooms and public
volunteers in the restoration of the tidal creek and laying down oyster cultch would allow residents to play an active role in benefitting their local wildlife, and facilitate learning about their regional ecology and biodiversity. If the oyster reef establishment were to reach a stable population dynamic, then having a public oyster roast to celebrate the marsh community could be appropriate, and perhaps become a fundraiser for further restoration efforts. The proposed design would feature *Adaptivity* in the processes of sediment deposition at the marsh edge, maturity of the restored seedlings in the tidal creek, and the invertebrate colonization of the tabby poles and walls. The *Scale* of the installation’s effect would be mainly at the habitat level, as individual organisms would be provided with necessary resources, and the marsh corridor along the peninsula’s west edge would be strengthened. Potentially, the hydrologic system connecting to the ocean would be guarded from the introduction of landfill contaminants, though more research is needed to understand this scenario. The *Interaction* of humans with the installation would be immersive, as they move through different zones of the tidal creek and marsh, and through the art installations, able to touch the grass, water, and oyster shells. *Legibility* of the wildlife would be strengthened by the presence of the long, looming walls displaying the fouling community at low tide, and the paths and boardwalk leading visitors through the various zones of the marsh, creek, and maritime forest. The ecologic processes of plant zonation in the marsh would be made legible as the restored tidal creek grew into maturity; sedimentation would be made legible as the flexible rods at the marsh edge were engulfed by sediments and spreading cordgrass. Interpretive signage could be introduced at various points in the site to further explain details of the project and its objectives. The *Engagement* of people at the site would occur via the “journey” through
the creek, marsh, and intertidal zone, and would be particularly strong at the walls, where
tidal movement would change the position of the floating dock in only a few hours,
giving the invested visitor the chance to stop and watch the wall being unveiled from the
Ashely River with its accompanying wildlife community. Finally, the proposed design
would facilitate the development of an anthroecologic and biophilic Community, where
art also becomes habitat substrate, and people partner with processes of wind and water
to bring biodiversity into the center of the park, while also preparing for a future of
increased daily flooding. Ecologic restoration events and festivals celebrating the
resilience and vigor of the oyster and smooth cordgrass would encourage residents to see
themselves as part of a larger whole, in which they can also participate and share in the
beauty of the world.
TABLE 5.1: Analysis of Brittlebank Park Proposed.

GOOD FOR WILDLIFE: Contributes to Ecosystems

1. **PURPOSE**: How does the installation intend to help wildlife?

   **PASSIVE**
   - Informs About Wildlife
   - Provides Specific Physical Benefit to Wildlife
   - Remediates Regional Ecologic Problem
   - Bring humans into closer contact with local salt marsh wildlife.
   - Restores salt marsh and tidal creek habitat, protects shoreline for oyster reef establishment.
   - Restores degraded marsh buffer, protects landfill from eroding and contaminating the river.

2. **EFFECT**: How do humans affect wildlife via the installation?

   **DISRUPTIVE**
   - Humans Temporarily Disrupt Wildlife Activities
   - Human Presence Neutral/“Leave No Trace”
   - Humans Produce Beneficial Effect or Modification
   - Visitors may initially frighten wildlife in the restored tidal creek.
   - Visitors on the boardwalk will have little impact on fouling community activities.
   - Humans may participate in salt marsh restoration and oyster harvesting.

3. **ADAPTIVITY**: How will the installation interact with the site over time?

   **STATIC**
   - Installation’s Form and Function Static, Inflexible
   - Installation Catalyzes a Needed Change
   - Installation Adapts With Site Ecology Over Time
   - Wall and pole installation will facilitate sedimentation for marsh growth.
   - Tidal creek will change and adapt over time with sea level rise; fouling community will cover installation.

4. **SCALE**: What is the extent of the installation’s impact?

   **ORGANISM**
   - Specific Organism Benefits
   - Habitat/Community Benefits
   - Ecologic Region Benefits
   - Provides substrate for sessile organisms, foraging habitat for mobile animals.
   - Restores functioning oyster reefs and marsh, strengthens connection to adjacent marsh.
   - Ecosystem
**GOOD FOR PEOPLE: Building Awareness of Anthroecologic Community**

1. **INTERACTION**: How do people interact with the installation?

<table>
<thead>
<tr>
<th>DISTANT</th>
<th>Mainly Visual</th>
<th>Immersive, Experiential, Haptic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial, Distant, Indirect</td>
<td>Humans walk through various marsh zones and through the wall and pole installation.</td>
<td></td>
</tr>
</tbody>
</table>

2. **LEGIBILITY**: How well does the installation reveal wildlife?

<table>
<thead>
<tr>
<th>ABSTRUSE</th>
<th>Symbolic Devices Absent or Ambiguous</th>
<th>Symbolic Devices Aid Comprehension of Wildlife</th>
<th>Symbolic Devices Aid Comprehension of Ecologic Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trails/boardwalks with floating docks guide humans into proximity with wildlife.</td>
<td>Interpretive signage informs; floating docks, marsh path display ecologic cycles and zones.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. **ENGAGEMENT**: Does the installation facilitate experiences of complexity/mystery?

<table>
<thead>
<tr>
<th>CERTAINTY</th>
<th>Installation Contains No or Few Elements of Uncertainty</th>
<th>Installation Provokes Moderate Degree of Uncertainty</th>
<th>Installation Provokes High Degree of Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Path screened by marsh grass and poles; floating docks create change and mystery.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. **COMMUNITY**: Does the installation foster community solidarity?

<table>
<thead>
<tr>
<th>INDIVIDUAL</th>
<th>Fosters Human Community</th>
<th>Fosters Anthroecologic Community Through Shared Rituals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individually Experienced, Small Target Audience</td>
<td>Community events will continue in open areas of the park.</td>
<td>Restoration projects, oyster harvesting, citizen science data collection celebrates the marsh.</td>
</tr>
</tbody>
</table>
FIGURE 5.34: Representative Wildlife of the Salt Marsh
CHAPTER 6
CONCLUSION

Discussion of Thesis Inquiry, Methods, and Outcomes

This thesis set out to find ways of designing and shaping the land that would benefit both wildlife and people. It looked at the intersection of art, landscape architecture, and ecology to tease out common goals, and areas of strength which each profession might bring to the table in creating an interspecies space—one where both wildlife and people are welcome, respected, and celebrated. Here in the conclusion, the usefulness of the research methods will be discussed, and areas for future research will be considered.

The evaluative rubric was helpful in creating a framework by which to compare and categorize the case studies. However, there were many “gray areas” in which it was difficult to decide where on a given continuum the case study fit. For example, differentiating “wildlife” from “ecology” was employed as a way to determine whether the case study was having any significant impact in the greater system of which it was partaking. However, there is an inherent difficulty in separating out the parts (wildlife) from the whole (ecology). It is not easy—in fact, it might be impossible—to tell whether and how improving the situation of an individual or small group will eventually affect the workings of the larger system. For example, in the case of the Bat House, the installation was graded as only benefitting a small group of animals, two common species of bats.
Had the bats been endangered keystone species, the installation would probably have scored higher in at least two criteria, *Purpose* and *Scale*. But in a sense, maintaining any link in the food web, even a peripheral one, is still a benefit to the network as a whole; as John Muir famously said: “When we try to pick out anything by itself, we find it hitched to everything else in the universe.” Nevertheless, for the practical purposes of comparing six case studies, the rubric had to make various distinctions, and thus there was some subjectivity on the part of the author involved in deciding where and when that distinction was made. In an attempt to mitigate this difficulty, both *Purpose* and *Scale* were kept as separate criteria, even though most installations that scored high in one also scored high in the other; the reason for this was that if an installation didn’t intend (*Purpose*) to remediate an ecologic scale problem, but did indirectly, it would still be able to score well under *Scale*. Conversely, if an installation did intend to remediate an ecologic problem, but for all intents and purposes did not successfully do so, then it could still receive credit in the *Purpose* category, but score lower under *Scale*. This was somewhat the case with *Amphibious Architecture*, which introduced the toxin-binding fish food at the installation, potentially an ecosystem-scale bioremediation effort to combat river pollutants; however, the project was a small-scale prototype of a longer-term effort by the artists and engineers, and the food allegedly was given to passers-by by the artists only at certain times; hence the effort was not widespread. Similarly, in the proposed design for Brittlebank Park, the intentions were to address the ecologic problems of degraded marsh on the Charleston peninsula, and potential landfill leachate entering the Ashley River, but in actuality the proposed solutions would have a highly localized impact in the region.
The “good for people” section of the rubric was also somewhat difficult to score objectively. Even in the Engagement category, which was based in part off Gimblett et al.’s 1985 study of what people find mysterious about a landscape, it was not always obvious how a given case study fit their descriptions, which were all based off photographs of rural Ontario, Canada (89). The general principles of what they discovered could be extrapolated for use in examining the six case studies, but once again, some subjectivity was involved in deciding what installations were “moderately mysterious” or “highly mysterious.” Perhaps the criteria would be more effective with more specific measurements under each metric, yet this in some ways would also have made the rubric less informative, as the rubric’s true function was to reveal unique and creative ways of addressing the criteria. In the end, finding creative and effective strategies for enhancing both nature and culture was the goal, and in this sense, the rubric served to give some organizing framework for those strategies and what they were accomplishing. Applying the rubric to the chosen site, Brittlebank Park, was helpful in identifying areas of potential improvement and setting goals that were balanced in serving both natural and cultural agendas.

There are many areas for future research which arose out of this thesis inquiry. This thesis could not satisfactorily answer questions about the integration of large predators into human cultural space. Large mammals such as bears and wolves are feared by many people, and bears have certainly been known to become a nuisance and danger in urban areas. How to share space with these wildlife successfully is a difficult challenge indeed, and would probably require a great deal more tolerance and accommodation of these animals from the general public than would currently be granted.
Another idea which emerged from this project was that of choosing a charismatic species to be the “poster-child” of an eco-revelatory type installation. Like the World Wildlife Fund’s panda, perhaps communities could create public traction and support for wildlife by rallying around a specific species that appeals to most people. In the case of the proposed design for Brittlebank Park, the oyster was chosen as a species of focus, not only because it is a keystone species that has a high tolerance for the degraded environmental conditions found in an urbanized location, but also because it is a culinary symbol of the Charleston Lowcountry and has immense cultural importance. However, one possible danger of focusing attention on a few animals in order to subtly save a number of less obvious species along with them, is that in doing so, we fail to affirm to the general public that it is not, in fact, just a few species that are important, but all of them. Biodiversity is important, and often the most necessary—and numerous—organisms in an ecosystem are the ones that we cannot see, or don’t prefer to. A paradigm shift in our relationship with nature would require that we see nature as it really is, including the bacteria, fungi, insects, worms, and reptiles that many people find distasteful.

A third idea for future inquiry is stretching the parameters of art from a site to a region. The majority of the case studies were at a scale which could be visually taken in at one time, except for Owens Lake Trails. But even at Owens Lake, the land art was clustered in one place, while the trails and restored habitat encompassed a greater space. Could larger-scale land art, such as Christo and Jeanne-Claude’s Running Fence or even Surrounded Islands, be the beginnings of regional art endeavors that benefit nature instead of disrupt it? As art expands its definitions beyond physical objects to concepts
and systems of inquiry, one can imagine a work of art that is able to transcend physical distance, or physicality at all, to achieve ecologic goals. However, an endeavor at this scale would require an acute sensitivity to the complexities of the landscape matrix and the collective movements of species across and within it.

Finally, there is more research to be done on the role of landscape architects in what might be called anthroecologic design, or design that accepts that humans have made irreversible changes to ecology, and that moving forward will require learning to balance our needs with those of other species, and, hopefully, learning to give back—to contribute positively to ecosystems instead of simply trying to get by with the least damage possible. Erle Ellis (2015) has stated that “the ultimate causes of human transformation of the biosphere are inherently social and cultural, not biological, chemical, or physical” (321). If this is true, then in moving forward, agents of cultural change will be necessary partners to ecologists and biologists in shifting the paradigms of human interaction with the nonhuman world. There will be a place for artists here to intuit truths, push the boundaries of what is accepted knowledge, and try out new ideas; where these ideas involve ecology, then scientists may rigorously test these ideas to see if they hold up against statistical measurement and objective observations in settings with limited variables. Perhaps it will sometimes be the role of the landscape architect to actually be the artist, or be the scientist, or both, or sometimes just the orchestrator. And finally, it will be the role of landscape architects to synthesize the truths from both these disciplines—to apply them in large scale planning, and in small plazas, to glean the most creative, and most truthful, ideas and bring them out of obscurity into the places where they can solve a problem—which is exactly what good design does.
**Final Thoughts**

This thesis developed out of a question about zoos: is there a better way to bring people into contact with animals? For some of us, going to the zoo is a bittersweet activity—we love to see the magnificence of an elephant up close, yet we also know that this magnificence is a mere fraction of what it could be if the elephant were able to truly be an elephant. In addition to questions of morality and animal rights, at the zoo we are faced with the reality that what we are seeing is an illusion—an artificial representation of the beauty that is a living organism. In a more scientific sense, zoos present an inaccurate picture of ecology and how it works, as only the cutest and most iconic animals, usually those at the narrow top of the trophic pyramid, make it into the displays or are given any notable attention. In a zoo, the animals are like artwork in a gallery—we see them as the zoo curators want them to be seen. The signage, the shows, the habitat designs—all is meant to give us a particular picture of the animals. It could be argued that this is a valid endeavor; individual animals for the most part act very similarly within their species—eating and hunting the same way as their counterparts, for example—and to educate the public on their life histories is helpful. Yet this is still not the same as experiencing an animal in its purest form, as itself, in the wild, reacting to a specific set of environmental conditions and circumstances, including, even, our human presence. In a zoo, animals, like paintings, can also be “presented as objects offered for distanced contemplation,” as Xin Wu (2013) noted of gallery art (6). This distance does not make us feel closer to the animals; it does not satisfy our biophilia. As Jeffrey Masson and Susan McCarthy (1995) have pointed out, “In zoos, visitor after visitor remarks on the
apparent boredom of so many of the animals. Many people express a sense of unease, an understanding of how they would feel under such circumstances” (123).

Perhaps, much as art moved out of the gallery and into public space, it is time for wildlife to be brought out of the zoo. More to the point, perhaps we simply need to change our perspective, and realize that the whole world *is* a zoo already—a gallery of moving, breathing life forms. Such a perspective wouldn’t fully address human motivations for going to the zoo, i.e., seeing exotic animals like tigers that aren’t native to the United States. But perhaps over time, an increased feeling of connectivity to one’s local wildlife and regional ecology would bolster a more developed wildlife ethic, and the desire, even need, for zoos might naturally decrease. Perhaps concurrently, an increase in ecotourism ventures as a means for preserving natural areas around the world will open up new and increased opportunities for the average person to travel to the actual habitats of these animals and see them where they belong, supporting local human cultures along the way.
BIBLIOGRAPHY


APPENDIX A

ATTRIBUTIONS FOR PHOTOS IN DIAGRAMMTIC FIGURES

Figure 2.5

Bobcat: Calero Creek Trail Bobcat, Don DeBold, 2007, downloaded from Wikimedia Commons.

Figure 3.22


Figure 3.27

Alligator: “An American Alligator (One of two) in captivity at the Columbus Zoo, Powell, Ohio,” by user Postdlf, 2006, downloaded from Wikimedia Commons.

Little Blue Heron: “A Little Blue Heron in Cananeia, Sao Paulo, Brazil,” Dario Sanches, 2010, downloaded from Wikimedia Commons.


**Figure 3.33**

Phone with Text Message: Chris Woebken, downloaded from http://chriswoebken.com/AMPHIBIOUS-ARCHITECTURE.


**Figure 3.39**


Soprano Pipistrelle (Resting): Evgeniy Yakhontov, 2009, downloaded from Wikipedia.

Figure 3.45

Western Pond Turtle: Yathin S. Krishnappa, 2009, downloaded from Wikipedia.


Figure 3.50

Plaza: Courtesy of NUVIS Landscape Architecture.


Figure 5.8

Map: Esri/ArcGIS.

Figure 5.9

Map: Esri/ArcGIS.

Figure 5.14

Figure 5.14

Map: Esri/ArcGIS, Google.

Figure 5.27


Sea Whip Coral: “Figure 1. *Leptogorgia virgulata* in situ, whole colony,” downloaded from *South Carolina Department of Natural Resources*, http://www.dnr.sc.gov/marine/sertc/octocoral%20guide/Leptogorgia_virgulata.htm.

Sea Lettuce: Philippe Bourjon, 2016, downloaded from *Wikimedia Commons*. 

Sea Grape Tunicate: Melissa Frey, downloaded from https://invasions.si.edu/nemesis/calnemo/SpeciesSummary.jsp?TSN=159557.


**Figure 5.34**

Raccoon: “Raccoon crossing a road in Loxahatchee nature refuge, Florida,” by user Korall, downloaded from *Wikimedia Commons*.

Gray Fox: Virginia State Parks, 2007, downloaded from *Wikimedia Commons*.

Eastern Mud Turtle: LA Dawson, 2006, downloaded from *Wikimedia Commons*.

Diamondback Terrapin: “Malaclemys terrapin,” J.D. Willson, downloaded from *Wikimedia Commons*.


White Ibis: By user Themassiah, 2012, downloaded from *Wikimedia Commons*.

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Great Blue Heron: “Great blue heron flying on Lac Noir, Saguenay-Lac-Saint-Jean, Quebec, Canada,” Laurent Silvani, 2017, downloaded from *Wikimedia Commons*.


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Blue Crab: Southeast Regional Taxonomic Center, South Carolina Department of Natural Resources, downloaded from http://www.dnr.sc.gov/marine/sertc/gallery.htm.

Stone Crab: Andrea Westmoreland, 2009, downloaded from *Wikimedia Commons*.