TRAVERSING URBAN "WILDLANDS": AN INTERVENTION WITHIN THE UNIQUE PLANT COMMUNITIES OF LIBERTY STATE PARK

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ABSTRACT OF THE THESIS

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This project considers the urban "wildland" as an opportunity to provide residents in cities with access to self-organizing nature. The 250-acre interior portion of Liberty State Park in Jersey City is a spontaneously vegetated site where the railyard for the Central Railroad of New Jersey was once located. This thesis explores what non-traditional design strategies can be implemented on a post-industrial site that has been colonized by unique plant communities. Research on fourth-nature, post-industrial landscapes, and urban ecology reveals the complexities involved with urban landscapes. Such landscapes are highly disturbed by humans and are often contaminated. A design is proposed that considers the current conditions of the site as well as how the site has transformed over time. The design consists of an educational trail that allows users to enter and experience the site and provides opportunities for people to learn about urban ecology and interact with urban nature. Several destinations exist along the trail where users can learn about the landscape. Overall, the project explores the various possibilities that can be realized within unique plant communities.

Acknowledgements

I would like to deeply thank my thesis advisor, Frank Gallagher, for all his encouragement, support, and guidance throughout this process. He has opened a whole new world to me through his vast knowledge and understanding of urban ecology. His devotion to his research and to Liberty State Park has been a true inspiration and I am thankful to have had the opportunity to learn about the park in such an in-depth way. His care and compassion show through his dedication to his students. I would also like to thank my committee members, Holly Nelson and Arianna Lindberg. Both have offered insight and support and provided new perspectives to the project. Thank you to all the faculty of the Rutgers University Landscape Architecture department for providing me with so many opportunities and guiding me through my coursework.

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Introduction

The environmental degradation that occurred during the Industrial Revolution, as well as in recent history, is a direct result of industrial practices. Degradation of the landscape has negative ecological, economic, social, and cultural impacts. When natural resources are depleted, and soil, water, and air become contaminated, the landscape loses value and even becomes a hazardous environment. The human population continues to grow and cities, where industrial practices often exist, are expanding. There is an increasing proportion of the population living in urban areas.[1] Such a trajectory has caught the attention of various disciplines, such as landscape architecture, ecology, and forestry, as the problematic flux of disturbed spaces degrades the overall landscape composition.

At a time where pollution and contamination have become ever-present within the landscape, and climate change is fundamentally altering the environment at an irrevocable rate, there is an unavoidable need to develop new and innovative design strategies for post-industrial landscapes. This thesis explores non-traditional strategies for the redesign of such landscapes through a case study analysis of a brownfield located within Liberty State Park in Jersey City, New Jersey.

[1] United Nations Department of Economic and Social Affairs/Population Division, "World Urbanization Prospects: The 2011 Revision," *Economic and Social Affairs* (2011): 4, accessed Feb. 16, 2019, http://www.un.org/en/development/desa/population/publications/pdf/urbanization/WUP2011_Report.pdf.

Background

Post-Industrial Landscapes

Industry often leaves a legacy of contamination. Post-industrial sites can be considered some of the most degraded places because of the extent of ecological destruction. The hazardous state of contaminated landscapes yields an obvious need for stabilization and remediation. Most of the time, these polluted and degraded landscapes are in advantageous places, such as along waterfronts or near city centers.[2] Post-industrial landscapes exist in urban areas where art, history, and culture are rich. Addressing such spaces is an investment in the cities where they exist and can create a better environment for residents and community members. By addressing post-industrial landscapes, it is possible to both mitigate contamination and investigate ways to make the site more user-friendly.

How do we alter post-industrial landscapes in a way that allows such spaces to reach their fullest potential? How do we do so with resiliency? When a post-industrial landscape is abandoned, ecological and social possibilities are often overlooked. There is potential to restore these landscapes and give them a new purpose within their surrounding urban environments. Addressing a post-industrial landscape through design strategies can not only combat the contamination that exists but can also be the platform for innovative landscape experiences for residents and visitors.

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[2] Luís Loures, "Post-industrial landscapes as drivers for urban redevelopment: Public versus expert perspectives towards the benefits and barriers of the reuse of post-industrial sites in urban areas," *Habitat International* 45 (2015): 72, accessed Feb.16, 2019, https://www.sciencedirect.com/science/article/pii/S0197397514001040?via%3Dihub.

Fourth Nature

Fig. 1: A novel urban woodland that has developed spontaneously in Germany. Source: Ingo Kowarik, "Cities and Wilderness: A New Perspective," *International Journal of Wilderness* 19, no. 3, (2013): 35, accessed Feb. 16, 2019, https://www.researchgate.net/publication/259389620_Cities_and_wilderness_A_new_perspective.

Fig. 2: A novel urban woodland that has developed spontaneously in Liberty State Park. Source: Photo taken by author (2018).

When considering the opportunities of post-industrial landscapes, it is first critical to interpret the existing features. Because industry alters and may even eliminate nature, restoration efforts often attempt to bring natural elements back. This can be accomplished by replacing contaminated soil with clean soil and then establishing plantings to increase vegetation. But, absent of human intervention, post-industrial sites undergo a unique landscape transformation, through the colonization of spontaneous vegetation. The vegetation composition that arises, though often dominated by non-native species, contributes to the overall biodiversity of the area and can lead to the rise of woodlands.[3] Figure 1 and Figure 2 show examples of such urban woodlands. Figure 1 shows a photo taken in Berlin by Ingo Kowarik, a German forester and professor at Technische

[3] Ingo Kowarik, "Cities and Wilderness: A New Perspective," *International Journal of Wilderness* 19, no. 3, (2013): 32-36, accessed Feb. 16, 2019, https://www.researchgate.net/publication/259389620_Cities_and_wilderness_A_new_perspective.

Universität Berlin. Figure 2 shows the vegetation at Liberty State Park. The similarity in the photos show that metropolitan species tend to be similar regardless of location.

Defining spontaneous vegetation is critical in order to understand its composition as well as its role in a post-industrial landscape. Though spontaneous vegetation formulates without intentional human influences, its existence begins after significant human disturbance. As stated by David Seiter in his book, "Spontaneous Urban Plants," "Landscape architecture as a discipline and profession continually explores the historical relationship between artifice and nature, or the constructed object and the vast landscape".[4] Spontaneous vegetation can be analyzed through the lens of the four natures.

The idea of the first three natures was originally introduced in the Renaissance and, "represents the unfolding layers of space between the artificial and wild – each layer incorporating a different level of human intervention".[5] There have been several interpretations of the definitions of the first three natures, as well as the newest "fourth-nature" term. In his book, "Greater Perfections: the Practice of Garden Theory", John Dixon Hunt, a landscape architecture historian, writes of, "'a series of differentiated natures,' often horizontally juxtaposed in space, that have been used to understand our relationship to nature".[6] First nature was a world before humans.[7] According to Hunt, the Roman writer Cicero wrote of a second nature, or the cultural landscape, defined by agriculture.[8] In sixteenth-century Italy, the art of gardening led to various commentators,

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[4] David Seiter, *Spontaneous Urban Plants: Weeds in NYC* (New York: Archer, 2016), 23.
[5] Ibid.
[6] Ibid.
[7] "Biodiversity and the Fourth Nature," *Landscape Architects Association*, accessed Feb. 16, 2019, http://www.landscapearchitecture.org.uk/theory-of-landscape-architecture/biodiversity-the-sixth-extinction-and-the-fourth-nature/.
[8] Ibid.

one of them Jacopo Bonfadio, writing of gardens being "'nature incorporated with art'", and the term third nature emerged.[9] In short, the three categories of nature are described with, "'first nature' being wilderness, 'second nature' being the cultivated landscape, and 'third nature' being the garden, a combination of nature and culture".[10] The first, second, and third natures are further described within Seiter's book:

> *First nature* came to represent the wilderness – unreachable and sacred. Represented in landscape paintings far off in the distance, *first nature* is an inaccessible landscape, like the mountaintop or the moon. First nature is best represented by places that were revered for their absence of humans and therefore held the projections of people's hopes and dreams. It was an unknown nature where the mysterious and the sacred became intertwined.
>
> *Second nature* was the cultivated landscape of known lands, paths, and small-scale agricultural fields. It was the nature historically beyond the walls of the site used for agricultural or other productive landscape purposes. In hunter-gather societies, this was perhaps the known territory of walked paths along which berries and nuts were picked.
>
> *Third nature* was the manicured gardens surrounding an architectural intervention – an art form blending landscape and culture. Within the walled enclosure, this tended and tidy nature was found in the formal gardens of estates and castles. Highly visible, these gardens became an extension of architectural program, offering places for rest and leisure while at the same time being articulated forms of cultural expression.[11]

The terms first, second, and third nature show a progression between the interactions of humans with nature. They are transformational stages of pristine landscapes, each variation stepping further and further away from "untouched" nature.[12] Though Hunt's

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[9] Ibid.
[10] Lola Sheppard, "1-2-3…Fourth Nature?", ParadoXcity Studio Venice, accessed Feb. 16, 2019, https://pages.shanti.virginia.edu/Venice_11Sp_ALAR/resources/1-2-3-fourth-nature/.
[11] David Seiter, *Spontaneous Urban Plants: Weeds in NYC* (New York: Archer, 2016), 23.
[12] Ingo Kowarik, "Cities and Wilderness: A New Perspective," *International Journal of Wilderness* 19, no. 3, (2013): 32-36, accessed Feb. 16, 2019, https://www.researchgate.net/publication/259389620_Cities_and_wilderness_A_new_perspective.

historical references and definitions of the first three natures is well documented among various authors, it is the definition of fourth-nature that has various interpretations.

Types of Forests	*Types of Ecosystem*	*Types of "Nature"*
Remnants of pristine forests	Pristine ecosystems	Nature 1: "old wilderness"
Forests characterised by human management/planting	Ecosystems shaped by forestry and agriculture	Nature 2: "traditional cultural landscape"
Planted tree stands in green spaces such as parks	Ecosystems established by urban planning	Nature 3: "functional greening"
Woodland succession on urban industrial sites	Ecosystems evolved naturally on urban industrial sites	Nature 4: "new wilderness"

Fig. 3: Brown's chart describing Kowarik's definitions of the four natures. Source: Mark Brown, "Nature of the Fourth Kind: Berlin," *City Livability* (blog), Aug. 22, 2013, https://www.citinature.org/city-livability-blog/nature-of-the-fourth-kind-berlin.

According to Ingo Kowarik, fourth-nature emerges spontaneously as a novel urban green space on vacant lots or other urban-industrial sites and develops towards wild urban woodlands.[13] Author Mark Brown explains fourth-nature as polluted, urban areas that have been naturally colonized by plant species and defines it as a "new wilderness".[14] Figure 3 shows a chart Brown created after learning about Kowarik's interpretations of the four natures. As explained by Seiter, the term fourth-nature is used to include the post-industrial landscape, altered and degraded by human presence, within previous definitions of nature.[15] The Landscape Architects Association recognizes habitat creation by landscape architects for ecological reasons as the creation of fourth-nature, dating from the second half of the twenty-first century.[16] Professor Lola

[13] Ibid.
[14] Mark Brown, "Nature of the Fourth Kind: Berlin," *City Livability* (blog), Aug. 22, 2013, https://www.citinature.org/city-livability-blog/nature-of-the-fourth-kind-berlin.
[15] David Seiter, *Spontaneous Urban Plants: Weeds in NYC* (New York: Archer, 2016), 24.
[16] "Biodiversity and the Fourth Nature," *Landscape Architects Association*, accessed Feb. 16, 2019, http://www.landscapearchitecture.org.uk/theory-of-landscape-architecture/biodiversity-the-sixth-extinction-and-the-fourth-nature/.

Sheppard perceives fourth-nature as mutant environments which fuse natural and artificial.[17] She explains that, "the boundaries of built and unbuilt, mediated and natural are growing ever more complex and ambiguous".[18] Each of these definitions vary and affect our understanding of what fourth-nature is and how it relates to post-industrial landscapes. Although there are numerous definitions, we consider here that the spontaneous vegetation that accumulates on post-industrial sites can be considered an aspect of fourth-nature, a natural system formulated after extensive human disturbance. When spontaneous vegetation grows and various plant communities, such as grasslands and woodlands, begin to formulate, an urban "wildland" emerges.

Understanding Nature

When considering fourth-nature, it is critical to also consider the definition of nature itself. One of two perspectives can be used to define naturalness.[19] The first is, "by a reference to historical benchmarks (pristine landscapes virtually untouched by humans)", and the second is, "relying on a high level of self-organization of ecosystems that may be achieved even after human-mediated, nonreversible shifts in environmental conditions".[20] It is vital to recognize this distinction when considering the role and value of spontaneous vegetation on post-industrial landscapes. When relying on historical benchmarks for defining naturalness and wilderness, it is likely that a higher valuation

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[17] Lola Sheppard, "1-2-3…Fourth Nature?", ParadoXcity Studio Venice, accessed Feb. 16, 2019, https://pages.shanti.virginia.edu/Venice_11Sp_ALAR/resources/1-2-3-fourth-nature/.
[18] Ibid.
[19] Ingo Kowarik, "Cities and Wilderness: A New Perspective," *International Journal of Wilderness* 19, no. 3, (2013): 32-36, accessed Feb. 16, 2019, https://www.researchgate.net/publication/259389620_Cities_and_wilderness_A_new_perspective.
[20] Ibid., 32.

would be assigned to historical ecosystems, especially by conservationists.[21] This approach is logical, considering the rare and endangered species that often appear in historical ecosystems.[22] However, urban ecosystems that can achieve a high level of self-organization provide opportunities for people living in an urban environment to experience natural processes in their own neighborhoods.[23] Therefore, though there are vast differences between urban and non-urban ecosystems, between pristine woodlands and urban woodlands, within the urban framework such environments are valuable and contribute to the overall biodiversity of the area. It can also be argued that what is defined as a pristine first nature, untouched by humans, no longer exists. For example, the amount of carbon dioxide in our environment is so high and pervasive that is has affected all of nature, wherever it may lie within the framework of the landscape.[24] Carbon dioxide has affected plants everywhere and has created new growing conditions.[25]

Since the 1990s, an ideology called the "Four Natures Approach" has promoted the concept that all green space within the urban context can be considered as part of the ecology of the area.[26] The "Four Natures Approach" has been promoted as a conceptual framework to structure and communicate the variety of green spaces within urban areas, without the assignment of a value.[27] Kowarik explains how all four natures appear in an urban context, differing in terms of landscape legacies, human interventions, and

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[21] Ibid., 32-36.
[22] Ibid., 32-36.
[23] Ibid., 32-36.
[24] David Seiter, *Spontaneous Urban Plants: Weeds in NYC* (New York: Archer, 2016), 17.
[25] Ibid.
[26] Ingo Kowarik, "Cities and Wilderness: A New Perspective," *International Journal of Wilderness* 19, no. 3, (2013): 32-36, accessed Feb. 16, 2019, https://www.researchgate.net/publication/259389620_Cities_and_wilderness_A_new_perspective.
[27] Ibid.

environmental characteristics.[28] In the context of urban landscapes, nature of the first kind is old-growth forests that exist on the urban fringe.[29] Nature of the second kind are fields, hedges, and grasslands found in the urban periphery.[30] Nature of the third kind covers urban green spaces such as gardens, parks, or graveyards.[31] Finally, nature of the fourth kind emerges spontaneously as a novel urban green space on vacant lots or urban-industrial sites.[32] Such an approach, using the terminology of four natures, allows urban planners to understand the framework of nature within a city and establishes an equal value on all types of natures, whether it be a row of street trees or a patch of phragmites.

Urban Ecology – Perceptions, Benefits, and Strategies

The positive effects of nature on people, both physically and psychologically, has been well-documented, especially when it comes to the urban environment. As outlined by Kowarik, the spontaneous vegetation that pervades vacant wastelands can contribute to the overall presence of nature in an urban landscape.[33] However, nature of the fourth kind within the fabric of a city may not be perceived as beneficial. As stated by Kowarik, "habitats comprising the fourth kind represent the greatest distance from historical benchmarks in terms of soils, hydrology, or species assemblages".[34] Also, fourth-nature sites often exhibit high numbers of non-native plant species.[35] These factors are viewed as problematic, especially because native versus non-native species distinctions have

[28] Ibid.
[29] Ibid.
[30] Ibid.
[31] Ibid.
[32] Ibid.
[33] Ibid.
[34] Ibid., 33.
[35] Ibid, 32-36.

been a guiding principle in most conservation and restoration management efforts.[36] As stated by Davis, "Over the past few decades, 'non-native species have been vilified for displacing 'native' species decreasing biodiversity and generally polluting 'natural' environments".[37] Such characterizations have contributed to an overarching bias towards non-native species, species which tend to inhibit post-industrial sites.[38] In addition, there are supposed aesthetic issues when it comes to spontaneous urban vegetation.[39] What looks unkempt to one person can be viewed as natural and robust to another.[40] Most people refer to spontaneous urban vegetation as "weeds", a term with no biological meaning.[41] Such perceptions can lead to a misunderstanding and even condemnation of fourth-nature landscapes.

However, the plants that grow spontaneously in urban areas, whether native or non-native, perform important ecological functions, and contribute to the urban ecology.[42] Environmental services of urban vegetation include, "excess nutrient absorption in wetlands, heat reduction in paved areas, erosion control, soil and air pollution tolerance and remediation, food and habitat for wildlife, and food and medicine for people…".[43] Also, fourth-nature can be viewed as a way to mitigate the impacts of the Sixth Extinction, by offering a way to increase biodiversity in places where habitat

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[36] Mark A. Davis et. al, "Don't judge a species on their origins," *Nature* 474 (2011): 153, accessed Feb. 16, 2019, https://doi.org/10.1038/474153a.
[37] Ibid.
[38] Ibid., 153-154.
[39] Peter Del Tredici, "The Flora of the Future," *Places Journal* (2014), accessed Feb. 16, 2019, https://doi.org/10.22269/140417.
[40] Ibid.
[41] Ibid.
[42] Ibid.
[43] Ibid.

was lost.[44] An urban woodland is more biodiverse than a traditional "middle landscape", which is so often inserted into our urban and suburban areas.[45] Also, the presence of vegetation on post-industrial landscapes can serve in the remediation process. Despite contamination, soil organisms and plant communities can thrive in post-industrial landscapes.[46] In some cases, the plants can even stabilize the contaminants, or help in the remediation process.[47] Phytoremediation and/or phytostabilization can benefit the land and is made possible with emergent plant species. Lastly, spontaneous vegetation can eventually become woodlands within an urban environment, which provides people with access to nature and can have health and educational benefits.

While the emergent vegetation of post-industrial landscapes can offer ecosystem services it is important to understand the risk associated with soil contamination. The traditional method for remediating soil contamination is to cap the soil or remove it and replace it with clean soil. Although this method tends to be successful, it may not be the most sustainable approach for all sites. According to Rutgers University professor Frank Gallagher and his colleagues:

> Managers of sites within the urban context should consider the role that naturally assembled urban wildlands can play in contaminant stabilization before prescribing a traditional species mix based upon traditional concepts of diversity and accepted trajectories.[48]

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[44] "Biodiversity and the Fourth Nature," *Landscape Architects Association*, accessed Feb. 16, 2019, http://www.landscapearchitecture.org.uk/theory-of-landscape-architecture/biodiversity-the-sixth-extinction-and-the-fourth-nature/.

[45] Ibid.

[46] Jennifer Adams Krumins et. al, "Plant-soil interactions in metal contaminated soils," *Soil Biology and Biochemistry* 80, (2015): 224-231, accessed Feb. 16, 2019, https://doi.org/10.1016/j.soilbio.2014.10.011.

[47] Ibid.

[48] Frank J. Gallagher et. al, "Altered vegetative assemblage trajectories within an urban brownfield," *Environmental Pollution* 159, no. 5 (2011): 1165, accessed Feb. 16, 2019, https://doi.org/10.1016/j.envpol.2011.02.007.

This strategy recognizes the benefits of urban woodlands and proposes leaving such landscapes to progress on their own as a viable way to remediate the site. When spontaneous vegetation, and consequently urban woodlands, are accepted as part of the ecological framework of urban landscapes, and their benefits are communicated, there is an opportunity to enhance quality of life for people as well as other natural organisms. New design techniques that consider the unique qualities of fourth-nature can support urban ecologies.

Liberty State Park

Fig. 4: Major cities around Liberty State Park. Source of satellite image: Google Earth 2018.

Liberty State Park is a post-industrial landscape located in Jersey City, New Jersey. The park is in the center of several major cities, as shown in Figure 4. The site itself is in Jersey City, but it is in very close proximity to New York. It consists of 1,122-

acres on the west bank of the Upper New York Bay, at the river mouth of the Hudson River and the Atlantic Ocean .[49] It is in direct proximity to New York City's lower Manhattan, the Statue of Liberty, and Ellis Island, as shown in Figure 5.[50] The area previously served as the rail yard for the Central Railroad of New Jersey, until bankruptcy in 1967.[51] Today, Liberty State Park is highly visited and is the only urban park in New Jersey's state parks system.[52] It provides remarkable views and as well as the opportunity to enjoy nature in one of the most heavily urbanized areas in the world.[53] More than four million people visit the park each year.[54] 600,000 visitors travel from around the globe, passing through the park on their way to the Statue of Liberty and Ellis

Fig. 5: Views of the Statue of Liberty, Ellis Island, and the Manhattan skyline. Source: Photos taken by author (2017).

[49] U.S. Army Corps of Engineers New York District, "Liberty State Park Environmental Resources Inventory," *Hudson-Raritan Estuary Environmental Restoration Study* (2004): 2.
[50] Ibid.
[51] Ibid., 2-3.
[52] Department of Environmental Protection, "The Future of Liberty State Park: Creating a World Class Destination," *NJ.gov*: 1-2, accessed Feb. 16, 2019, *http://www.state.nj.us/dep/sustainableparks/docs/dep-lsp-report.pdf*.
[53] Ibid.
[54] Ibid.

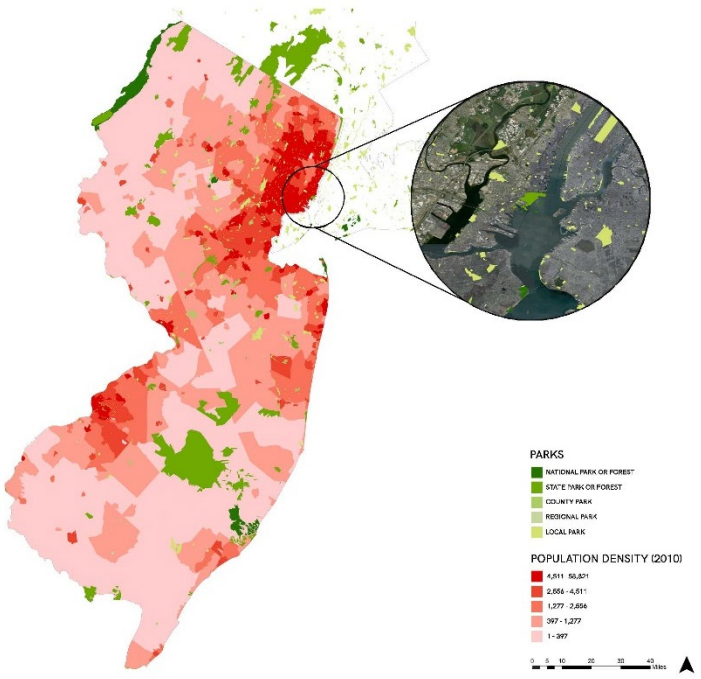

Fig. 6: Map of parks and population density in New Jersey. Source of GIS data: Department of Environmental Protection: Bureau of GIS, https://www.nj.gov/dep/gis/listall.html.

Island.[55] Another 600,000 visit the Liberty Science Center, an interactive science museum and learning center just beyond the park.[56] Visitors also include residents of Jersey City, who use the park scape in their daily lives. The combined direct and indirect value of both the social and ecological services provided by the park have been estimated at approximately $400 million per year.[57] When considering Liberty State Park in relation to the state of New Jersey, it is a relatively large state park located in one of the most densely populated areas of New Jersey. Figure 6 shows the population density of New Jersey as well as the location of the parks in New Jersey.

Contrasted to the areas along the waterfront of the park that have already been developed and are currently being utilized, the interior part of the park remains restricted from public use. Figure 7 shows one of the signs that hangs on the fence surrounding the interior. Its restriction, and its lack of development, are a result of the presence of

[55] Ibid.
[56] Ibid.
[57] Esther Rose-Wilen et. al, "The Valuation of Open Space in an Urban Context: A Case Study Using an Urban Park," *Landscape and Urban Planning*, (2019). In Review.

Fig. 7: Sign that currently hangs from the fence surrounding the park's interior. Source: Photo taken by author (2017).

hydrocarbons, pesticide, and metals.[58] However, the interior's abandonment has allowed for the development of spontaneous vegetation. Having been undisturbed for nearly 50 years, an urban "wildland" comprising novel assemblages has established itself at Liberty State Park. Such a space is characteristic of a fourth-nature landscape. Figure 8 shows an aerial of the park and a diagram outlining the park's boundary. The dark green portion is the interior of the park. There are several elements outlined within the interior and these are proposed restoration elements by the U.S. Army Corps of Engineers. They include a berm, two freshwater wetlands, and a salt marsh. Although these elements are not yet on the site, they will be incorporated in the near future.

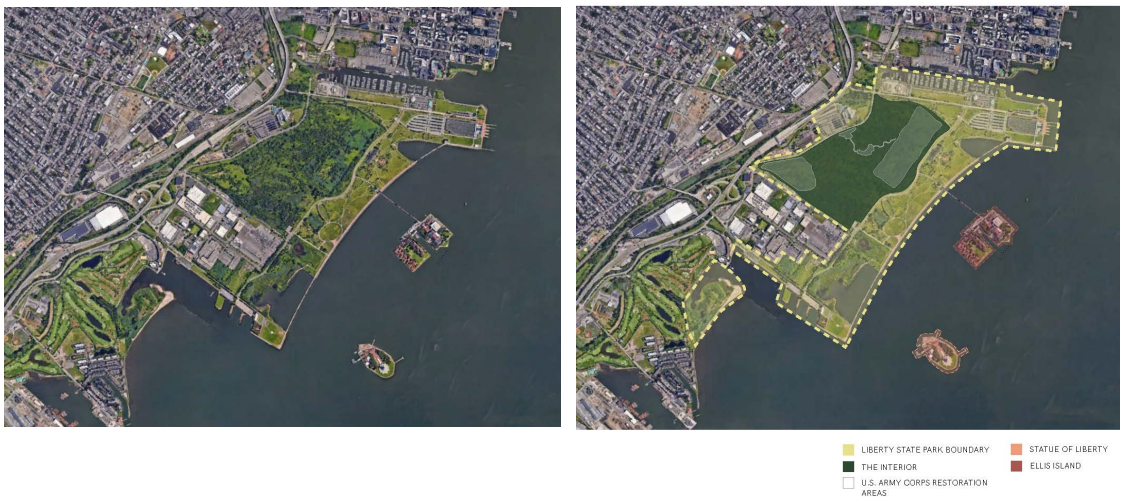

Fig. 8: Satellite image of the park and diagram showing the outline of the park. Satellite image source: Google Maps 2018.

[58] U.S. Army Corps of Engineers New York District, "Liberty State Park Environmental Resources Inventory," *Hudson-Raritan Estuary Environmental Restoration Study* (2004): 3.

History of the Site

From Railyard to Park

Fig. 9: Central Railroad of New Jersey Terminal around 1941. Source: "Jersey City/Communipaw Terminal", American-Rails.com, accessed Feb. 18, 2019, https://www.american-rails.com/jct.html.

As the site of investigation, it is vital to understand Liberty State Park's history and how it has transformed, both in composition and function, over time. The land that is now Liberty State Park came into existence during the Industrial Revolution, when the existing salt marshes and mudflats were filled in with, "millions of cubic yards of construction debris, refuse from New York City and ballast from ocean-going vessels to fill the area out towards deep waters."[59] The land was created by the Central Railroad of New Jersey to connect the railroad to the New York Harbor area. The site in Jersey City

[59] The Division of Parks and Forestry, "Liberty State Park: Historic Gateway to America," *Liberty State Park CRRNJ Prospectus* (2001): 8.

served as a waterfront location. By 1889, a new terminal was designed and constructed. The complex, equipped with twelve train tracks, six platforms for ferry flips, float bridges, and barges was the largest in New York Harbor (Figure 9).[60]

The Central Railroad of New Jersey Terminal was a busy commuter hub by the turn of the twentieth century. The hub became even busier with the opening of the Ellis Island Immigration Station in 1892. Within the next few decades, between 12-17 million immigrants passed through Ellis Island and half to two-thirds passed through the CRRNJ Terminal. However, by the 1900s, highways, competition from the trucking industry, and a shift from coal to oil and gas ultimately lead to the rerouting of rail traffic and eventually, in 1967, the CRRNJ declared bankruptcy. Following the bankruptcy, the railroad yards and buildings lay deserted and the adjacent acreage was bought through local, state, and federal funds. In 1975, the terminal building was added to the State and National Registers of Historic Places, and a massive restoration campaign began.[61]

Besides the development of the railyard, the site experienced significant disturbance during World War I. A small offshore island known as "Black Tom" was connected to the mainland by a causeway and rail lines and served as a major munitions depot. Supplies were sold to any buyer until the Allies established a blockade and the Germans were excluded. On July 30th, 1916, agents of the German government sabotaged freight cars loaded with munitions for the Allies. Incendiary devices were placed in cars containing ammunition and explosives and the result was a massive explosion. According to the Liberty State Park CRRNJ Prospectus, "Windows within a 25-mile radius were

[60] Ibid., 7-8.
[61] Ibid., 8-9.

shattered, the outside wall of Jersey City Hall cracked, pieces of metal damaged the Statue of Liberty…and immigrants on Ellis Island were evacuated".[62]

In 1957, Jersey City Businessman, Morris Pesin, after an attempted family visit to the Statue of Liberty, arranged a demonstration during which he and a reporter from the Jersey Journal canoed from the area formerly containing "Black Tom" to the Statue. Previously, the only way to reach the Statue was via a ferry from Battery Park, though the Statue was near the New Jersey Waterfront. The act brought attention to the site. In 1964, President Lyndon Johnson promised $6 million to beautify the island and the area of Jersey City behind it. In 1965, Jersey City gave the State of New Jersey 156 acres, which would become the nucleus of Liberty State Park. In 1976, Governor Brendan Byrne announced that $1.2 million would be used towards the park, making it ready for the nation's bicentennial celebrations. The park would be "New Jersey's gift to the Nation". Finally, on June 14th, 1976, Liberty State Park was dedicated. The Park has since grown to encompass 1,232 acres.[63]

The master plan for Liberty State Park was designed by the architectural firm of Geddes, Brecher, Qualls, Cunningham and landscape architects Zion and Breen.[64] The first ferry connecting New Jersey to the Statue of Liberty began operation in 1977 and in 1985 the Interpretive Center began offering interpretive and educational programs to the public. In 1993, the Liberty Science Center, a privately-run museum, opened in the northwest corner of the park. The Liberty Landing Marina is another privately owned and

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[62] Ibid., 9-10.
[63] Ibid., 10-11.
[64] "Liberty State Park," Robert Geddes, accessed Feb. 16, 2019, https://www.robertgeddesarchitect.com/urbanism/liberty-state-park/.

operated facility within the park, containing a ferry service to New York City, harbor cruises, and boat charters, as well as a restaurant. In 1998, construction of Green Park, an 88-acre park within Liberty State Park, began. It consists of wildflower meadows, lawns, a playground, plazas, and pathways. In 2000, Millennium Park was dedicated, containing a butterfly garden, a sensory garden, planted beds, lawns, seating areas, and paved pathways. Today, the entirety of the land is designed and programmed, except for the center portion of the park.[65]

The Interior

While the rest of the area was being developed, the center of the park – approximately 250 acres that was formerly the railroad yard – remained untouched.[66] After years of neglect, the space became re-colonized by various plant communities.[67] Figure 10 shows a photo of the interior in 2018. A fence with warning signs went up around the area in 1993 because of a lawsuit against the state by the Interfaith Community Organization[68] due to high concentrations of metal

Fig. 10: Interior of Liberty State Park in 2018. Source: Photo taken by author (2018).

[65] The Division of Parks and Forestry, "Liberty State Park: Historic Gateway to America," *Liberty State Park CRRNJ Prospectus* (2001): 10-11.
[66] Ibid., 26.
[67] Ibid., 26.
[68] Steve Strunsky, "Creating Liberty State Park from the Outside In," *The New York Times*, Mar. 19, 2006.

and other toxic contaminants in the soil.[69] Despite the contamination, the interior has developed into, "an urban mosaic of native and invasive species so rare it may not exist anywhere else in the world," according to Rutgers-Newark ecologist Claus Holzapfel.[70] The plants that have established at the site are a result of seed dispersal by wind as well as historical events. Many plants arrived through the dumped ballast of immigrants' ships coming from Europe, during the late 1890s to the 1950s.[71] Plants also came from the American Midwest, when trains went back east to the CRRNJ Terminal freight yards.[72] The result is a unique vegetative assemblage in a densely urban area.

Many different development ideas were proposed for the interior portion of Liberty State Park. Less than a year after the park opened in 1976, a proposal for a theme park emerged, but was defeated by the Save Liberty State Park Coalition, which was founded by Jersey City activist Sam Pesin.[73] In 1981, a plan for another theme park as well as 8,000 condominiums was proposed and in 2001 a plan for a waterpark was proposed.[74] The most persistent and controversial development idea was that of a golf course.[75] However, the golf course proposal was terminated in 1995 by Governor Christie Whitman.[76] Overall, public meetings drew in hundreds of people, most who opposed any commercialization of the site.[77]

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[69] "A green rebirth for the park," *The Star-Ledger (Editorial)*, Apr. 23, 2008.
[70] Diego Cupolo, "A wasteland thrives in Jersey," *The Star-Ledger*, Jan. 14, 2009.
[71] Ibid.
[72] Diego Cupolo, "A wasteland thrives in Jersey," *The Star-Ledger*, Jan. 14, 2009.
[73] Alexander Lane, "Turning back the ecological clock," *The Star-Ledger*, Feb. 19, 2006.
[74] Ibid.
[75] Ibid.
[76] Steve Strunsky, "Creating Liberty State Park from the Outside In," *The New York Times*, Mar. 19, 2006.
[77] Alexander Lane, "Turning back the ecological clock," *The Star-Ledger*, Feb. 19, 2006.

Instead of developing on the site, a plan emerged that suggested environmental restoration. In 1999, the U.S. Army Corps of Engineers started planning for wetlands restoration within the interior, as part of the broader goal of bringing life back to the developed shores of the Hudson-Raritan Estuary.[78] There are four components of the restoration project, which include the creation of approximately 46 acres of salt marsh, 26 acres of freshwater wetlands, 50 acres of warm weather grasslands, and the enhancement of approximately 100 acres of urban successional northern hardwoods and maritime shrub assemblages.[79] The salt marsh is to be formed by cutting a channel to the Hudson River.[80] The freshwater wetlands are to be fed by rainwater runoff from parking lots and the roof of the nearby Liberty Science Center.[81] A berm will be created by using the soil dug up for the salt marsh and will serve as a sight and sound buffer against the New Jersey Turnpike Extension, as well as a source of grassland for many bird species.[82] According to the vice president of the New Jersey Audubon Society, Richard Kane, "Restoring the wetlands, marshes, and grasslands is essential for maintaining the 278 species of birds that use the park as a stopping point before flying to South America".[83] A design for the interior was created by landscape architecture firm Wallace Roberts and

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[78] Ibid.
[79] Frank J. Gallagher, "Liberty State Park Interior Restoration," accessed Feb. 17, 2019, http://gallaghergreen.com/.
[80] "Bettering our own national treasure," *The Jersey Journal (Editorials)*, Apr. 25, 2008.
[81] Steve Strunsky, "Creating Liberty State Park from the Outside In," *The New York Times*, Mar. 19, 2006.
[82] Ibid.
[83] Prescott Tolk, "The grass gets greener: Liberty State Park receives more environmental restoration funds," *The Jersey City Reporter*, Feb. 10, 2002.

Fig. 11: Illustrative Plan created by WRT. Source: "Interior Restoration," Friends of Liberty State Park, accessed Feb. 18, 2019, https://www.folsp.org/interior/1L-illustrative_plan.pdf.

Todd (WRT). The design includes plans for the constructed wetlands as well as a circulation system, which would provide access to the site and connect the Liberty Science Center to the rest of the park. The illustrative plan is shown in Figure 11. Though the design was created, and both state and federal funds have been acquired, the interior portion of the park remains undeveloped and inaccessible.

The Vegetation

A large portion of the interior is proposed to be left alone mainly because of the unique features of the vegetation and the role it plays in the site's remediation. Scientists

have been studying the site since the 1990s.[84] The first natural resource inventory was conducted by Frank Gallagher, who has worked with the park since 1983 and is currently a professor in the Department of Landscape Architecture at Rutgers University.[85] Since then, the site has been carefully observed and many tests have been performed on both the soil of the site as well as the vegetation. The vegetation communities suggest a balance between invasive and native species cooperatively coexisting.[86] Although invasive species are commonly thought to devastate ecosystems, "any plant life is good plant life in places heavily impacted by industry," according to Gallagher.[87] He also notes that, "invasive species actually paved the way for native ones…Today, the percentage of invasive species on the site is in decline".[88] Scientists have also observed the rate of plant growth on the site. According to Holzapfel, plant growth has been considerably slow due to the harsh soil conditions.[89] The rate of forest succession has been slower compared to that of a more rural site.

In terms of the soil contamination, extensive research has been done documenting the type of contamination that exists as well as the relationship the contaminants have with the emerging vegetation. The USDA Natural Resource Conservation Service has given the soil in the interior its own series designation, the Ladyliberty Series.[90] The condition of the soil is a result of the debris and urban fill from which it was formed as

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[84] Matt Hunger, "Nature Untamed: Liberty State Park's Interior Natural Area Continues its Comeback," *The Jersey City Independent*, Nov. 12, 2010.
[85] Ibid.
[86] Ibid.
[87] Ibid.
[88] Ibid.
[89] Diego Cupolo, "A wasteland thrives in Jersey," *The Star-Ledger*, Jan. 14, 2009.
[90] Jennifer Adams Krumins et. al, "Plant-soil interactions in metal contaminated soils," *Soil Biology and Biochemistry* 80, (2015): 224-231, accessed Feb. 16, 2019, https://doi.org/10.1016/j.soilbio.2014.10.011.

well as industrial pollution associated with the rail traffic.[91] The concentrations of soil metals have been mapped, revealing gradients in metal loads.[92] Arsenic, chromium, lead, zinc, and vanadium exist at concentrations above those considered ambient for the area.[93]

The distribution of pioneer forest assemblages correlates to the total soil metal load and the trajectory of the assemblages has been affected by the metal contamination.[94] The successful colonizers of the site have not only been able to tolerate the metal contamination but have also been able to translocate the metal.[95] Some plant species, such as *Betula populifolia*, are able to translocate metals themselves while other need the presence of organisms in the rhizosphere.[96] In one study, *Betula populifolia* and *Populus deltoides* were found to be accumulating zinc in leaf tissue.[97] The study also found that both those trees, as well as *Rhus copallinum* accumulated chromium primarily in the root tissue.[98] A comparison of soil metal maps and vegetative assemblage maps

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[91] Ibid.
[92] Frank J. Gallagher et. al, "Soil metal concentrations and productivity of *Betula populifolia* (gray birch) as measured by field spectrometry and incremental annual growth in an abandoned urban Brownfield in New Jersey," *Environmental Pollution* 156 (2008): 699-706, accessed Feb. 17, 2019, http://gallaghergreen.com/EP156.pdf.
[93] Frank J. Gallagher et. al, "Soil metal concentrations and vegetative assemblage structure in an urban brownfield," *Environmental Pollution* 153 (2008): 351-361, accessed Feb. 17, 2019, https://www.researchgate.net/publication/5943541_Soil_metal_concentrations_and_vegetative_assemblage_structure_in_an_urban_brownfield.
[94] Frank J. Gallagher et. al, "Altered vegetative assemblage trajectories within an urban brownfield," *Environmental Pollution* 159, no. 5 (2011): 1159-1166, accessed Feb. 16, 2019, https://doi.org/10.1016/j.envpol.2011.02.007.

[95] Ibid.
[96] Jennifer Adams Krumins et. al, "Plant-soil interactions in metal contaminated soils," *Soil Biology and Biochemistry* 80, (2015): 224-231, accessed Feb. 16, 2019, https://doi.org/10.1016/j.soilbio.2014.10.011.
[97] Frank J. Gallagher et. al, "Soil metal concentrations and vegetative assemblage structure in an urban brownfield," *Environmental Pollution* 153 (2008): 351-361, accessed Feb. 17, 2019, https://www.researchgate.net/publication/5943541_Soil_metal_concentrations_and_vegetative_assemblage_structure_in_an_urban_brownfield.
[98] Ibid.

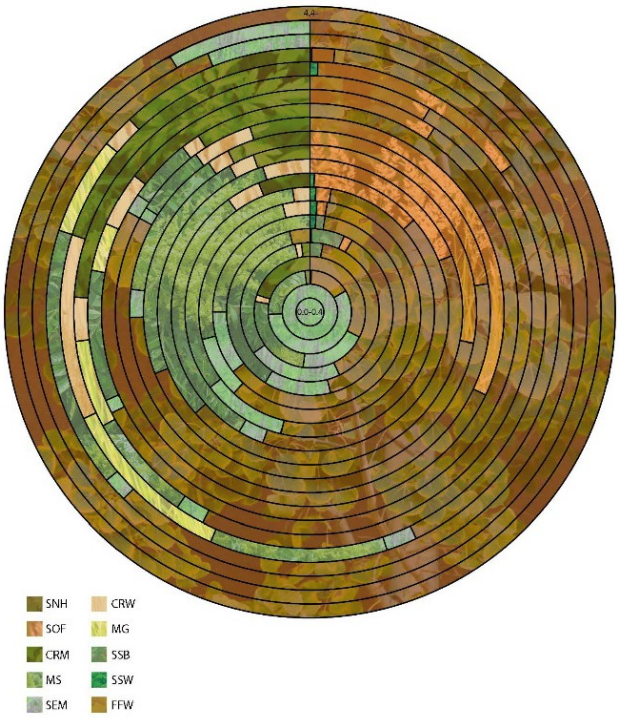

Fig. 12: Assemblage Type Area Ratios Vs. Total Metal Load diagram. Diagram adaptation created from: Frank Gallagher et. al, "Soil metal concentrations and vegetative assemblage structure in an urban brownfield," *Environmental Pollution* 153 (2008): 356, accessed Feb. 17, 2019, https://www.researchgate.net/publication/5943541_Soil_metal_concentrations_and_vegetative_assemblage_structure_in_an_urban_brownfield.

show that areas of increasing total soil metal load are surprisingly dominated by successional northern hardwoods while semi-emergent marshes consisting mostly of endemic species were restricted primarily to areas of low soil metal load.[99] Figure 12 shows a diagram representing this phenomenon. Each ring of the circle represents a range of soil metal load. The lowest soil metal load is in the center and the highest is the outermost ring. Another study has found that, the presence of mycorrhizae can have positive effects on plant growth and the ability for plants to sequester heavy metals.[100] Lastly, on a site like this, plants that hold resistance qualities are more successful than plants with competitive qualities.[101] All of these studies show the complex ecological processes that are occurring on the site.

Overall, the interior of Liberty State Park offers a unique situation that contributes significantly to the study of urban forestry. According to U.S. Senator Robert Menendez, "When complete, it will be one of the largest contiguous areas of natural established

[99] Ibid.
[100] Jennifer Adams Krumins et. al, "Plant-soil interactions in metal contaminated soils," *Soil Biology and Biochemistry* 80, (2015): 224-231, accessed Feb. 16, 2019, https://doi.org/10.1016/j.soilbio.2014.10.011.
[101] Ibid.

hardwoods in the metropolitan area…".[102] For scientists, it represents a glimpse of how future plant communities might assemble under the rapidly changing climate.[103] It can also serve as a model for other vacant industrial lands.[104] According to Gallagher, "The processes we observe here are applicable on a broad scale".[105] As quoted by the Department of Environmental Protection, "the center of the park won't be pure, but it also won't be dangerous".[106] The interior of Liberty State Park, and the vegetative communities that have colonized there, offer a highly unique opportunity to further both the mission of the Park and the study of forestry in urban environments.

Scope of the Project

Design Concept

Liberty State Park is a dynamic public space with a rich history. There is a need to address the interior portion of the park because of its potential as a unique destination for park users. The fourth nature site is a prime example of how naturally assembled urban plant communities can be utilized in transforming derelict places into safe and interesting environments. There are already established goals for the interior and scientific as well as public support for an intervention. These goals can be met through innovative design strategies.

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[102] Brian T. Murray, "Officials envision a wildlife refuge in Liberty State Park, "*The Star-Ledger,* Apr. 22, 2008.
[103] Diego Cupolo, "A wasteland thrives in Jersey," *The Star-Ledger*, Jan. 14, 2009.
[104] Matt Hunger, "Nature Untamed: Liberty State Park's Interior Natural Area Continues its Comeback," *The Jersey City Independent*, Nov. 12, 2010.

[105] Ibid.
[106] "A green rebirth for the park," *The Star-Ledger (Editorial)*, Apr. 23, 2008.

The plans for the salt marsh, freshwater wetlands, and berm have been thoroughly developed and, in the future, will be implemented. It has also been determined that the existing woodlands will be left intact because of its ability to stabilize the soil metal contamination. The design proposed within this project will consider the existing vegetation of the interior. This project proposes a trail system through the interior and identifies significant nodes along the trail that can be used to tell a story of urban ecology while connecting the Liberty Science Center to Liberty State Park's Interpretive Center. The nodes will provide educational opportunities to be utilized by both the public and through interpretive programs. Along with the trail and its corresponding nodes, planting strategies will be explored. Plantings will be proposed where significant disturbance occurs to the vegetation when constructing the restoration elements and the trail system. The needs of the visitor, the history of the site, and the unique plant communities will all be considered.

Figure 13 shows an outline of the overarching design concept. The existing conditions of the interior consist of the soil, which is made up entirely of historic fill, and

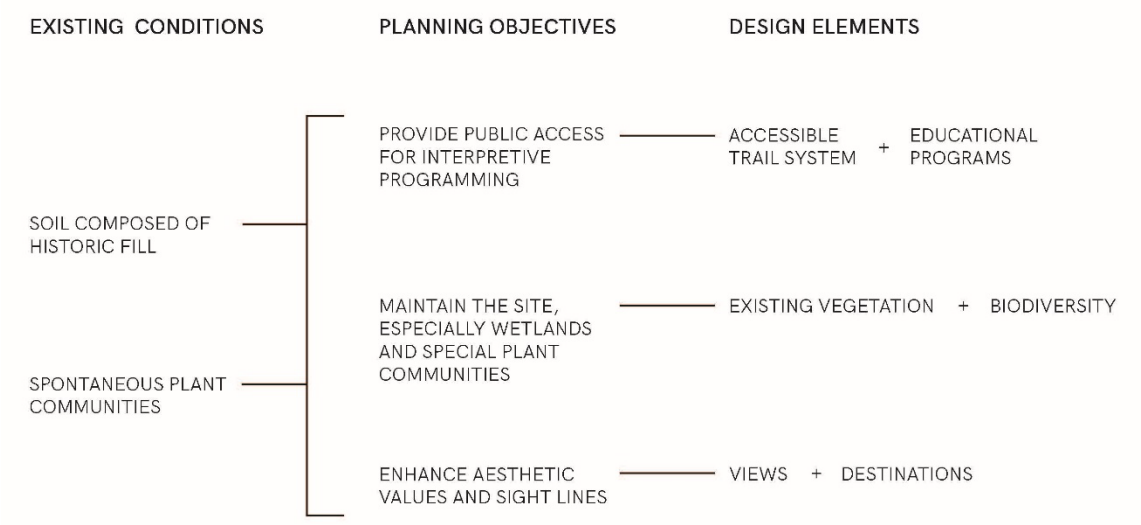

Fig. 13: Outline of design concept.

the vegetation, which consists of spontaneous plant communities. In terms of planning objectives for the area, the Interdisciplinary Planning Committee of Liberty State Park has outlined several planning objectives for the site. The three that will be addressed through this design are: 1. to provide public access for interpretive programming, 2. to maintain the site, especially wetlands and special plant communities, and 3. to enhance aesthetic values and sight lines.[107] These planning objectives can be accomplished through design. The design elements that will be implemented on the site through this project are: an accessible trail system with educational programming, existing vegetation with increased biodiversity, and optimal views and destinations within the landscape. These design elements, together, will comprise the plan for the interior.

Regulations and Guidelines

A few guidelines do need to be followed when designing within the interior, because of the soil contamination. In 2001, a consent decree, resulting from a law suit brought against the state due to soil contamination concerns (Interfaith Community Organization v. Robert Shinn civil action 93-4774, 94-3434, 94-3793) was issued that included instructions pertaining to the interior.[108] The decree stated that the undeveloped areas should remain in a natural state and that they, "need not be covered with a foot of clean soil and/or excavated, especially in areas that have vegetated cover, wetlands or open water, before being opened to the public".[109] This part of the decree supports leaving the plant communities in place. In terms of the construction of the trail, the

[107] "Summary of the Interdisciplinary Planning Committee," *The Future of Liberty State Park.*
[108] Interfaith Community Organization v. Robert C. Shinn, JR., et. al, civil action nos. 93-4774, 94-3434, 94-3793 (2001).
[109] Ibid., 17-18.

decree states that, “public access shall be limited to walkways and observation areas which are constructed with one foot of clean soil base, or are of boardwalk construction”, and, “a physical and/or vegetative barrier shall border walkways and observation areas…”.[110] These parameters will be applied when developing plans for the trail system. In places where the existing vegetation is disrupted by construction, an opportunity to integrate new plantings within the composition of the existing vegetation emerges. Such plantings can satisfy restoration needs while also providing ecological benefits and prescribed aesthetic qualities. The decree offers design guidelines that will be followed when designing pathways and nodes within the existing vegetation. Integrating new vegetation into the existing urban “wildland” is rationalized and can offer another layer of depth to the forest composition. Overall, the design will allow the interior to become a unique destination, characterized by fourth nature.

Analysis

Site Elements

The interior portion of Liberty State Park comprises several elements. Figure 14 shows the vegetation composition of the site in 2015. The vegetation map shown is separated by several different vegetation types: herbaceous, shrub, and hardwood species.

[110] Ibid., 18.

Fig. 14: Vegetation Map. Source: Graphic created by author. Data retrieved from Xiang Lin, Novel Ecologies Lab, Rutgers, The State University of New Jersey – Newark.

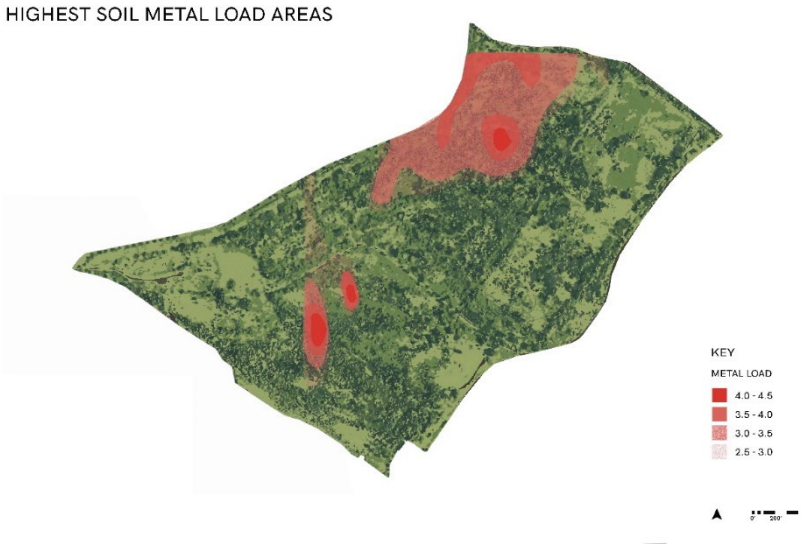

Fig. 15: Soil Metal Load Map. Source: Graphic created by author. Soil metal load data retrieved from Frank J. Gallagher. et. al, "Altered vegetative assemblage trajectories within an urban brownfield." *Environmental Pollution* 159, no. 5 (2011): 3, accessed Feb. 16, 2019, https://doi.org/10.1016/j.envpol.2011.02.007.

There are also a few areas on the site where bare soil exists. Figure 15 shows where the highest soil metal load areas exist within the interior. The darkest red color shows where the total metal loads are 4.0 - 4.5 and represent the highest concentration of soil metal.

Fig. 16: Fence around the interior.

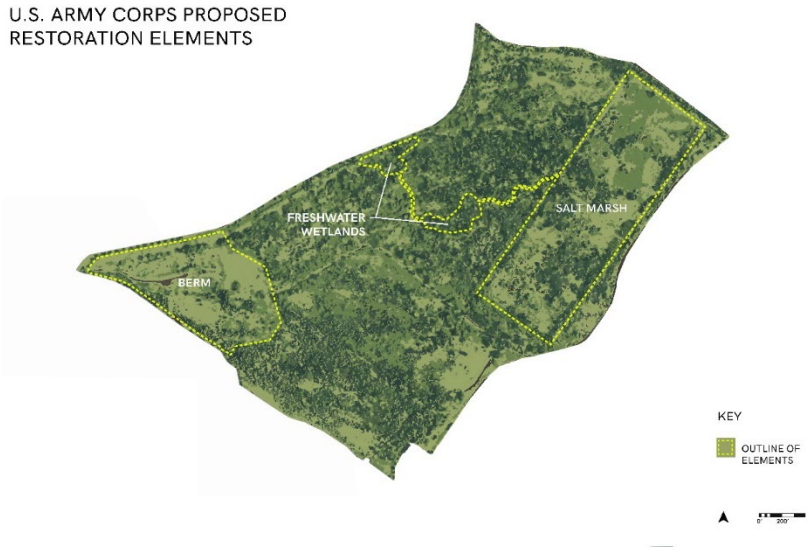

Fig. 17: Restoration elements proposed by the U.S. Army Corps.

The diagram shows where the hot-spots of contamination are located on the site. Figure 16 shows where the fence surrounding the interior exists. This chain-link fence prevents park patrons from entering the site. Also, the existence of the fence has allowed the vegetation within the site to grow without disturbance. Figure 17 shows where the U.S. Army Corps are proposing restoration elements. These restoration elements are being considered as part of the landscape, although they do not yet exist on the site. The

restoration elements will be considered part of the landscape and represent part of a future plan for the interior. These series of diagrams show the several aspects that comprise the existing conditions of the site.

Plant Species

The vegetation was analyzed not only through a vegetation map but also by considering, overall, which species have been documented within the interior. When considering the vegetation, it is critical to see exactly what species exist and encompass the overall composition. Figure 18 shows a plant palette of all the species that exist within the interior. The plant palette is separated by vegetation type.

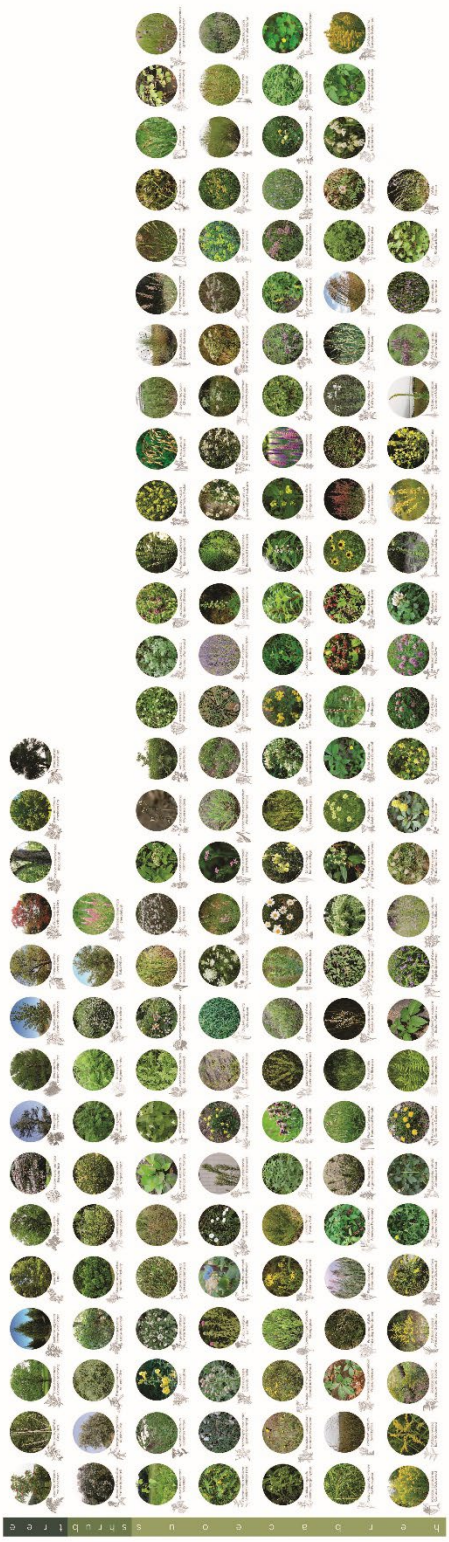

Fig. 18: Existing plants palette.

Successional Trajectory

Through the analysis process, it was critical to not only look at how the vegetation exists currently, but also how it has changed over time. Figure 19 shows the beginning of a

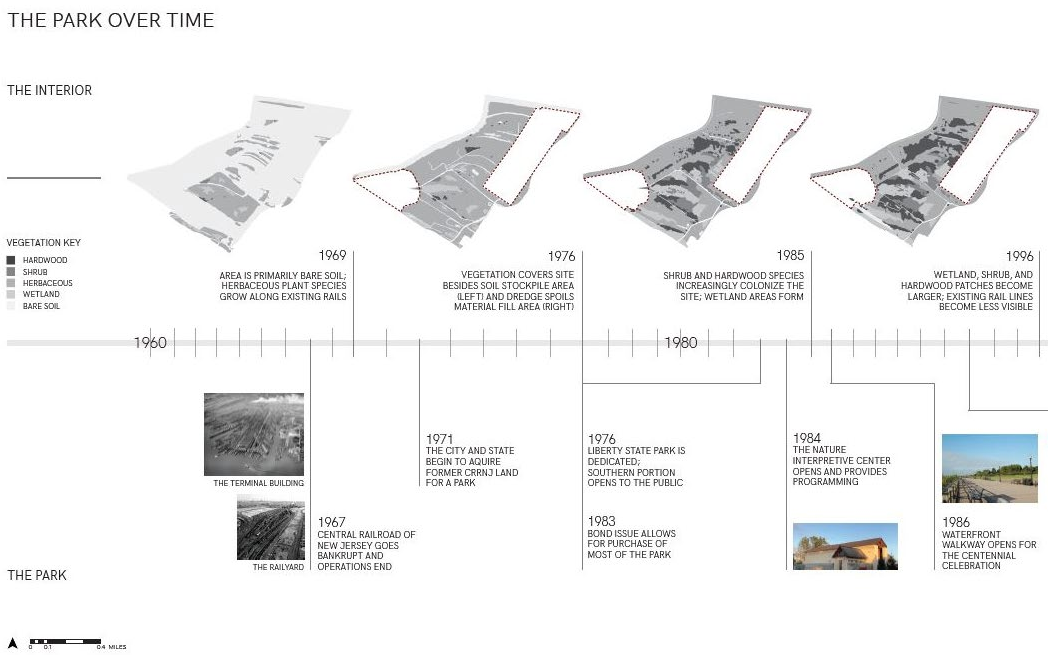

Fig. 19: Timeline of the interior from 1967 to 1996. Source: Graphic created by author. Vegetation maps adapted from originals provided by Frank Gallagher.

timeline of the successional trajectory of the site. The top of the timeline shows a series of vegetation maps representing what the vegetation composition was at various points in time over the past 50 years. The different tones of gray represent the different vegetation guilds. The darkest color represents hardwood communities. The site gets progressively more and more colonized by plant species. The bottom portion are key elements in the

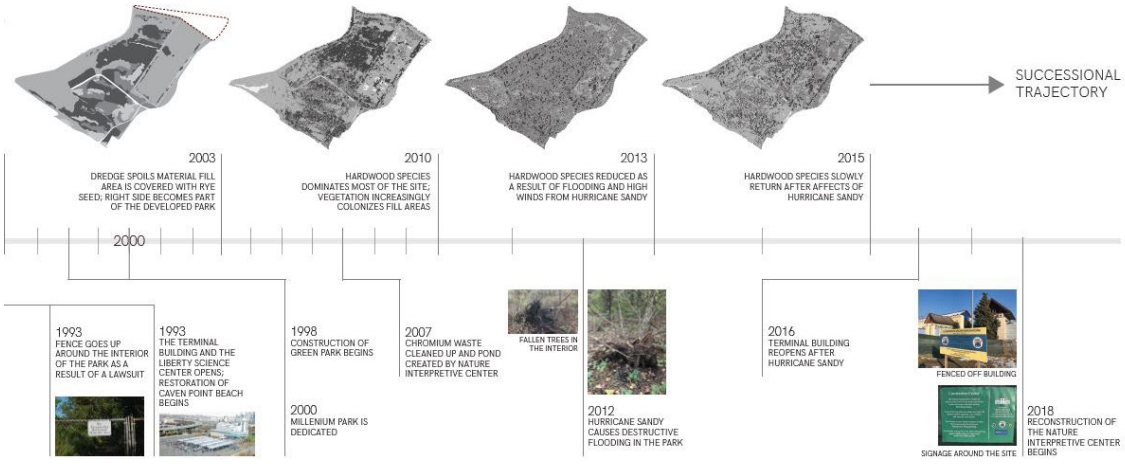

Fig. 20: Timeline of the interior from 1996 to 2018. Source: Graphic created by author. 2003 vegetation map adapted from original provided by Frank Gallagher. 2010, 2013, and 2015 vegetation maps adapted from data retrieved from Xiang Lin, Novel Ecologies Lab, Rutgers, The State University of New Jersey – Newark.

park's history that have impacted the park and the interior. Back in 1969, the park was primarily bare soil after the railroad went bankrupt. Over time, more and more herbaceous, shrub, and hardwood species colonized the space. The area of the west-most portion of the interior was used as a soil stockpile for the construction of "Green Park". The south-east portion was used as a dumping ground for dredge spoils, a muddy material dug up when the park's sea wall was built. In more recent years, the site is dominated by hardwood species, as shown in Figure 20. In 2012, Hurricane Sandy lead to massive flooding in the park. As a result, many of the trees in the interior fell and the overall tree canopy decreased. Viewing the successional trajectory of the site and analyzing how it has changed over time shows how the vegetation of the site have evolved into what it is today.

Site Exploration

In addition to analyzing the vegetation through vegetation maps, the site was analyzed through personal observation. Walking through the dense vegetation and photographing the various elements within the interior allowed for different areas to be viewed and documented. Figure 21 shows the route that was walked both around the fence of the interior and then within the interior itself. The various numbers on the plan correspond to the photos taken. The framework for the observational walk was to look for several key features within the site. These features were: 1. where potential access points could occur, 2. where there is a distinct change in vegetation guild, 3. where there are interesting views (for example, a view of Manhattan or a clearing), 4. where there are interesting and aesthetically appealing plant typologies, and 5. where potential

Fig. 21: Site exploration diagram. Source: Photos taken by author.

educational opportunities could be realized. Each of the photographs shows one of these features and is considered an important part of the landscape. Also featured on the map is the Liberty Science Center and the Nature Interpretive Center. These are shown because one of the main goals of an educational trail through the interior is to connect these two centers. This was a consideration while walking the site.

The first row of photos on the graphic is of areas around the Liberty Science Center. The first photo shows the center itself, while the others show were a potential access points could occur. The second area features photos of the forest located where the proposed freshwater wetlands will be implemented. The vegetation is very dense in this area, however there is a distinct view of the Freedom Tower, in New York City. The third area shows the vegetation along an existing roadway or pathway that is used for authorized vehicles only. The fourth area is where there is a distinct birch forest located along a past rail line and is also an area where there are higher levels of soil metal load. Within the birch forest, there are several red oak seedlings growing. This area was affected by the flooding of Hurricane Sandy and as a result, many birch trees fell. More and more oak trees are coming in. This is important to recognize because it shows that the interior's species composition is still shifting. The distribution of different plant species is still evolving. The fifth area is a very distinct wetland meadow. From this area, there are clear views of the Liberty Science Center, Jersey City, and New York City. Finally, the sixth area is where potential access points could exist near the Nature Interpretive Center. The potential access points are located next to a parking lot across from the Nature Center. Within the interior near this area, there are two distinct forest typologies, as shown in the last two photos of that sequence. Through this process of on-

foot exploration and photo documentation, different moments within the interior were realized and the various areas of the site were better understood.

Unique Plant Communities

The vegetation itself was also documented through photography. Figure 22 shows a series of photographs taken within the interior that show the novel plant communities that exist. As documented in the photos, there are a variety of plants that exist within the interior and oftentimes, species are growing together and within the same areas. The photos show a combination of native species growing with non-native species. These combinations are characteristic of the urban "wildland" and are what make the site unique. The coexistence of species on the site offers aesthetic as well as functional qualities. Figure 23 shows close-up photos of various species on the site. These photos show the rich diversity in colors and textures that exist on the site. The photos include various species of plants in different seasons.

Fig. 22: Novel plant communities. Source: Photos taken by author.

Fig. 23: Individual plant species. Source: Photos taken by author.

Overall, analysis of the site included diagramming the various elements of the site, showing all the species that exist on the site through a plant palette, looking at vegetation maps over time and noting the various changes that occurred throughout the parks' history, and experiencing the site through observation and topography. Each of these steps offers different information about the site. A combination of viewing the interior through mapping and through actual, on-foot experiences offers multiple layers of information about the site.

Case Studies

After analyzing the site, it is critical to consider several case studies. Looking at designs and projects that are similar to Liberty State Park allows for different ideas and methodologies to be realized. Though Liberty State Park is unique, there are several projects that exhibit comparable qualities and offer examples of possibilities for the interior. Each case study serves as an example of methodologies or site elements that can be incorporated for this project.

Fresh Kills Park: Creating a "Lifescape"

The History of Fresh Kills Park

Fresh Kills Park is a park that is currently being created through a series of stages. The area originally consisted of tidal creeks and coastal marshland until it was transformed into a landfill.[111] The name "Fresh Kills" comes from the site's location along the banks of the Fresh Kills estuary in western Staten Island, New York.[112] The landfill was created in 1948 by Robert Moses, whose initial plan was to open it for only three years.[113] Figure 24 shows an aerial photograph of the site in the year 1954. However, by 1955, it became the world's largest landfill and by 1961, it had grown to 1,284 acres.[114] In 1991, the Edgemere Landfill in Queens closed, so Fresh Kills became the sole dumping ground for the entire city of New York.[115] At that point in time, the landfill spanned 2,200 acres

Fig. 24: Fresh Kills Landfill (1954). Source: "Landfill-to-Park Timeline," *Freshkills Park*, accessed Feb. 18, 2019, http://timeline.freshkillspark.org/.

[111] Tanay Warerkar, "Freshkills Park: the history of the former landfill-turned-green space," *New York Curbed*, accessed Feb. 18, 2019, https://ny.curbed.com/2017/5/4/15545280/freshkills-park-staten-island-history-future.
[112] Ibid.
[113] Ibid.
[114] Ibid.
[115] Ibid.

and received 29,000 tons of trash each day.[116] In 2001, the landfill was temporarily closed after borough president Guy Molinari, along with several city and state agencies, filed a lawsuit, alleging that the site was in violation of the Clean Air Act.[117] The landfill was reopened after the terrorist attacks of September 11th, 2001.[118] The landfill served as part of the recovery effort as rescue workers sifted through 1.2 million tons of materials that came from the World Trade Center site.[119] The remaining World Trade Center materials were placed in a 48 – acre area immediately adjacent to the recovery site on the West Mound of Fresh Kills, and a layer of clean soil was placed below and above the materials.[120]

After the site's last use as a landfill, the idea of transforming Fresh Kills into a park (originally proposed by Robert Moses decades prior) was revisited.[121] In 2001, a design competition was implemented and by 2003, James Corner Field Operations' vision won the city's approval.[122] In 2006, the firm's master plan was adopted and in 2008 development began.[123] In 2012, the first section of the park opened, Schmul Park, which is located on the northern edge of the parkland.[124] Owl Hollow Soccer Fields opened the following year, and two years after that, an off-street bike and pedestrian path opened along the eastern edge of the park.[125] The park is still being developed today and new areas will continue to open for the public.

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[116] Ibid.
[117] Ibid.
[118] Ibid.
[119] Ibid.
[120] Ibid.
[121] Ibid.
[122] Ibid.
[123] Ibid.
[124] Ibid.
[125] Ibid.

Fig. 25: Rendering of James Corner Field Operations' Master Plan for Fresh Kills Park. Source: Irina Vinnitskaya, "Landfill Reclaimation: Fresh Kills Park Develops as a Natural Coastal Buffer and Parkland for Staten Island," *Arch Daily*, accessed Feb. 18, 2019, https://bit.ly/2S89dFv.

The Vision of Fresh Kills Park

The site of Fresh Kills Park is nearly three times the size of Central Park, making it the largest park developed in New York City in over 100 years.[126] The park is proposed to contain a variety of public spaces and facilities, including, "playgrounds, athletic fields, kayak launches, horseback riding trails, large-scale art installations, and much more".[127] To transform a landfill of such caliber into a diverse, ecologically-rich landscape, a unique set of strategies needs to be implemented. These strategies were designed and executed by James Corner Field Operations, providing innovative solutions pertaining to the transformation of the post-industrial site. Figure 25 is one of many renderings created by the firm. In the article titled, "Lifescape – Fresh Kills Parkland", James Corner articulates the thoughts behind the Fresh Kills Park master plan. Corner

[126] "Freshkills Park," *NYC Parks,* accessed Feb. 18, 2019, https://www.nycgovparks.org/park-features/freshkills-park.
[127] Ibid.

refers to the firm's plans, describing that, "A long-term strategy based on natural processes, agricultural practice and plant life cycles will help to rehabilitate the severely degraded land over the next 30 years, and transform the site into a huge public park".[128] The strategies realized by the firm can be applied to other sites as well.

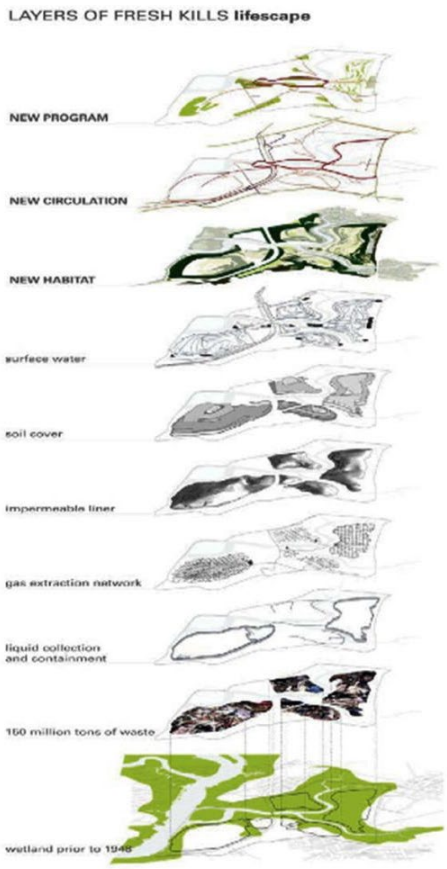

Fig. 26: Diagram created by James Corner Field Operations. Source: James Corner, "Lifescape – Fresh Kills Parkland," 18, accessed Feb.18, 2019, https://www.environmental-expert.com/Files/19643/articles/5873/aatopos51.pdf.

The master plan encompasses a series of steps and overall, approaches the landscape through layers. Instead of using the term "landscape", the term "lifescape" is used. Lifescape is defined as, "both a place and a process".[129] As a place, it is later described as, "a diverse reserve for wildlife, cultural and social life, and active recreation".[130] The term is also defined as, "dynamic staging and cultivation of new ecologies…".[131] By defining the space through the term "lifescape", Corner attempts to explain his team's work as a design of a method and process of transformation, versus a design of specific places.[132] This process of transformation of the site is approached through looking at each layer of the site, and manipulating the layers individually,

[128] James Corner, "Lifescape – Fresh Kills Parkland," 15, accessed Feb.18, 2019, https://www.environmental-expert.com/Files/19643/articles/5873/aatopos51.pdf.
[129] Ibid.
[130] Ibid.
[131] Ibid.
[132] Ibid.

through multiple stages. Figure 26 is a diagram created to illustrate the existing layers of the site, as well as the layers of new design that will be implemented. The design overall is organized into three main layers, which together create a framework for the park.[133] The new layers include habitat, circulation, and programming.[134] Providing space for these three layers will support the creation of event areas and facilities, roads and paths, and landscape.[135]

Besides the layers of the physical site, the site is also realized through layers of process. The first layer is soil, and the process associated with that is, "making soils using agricultural practices".[136] Field Operations' approach to soil amendment on the Fresh Kills site is "strip cropping". The strategy is borrowed from a "green manure" agricultural practice and will be implemented by seeding three selected crops each year and rototilling them into the soil, thus building organic material.[137] Organic matter in the soil, "improves the water holding capacity of soils and inhibits plants' uptake of metals and cations, which boosts plant growth and protects animals against ingestion of metals in the biomass of plants".[138] This strategy is implemented to improve the soil quality, providing a sufficient environment for plant communities to begin growing. The visual aesthetic of strip cropping is also consistent with the overarching goal of staging the implementation of the parkland.[139]

The next step is to create habitat and spaces with plants. Grasses will be established through the strip cropping, and then the first saplings will be installing in a

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[133] Ibid., 18.
[134] Ibid., 18.
[135] Ibid., 18.
[136] Ibid., 18.
[137] Ibid., 18.
[138] Ibid., 18.
[139] Ibid., 18.

point-grid, followed by two waves of interplanting young trees, and finally the seedlings will begin to self-sow.[140] This planting strategy will eventually build a layered woodland that will naturalize over time.[141] The overarching goal of these planting strategies is to create an ecosystem in which native species can repopulate and successional processes are augmented.

Once different vegetation communities are created, the next layer is earthwork. To create programmatic areas, "landscape atmospheres" need to be designed.[142] Corner proposes creating these atmospheres through grading and utilizing an extensive material palette.[143] The most dramatic landform that will be realized on the Fresh Kills site is the September 11 earthwork monument.[144] The two earth forms will mirror the exact width and height of the towers and the second incline will afford a clear vista to lower Manhattan and the entire region around.[145] Overall, James Corner Field Operations offers three primary large-scale landscape architectural techniques: soil making, successional planting, and landform manipulation.[146] These techniques are staged over time and serve to create layers to the space, overall creating the "lifescape" matrix.

Fresh Kills Park as a Model for Post-Industrial Landscapes

James Corner Field Operations' approach to the design of Fresh Kills Park offers a concrete strategy that encompasses techniques that can be utilized when considering other post-industrial sites as potential park spaces. The creation of a "lifescape" matrix

[140] Ibid., 19.
[141] Ibid., 19.
[142] Ibid., 19.
[143] Ibid., 19.
[144] Ibid., 20.
[145] Ibid., 20.
[146] Ibid., 20.

results in a place that is both wild and cultivated, emergent and engineered.[147] Corner's approach did not attempt to erase the past, nor did it try to recreate a lost environment.[148] The approach outlined three different systems, (habitat, program, and circulation), and offered solutions that would eventually yield a cohesive, dynamic framework.[149] "Lifescape" can be defined as, "an ecological process of environmental reclamation and renewal on a vast scale, recovering not only the health and biodiversity of ecosystems across the site, but also the spirit and imagination of people who will use the new park".[150] Realizing such a term helps categorize what the place truly is and helps define its existence, particularly within the scope of fourth nature.

Fig. 27: Undeveloped portion of Fresh Kills Park. Source: Photos taken by author (2017).

Fresh Kills Park is an example of a sustainable development reclamation project that evokes a natural and environmental character.[151] Such a character can be realized at Liberty State Park as well, as there are similarities in both the location and vegetation compositions of each site. Figure 27 shows several photos taken at Fresh Kills Park in an

[147] Ibid., 21.
[148] Ibid., 21.
[149] Ibid., 21.
[150] Luís Loures, "Strategies to reclaim derelict industrial areas," *WSEAS Transactions on Environment and Development* 2, no. 5 (2006): 602, accessed Feb. 18, 2019, https://bit.ly/2GvUpPD.
[151] Ibid.

undeveloped portion of the park. The plant species in this area are the same as the species in the interior of Liberty State Park. When considering planting strategies within the interior portion of Liberty State Park, it is vital to adopt a staged approach, through which a "lifescape" matrix can be established. The design for the trail system through the interior will work to create both a place and a process, and it will be essential to consider each layer of the landscape individually to create a whole, cohesive framework. Through soil amendments, successional planting, and earthwork, the interior of Liberty State Park can become a site of ecological habitats, programming, and circulation.

Landscaftspark Duisburg-Nord: Celebrating an Industrial Past

The History of Landscaftspark Duisburg-Nord

Liberty State Park's industrial history should be celebrated because it had a profound impact on the composition of the United States as a nation. The railroad tracks that still exist throughout the park were used by immigrants from around the world to travel through New Jersey and then to other parts of the country. These remnants provide evidence of the landscape's past and are an explanation for its current conditions. There are several strategies that can be used to properly represent Liberty State Park's history. One design project that strategically represents an industrial history is Landscaftspark Duisburg-Nord. Landscaftspark Duisburg-Nord is an example of a park that was designed with the concept of celebrating an industrial past.

Duisburg is a city located in the Ruhr basin, which is one of Germany's most densely populated areas, largely because of the heavy industrial growth that took place in

the mid-nineteenth century.[152] Two million inhabitants, residing in 17 cities, live within the Ruhr region, the watershed of the Emscher River.[153] Extensive coal mining in the region led to severe subsidence and consequently, underground sewer lines were not possible. As a result, the Emscher River was primarily used as a sewage collector.[154] There are several industrial landmarks that exist within the region, including mines, iron and steel works, and rail networks.[155]

Fig. 28: Former industrial blast furnace. Source: Judith Stilgenbauer, "Landschaftspark Duisburg Nord – Duisburg, Germany," *Places* (2005): 6-9, https://placesjournal.org/assets/legacy/pdfs/landschaftspark-duisburg-nord.pdf.

One of the industrial landmarks was the former iron and steel works, Thyssen Hochofenwerk Meiderich (Figure 28), located between Duisburg's Meiderich and Hamborn districts.[156] The facilities included, "a mining and coke-producing zone, the iron and steel works, cement tanks for materials as well as an extensive network of industrial railways."[157] The plant stopped production in the mid-1980s and the site contained high levels of land and water contamination.[158] Despite the contamination, vegetation began to establish on the site, prompting discussions about new uses of the area.[159]

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[152] Mònica Oliveres i Guixer, "Landschaftspark Duisburg-Nord," last modified Feb., 5th, 2018, https://www.publicspace.org/works/-/project/a008-landschaftspark-duisburg-nord.
[153] Ibid.
[154] Ibid.
[155] Ibid.
[156] Ibid.
[157] Ibid.
[158] Ibid.
[159] Ibid.

The Park's Creation

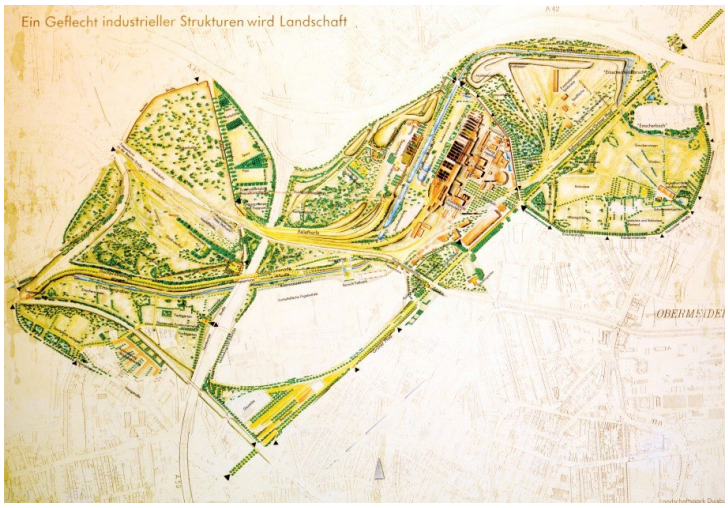

Fig. 29: Plan of the landscape park created by Latz + Partners. Source: Judith Stilgenbauer, "Landschaftspark Duisburg Nord – Duisburg, Germany," *Places* (2005): 6-9, https://placesjournal.org/assets/legacy/pdfs/landschaftspark-duisburg-nord.pdf.

Inspired by a series of earlier "International Building Exhibitions" (IBA) in other parts of Germany, a commission was formed that proposed the IBA Emscherpark, a ten-year effort from 1989 to 1999 to revitalize the densely populated region along the Emscher River.[160] The "exposition" would consist of a series of innovative design projects.[161] The program would include, "ecological transformation of the fluvial system of the Emscher…the reassessment of old industrial sites; the conservation and reutilization of industrial monuments as witnesses to history; and the preservation and reconstruction of the regional landscape".[162] The core topic of the program was to develop a network of green spaces that would link together through new uses and values given to the old industrial sites.[163] Landschaft-Duisburg Nord Park is within this territory and contributes to the aims of the program.[164]

The vision of the Landscaftspark Duisburg-Nord (Figure 29) was to, "recover a landscape shaped by former manufacturing industries and to open it up to new uses.[165]

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[160] Judith Stilgenbauer, "Landschaftspark Duisburg Nord – Duisburg, Germany," *Places* (2005): 6-9, https://placesjournal.org/assets/legacy/pdfs/landschaftspark-duisburg-nord.pdf.
[161] Ibid.
[162] Ibid.
[163] Ibid.
[164] Ibid.
[165] Ibid.

The approximately 570-acre site is unique in that it utilized, "the existing fragments of industry as layers that are recombined through the lens of park design".[166] Designer Peter Latz worked with the existing remnants of the site instead of starting from scratch.[167] As stated in the article, "Strategies to reclaim derelict industrial areas":

> Instead of creating a completely new landscape, the proposed design strategy attempts to celebrate the area's industrial past by integrating vegetation and industry, promoting sustainable development and maintaining the spirit of the place. Instead of tearing down the industrial buildings, the project integrates them, valorizing the past and creating a perfect symbiosis between the past, the present and the future landscape.[168]

Before the park came to be, the site was a system of motorways, roads, railway lines, walls, and industrial facilities.[169] Through design a series of smaller parks were created within the overall landscape, including the Blast Furnace Park, the Sinter Park, the Waterpark, and the Railway Park.[170] The Railway Park consists of, "…raised ribbons of old rail-beds and other structures of a formerly manmade topography; new footbridges and promenades…and fields of vegetation – woodland-like groupings of trees, pioneer plants, and prairie meadows...".[171] Overall, the designer uses the historic layers of the landscape and considers the disturbed and complex conditions as a creative potential, rather than something that should be erased or camouflaged.[172]

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[166] Luís Loures, "Strategies to reclaim derelict industrial areas," *WSEAS Transactions on Environment and Development* 2, no. 5 (2006): 601, accessed Feb. 18, 2019, https://bit.ly/2GvUpPD.
[167] Ibid.
[168] Ibid.
[169] Mònica Oliveres i Guixer, "Landschaftspark Duisburg-Nord," last modified Feb., 5th, 2018, https://www.publicspace.org/works/-/project/a008-landschaftspark-duisburg-nord.
[170] Latz + Partner, "Postindustrial Landscapes," accessed Feb. 21st, 2019, https://www.latzundpartner.de/en/projekte/postindustrielle-landschaften/.
[171] Judith Stilgenbauer, "Landschaftspark Duisburg Nord – Duisburg, Germany," *Places* (2005): 8, https://placesjournal.org/assets/legacy/pdfs/landschaftspark-duisburg-nord.pdf.
[172] Ibid., 6.

Landscaftspark Duisburg Nord as a Model for Post-Industrial Designs

There are several elements of the park that can be applied when looking at a design for Liberty State Park's interior. Themes associated with the park that can be applied in other post-industrial designs are 1. recognizing the *genius loci*, 2. utilizing the existing vegetation, and 3. providing educational opportunities.

According to Loures, "This project highlights the interest in the "genius of the place" rather than in the genius of the creator".[173] When this park was designed, Latz made the decision to create a place that functioned as a park, but through interventions that kept the existing elements intact. The design celebrates the space, it respects the *genius loci*, or spirit of the place.[174] The form of the park evolved from the past use of the

Fig. 30: Existing industrial structures. Source: Photo taken by author (2017).

Fig. 31: Planting within the iron and steel works. Source: Photo taken by author (2017).

[173] Luís Loures, "Strategies to reclaim derelict industrial areas," *WSEAS Transactions on Environment and Development* 2, no. 5 (2006): 601, accessed Feb. 18, 2019, https://bit.ly/2GvUpPD.
[174] Judith Stilgenbauer, "Landschaftspark Duisburg Nord – Duisburg, Germany," *Places* (2005): 9, https://placesjournal.org/assets/legacy/pdfs/landschaftspark-duisburg-nord.pdf.

site.[175] Figures 30 and 31 show two images of the park taken in 2017. The structures of industry are left intact and the park is seamlessly interwoven throughout, connecting the landscape to create one cohesive space.

This concept can be utilized at Liberty State Park. The existing structures of the railyard lines can be left intact and even highlighted, thus respecting the *genius loci* of the site. As stated by Loures, "The attraction of Landscaftspark Duisburg-Nord lies in what Rose Macaulay (1953) refers to as the pleasure of ruins, or the pleasure associated with exploring physical remains of the past".[176] This attraction can be achieved at Liberty State Park as well.

Landscaftspark Duisburg-Nord is a site, like Liberty State Park, that has evolved through the spontaneous emergence of vegetation and fauna.[177] According to Stilgenbauer:

> Disturbed soils on site often have high concentrations of slag, cinder, and the remains of coal or coke. Such extreme biological conditions have resulted in "natural" vegetation growth that reflects the site's industrial history. Moreover, over the years, seeds from all over the world were introduced along with industrial shipments, leading to a great present variety and mix of native and exotic species – as many as 450 neophytes. These plants now appear at many early stages of natural succession.[178]

Some of the vegetative composition at Landscaftspark Duisburg-Nord is unique in that it assembled through wide seed dispersal of species adapted to contaminated soils. Areas of the park where the vegetation was left intact contrast with the highly designed interventions in other areas of the park, as shown in Figure 32. The remnant vegetative

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[175] Ibid.
[176] Luís Loures, "Strategies to reclaim derelict industrial areas," *WSEAS Transactions on Environment and Development* 2, no. 5 (2006): 602, accessed Feb. 18, 2019, https://bit.ly/2GvUpPD.
[177] Mònica Oliveres i Guixer, "Landschaftspark Duisburg-Nord," last modified Feb., 5th, 2018, https://www.publicspace.org/works/-/project/a008-landschaftspark-duisburg-nord.
[178] Judith Stilgenbauer, "Landschaftspark Duisburg Nord – Duisburg, Germany," *Places* (2005): 9, https://placesjournal.org/assets/legacy/pdfs/landschaftspark-duisburg-nord.pdf.

Fig. 32: One of the many designed gardens within the park. Photo taken by author (2017).

assemblages evoke an appreciation for the adaptability of the novel assemblages that can survive in the poor soils of such post-industrial landscapes. Recognizing these novel plant communities as valuable is key to institutionalizing the concept of fourth nature. In addition, the areas where the vegetation was untouched were left as such primarily to reduce maintenance costs and keep energy inputs low.[179] This idea can be applied to Liberty State Park as well. The vegetation of the interior portion of the park is similar to the vegetation found at Landscaftspark Duisburg-Nord in that it has developed there spontaneously. The same strategies can be applied to Liberty State Park. Figure 33 shows an image and a sketch of the post-industrial fabric at Duisburg. The image

Fig. 33: Spontaneous vegetation at Landscaftspark Duisburg-Nord. Photo taken by author, sketch drawn by author (2017).

[179] Ibid.

captures the spontaneous vegetation that exists throughout the post-industrial landscape. Figure 34 captures similar spontaneous vegetation at Liberty State Park. Landscaftspark Duisburg-Nord is successful in not only respecting the industrial history of the site, but also respecting the unique, spontaneous vegetative assemblages that have accumulated on the site.

Fig. 34: Spontaneous vegetation at Liberty State Park. Photo taken by author (2017).

The last theme that can be taken from Landscaftspark Duisburg-Nord is its educational qualities. Although the site used to be industrial and was closed off, it is now open to the public and can be used freely.[180] There are several "play points" throughout the whole park, including a climbing wall and long tube slide, that can be enjoyed by children.[181] There is a water play area that allows children to control the flow of water, sedimentation, and erosion, providing the opportunity to learn through play.[182] Such features give visitors the opportunity to enjoy the space while also learning about some of its characteristics. The opportunities for education, especially environmental education, can be applied to Liberty State Park as well. Liberty State Park is in Jersey City, where many types of families and communities live. Integrating programming and activities would greatly benefit the local community of Jersey City.

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[180] Mònica Oliveres i Guixer, "Landschaftspark Duisburg-Nord," last modified Feb., 5th, 2018, https://www.publicspace.org/works/-/project/a008-landschaftspark-duisburg-nord.
[181] Latz + Partner, "Postindustrial Landscapes," accessed Feb. 21st, 2019, https://www.latzundpartner.de/en/projekte/postindustrielle-landschaften/.
[182] Ibid.

Overall, Landscaftspark Duisburg Nord is an example of a post-industrial landscape that was successfully transformed into a park that benefits the ecology of the region and is a destination for various visitors and the local community. The project incorporates several elements. These elements are the existing industrial structures, the unique vegetative assemblages, and educational and recreational activities for visitors. These elements work together to create a unique destination and such strategies can be applied to Liberty State Park.

Natur-Park Südgelände: From Freight Railyard to "New Wilderness"

The History of Natur-Park Südgelände

The interior portion of Liberty State Park is highly unique because the site was abandoned for more than 50 years, allowing for the undisturbed emergence of an urban woodland. A similar phenomenon took place in Berlin, Germany. Natur-Park Südgelände is an 18-hectare site that, like Liberty State Park, used to be a large railyard. As stated by Kowarik, "The particular political situation in Berlin between 1945 and 1989 had significant effects on the development of nature in the inner city".[183] Urban development ran in slow motion for four decades in the western part of Berlin because of World War II and the division of

Fig. 35: Urban woodlands growing on old railroad tracks at Natur-Park Südgelände. Photo taken by author (2017).

[183] Ingo Kowarik et al., "Natur-Park Südgelände: Linking Conservation and Recreation in an Abandoned Railyard in Berlin," *Wild Urban Woodlands: New Perspectives for Urban Forestry* (2005): 287, doi: 10.1007/3-540-26859-6_18.

Berlin.[184] Formerly built-up areas that had been destroyed in the war remained free of renewed development, allowing natural colonization processes to occur in fragmented areas throughout the city.[185] This occurred on many railyards in West Berlin specifically because the rights for all Berlin railyards were controlled from East Berlin.[186] Such an organization of power reduced train service in West Berlin, thus allowing urban woodlands to establish on many old railyards, as shown in Figure 35.[187]

In the walled, western part of the city, availability of green spaces and opportunities for experiencing nature were minimal.[188] As a result, Berlin administration provided for the integration of these natural areas into the urban open-space system.[189] Berlin urban ecologists studied these areas, which are today characterized as "nature of the fourth kind", for there was little nature to study besides these urban-industrial ecosystems.[190] When reunification occurred in 1989, construction began on many of these new wilderness areas.[191] Benefits that the areas brought, such as recreational functions, ecosystem services, and cultural-historical functions, would be lost. However, Schöneberger Südgelände was conserved and became, "one of the first official conservation areas in Germany in which urban-industrial nature is protected and made accessible to the public".[192] The area that is now Natur-Park Südgelände used to be a part of a large freight railyard called Rangierbahnhof bei Tempelhof that was built

[184] Ibid., 287-299.
[185] Ibid., 287-299.
[186] Ibid., 287-299.
[187] Ibid., 287-299.
[188] Ibid., 287-299.
[189] Ibid., 287-299.
[190] Ibid., 287-299.
[191] Ibid., 287-299.
[192] Ibid., 288.

between 1880-1890.[193] Operations gradually scaled back after World War II and eventually shut down in 1952.[194] The site was abandoned and by 1981, there was a, "richly structured mosaic of dry grasslands, tall herbs, shrub vegetation, and individual woodlands".[195] In 1996, the concept of a nature park began taking form and about one third of the site was designated as a nature reserve, while the remaining areas became a landscape conservation area.[196] Through the actions of many engaged citizens and the financial support from the Allianz Environmental Foundation, the place was created into a park open to the public, as shown in Figure 13.[197]

From Railyard to Public Park

There were several challenges in creating Natur-Park Südgelände. The planning group ÖkoCon & Planland was commissioned with the design of the master plan of the park and in later works of structure and art from the Odious group were added.[198] The first challenge was finding a balance between conservation of the unique ecosystems and allowing visitors to interact with the space.[199] Another challenge was maintaining the biodiversity of the site. Part of the reason the site was conserved was because of its species richness. If the site was left to its own trajectory, it would

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[193] Ibid., 287-299.
[194] Gruen Berlin, "Schöneberger Südgelände Park: Group Odious", *Landezine*, accessed Feb. 21, 2019, http://www.landezine.com/index.php/2013/02/schoneberger-sudgelande-park-by-odious/.
[195] Ingo Kowarik et al., "Natur-Park Südgelände: Linking Conservation and Recreation in an Abandoned Railyard in Berlin," *Wild Urban Woodlands: New Perspectives for Urban Forestry* (2005): 288, doi: 10.1007/3-540-26859-6_18.
[196] Senate Department for the Environment, Transport and Climate Protection, "Natur-Park Schöneberger Südgelände," *Berlin.de*, accessed Feb. 21, 2019, https://bit.ly/2NjKRbc.
[197] "Natur-Park Südgelände," *GrünBerlin*, accessed Feb. 21, 2019, https://gruen-berlin.de/en/natur-park-suedgelaende/about-the-park.
[198] Ingo Kowarik et al., "Natur-Park Südgelände: Linking Conservation and Recreation in an Abandoned Railyard in Berlin," *Wild Urban Woodlands: New Perspectives for Urban Forestry* (2005): 287-299, doi: 10.1007/3-540-26859-6_18.
[199] Ibid.

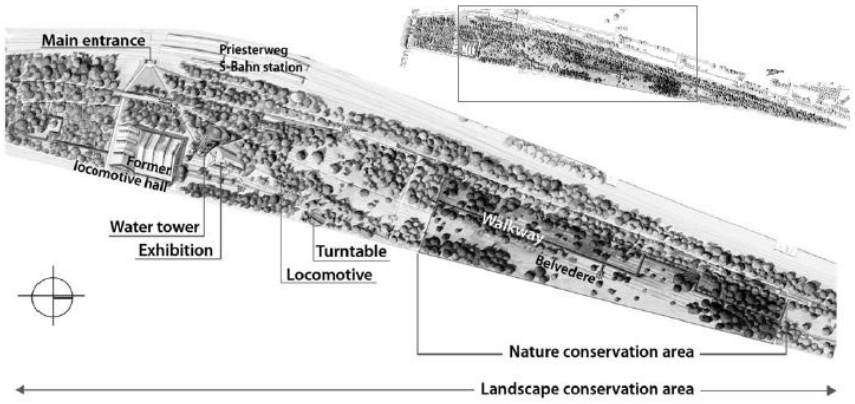

Fig. 36: Master Plan of Natur-Park Südgelände, designed by ÖkoCon & Planland. Source: Ingo Kowarik et al., "Natur-Park Südgelände: Linking Conservation and Recreation in an Abandoned Railyard in Berlin," *Wild Urban Woodlands: New Perspectives for Urban Forestry* (2005): 293, doi: 10.1007/3-540-26859-6_18.

become completely dominated by woodland, thus becoming less biodiverse.[200] To address the challenges of the site, "a concept of zoned spaces was created in which natural and social processes were partially controlled and partially left to their own dynamics".[201] Some areas were left to develop as a new wilderness and the role of non-native species in the vegetation were accepted while others were cut back to create open landscapes.[202] Open areas allow for the, "underlying cultural layer of the old railyard," to be easily perceived.[203] These interventions balance both nature and culture.

The park's design involved a path system that is fundamentally based on the linear structure of the earlier railyard, as shown in Figure 36.[204] In the nature conservation area of the park, the path system, "runs as a raised walkway 50 cm

[200] Ibid.
[201] Ibid., 291.
[202] Ibid., 287-299.
[203] Ibid., 292.
[204] Ibid., 287-299.

above the vegetation," making it known to the visitor to stay on the path.[205] Besides the path system, three types of spaces or "rooms" were defined: clearings, groves, and wild woods.[206] Differing landscapes, created by the removal of vegetation, model a transformation from railyard to urban wilderness over time.[207] In creating these spaces, factors like nature conservation, landscape aesthetics, lines of site, attractive vegetation, and old rail relics were considered.[208] The park officially opened in May 2000 and has been perceived as attractive by visitors.[209]

Natur-Park Südgelände as a Model for Post-Industrial Landscapes

The history and vegetation composition of Natur-Park Südgelände is strikingly similar to that of Liberty State Park and therefore serves as a clear model when considering the design of the park's interior urban woodland. Several ideas and strategies can be taken from the design and management of Natur-Park Südgelände. The main forms of intervention that occurred at the site were through the path system, the maintenance of the vegetation, and the installation of artworks and educational signage. The path system follows the old railyard train tracks and allows visitors to access the space. The differentiation between the nature conservation

Fig. 37: Pathway wraps around tree as a means of preserving the tree. Source: Photo taken by author (2017).

[205] Ibid., 292.
[206] Ibid., 287-299.
[207] Ibid., 287-299.
[208] Ibid., 287-299.
[209] Ibid., 287-299.

pathways and the rest of the pathways allows for access to be granted to visitors even in spaces that are intended to be preserved. Careful decisions were made when laying out the path system, with the goal of maintaining the desired aspects of the vegetation, as shown in Figure 37.

The concept of arrested succession allows for different types of plant communities to establish and tells a story of the emergence of an urban woodland on a post-industrial site. Such a maintenance strategy can be utilized at Liberty State Park. Removing species, instead of installing new plantings, can serve as a means of changing the landscape composition. Finally, the art and signage of Natur-Park Südgelände helps connect users to the site and provides a narrative for the space. Figure 38 shows an art installation within the park, which mirrors the industrial qualities of the site. Such art pieces could serve the same purposes at Liberty State Park. In 2017, an exhibition opened that consisted of 30

Fig. 38: Work of art that symbolizes the industrial history of the site. Photo taken by author (2017).

Fig. 39: The top photo shows the exhibition installed in 2017. Source: Senate Department for the Environment, Transport and Climate Protection, "Outdoor exhibition Groundbreaking nature," *Berlin.de*, accessed Feb. 21, 2019, https://bit.ly/2Nkwe7B. The bottom photo shows one of the panels. Source: Photo taken by author (2017).

panels placed throughout the park.[210] The panels show views of the natural beauties of the park, give insight into the park's history, and provide information about the biodiversity of the site. Such an exhibition could be installed at Liberty State Park to inform park users why the space is the way it is, and why it is an important place in terms of culture and ecology (Figure 39). Overall, a lot of important concepts can be learned using Natur-Park Südgelände as an example of what can be accomplished in a fourth-nature landscape. The park is a balance of nature, technology, and art. It is successful in bringing residents of urban neighborhoods closer to nature.[211]

Wald. Berlin. Klima.: Exhibition in the Forest

Goal of the Project

Fresh Kills Park, Landscaftspark Duisburg-Nord, and Natur-Park Südgelände all demonstrate re-designs of post-industrial landscapes. They take landscapes that were once inaccessible and turn that into public spaces. There are aspects of each of those projects that can be applied to Liberty State Park. Wald. Berlin. Klima. is not a design of a park, but there are several aspects of the project that can serve as inspirations for the interior of Liberty State Park. "Wald. Berlin. Klima. – Exhibition in the Forest" was created in 2017 in Grunewald, an urban forest in the west of Berlin, Germany.[212] The exhibition was a collaboration between landscape architecture firm hochC

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[210] Senate Department for the Environment, Transport and Climate Protection, "Outdoor exhibition Groundbreaking nature," *Berlin.de*, accessed Feb. 21, 2019, https://bit.ly/2Nkwe7B.
[211] Ingo Kowarik et al., "Natur-Park Südgelände: Linking Conservation and Recreation in an Abandoned Railyard in Berlin," *Wild Urban Woodlands: New Perspectives for Urban Forestry* (2005): 287-299, doi: 10.1007/3-540-26859-6_18.
[212] "Wald. Berlin. Klima. – Exhibition in the Forest", *Landezine*, accessed Feb. 21, 2019, https://bit.ly/2Vathcb.

Landschaftsarchiteckten and gewerkdesign.[213] The project had two goals, "…making visitors sensible to the natural environment on an emotional level and…educating them about the abstract topic of climate change on a cognitive level."[214] These goals were met through spatial measures as well as information communication through graphics and text. The outdoor exhibition allows users to learn about a place from being immersed in the place itself, and realize processes occurring in the landscape that are not visible.

Fig. 40: The top photo shows one of the "living room" spaces and the bottom photo shows an informational graphic. Source: "Wald. Berlin. Klima. – Exhibition in the Forest", *Landezine*, accessed Feb. 21, 2019. https://bit.ly/2Vathcb.

Components of the Exhibition

The exhibition is composed of a 4 km long path with 11 stations in the form of "living rooms".[215] Figure 40 shows a photograph of one of these living room spaces. The photo on top shows wooden structures and benches that provides users with a place to sit. Signage not only directs users through the exhibition, but also provides educational opportunities. The bottom photo of Figure 41 shows one of the graphics on these signs that explains a natural cycle. A graphic such as this makes the information more

[213] Ibid.
[214] Ibid.
[215] Ibid.

Fig. 41: Large-scale installation, as part of the exhibition. Source: "Wald. Berlin. Klima. – Exhibition in the Forest", *Landezine*, accessed Feb. 21, 2019, https://bit.ly/2Vathcb.

understandable and provides an interesting way to communicate information. Each "room" in the forest has these structural elements and informative graphics.

There are large-scale installations as well. One of the installations has all the trees in a 0,5 ha area marked blue (Figure 41).[216] This shows how big an area of forest is needed for every Berliner to bind their annual CO2 emission.[217] Such a concept allows visitors to have a personal connection to the forest and understand its value. The design elements that are part of the exhibition allow visitors to see the forest in a new, understandable way. By painting the trees blue, attention is brought to the trees and users feel compelled to understand why the trees are this way. Such a demonstration is an effective way to show a concept as complex as CO2 emissions.

Wald. Berlin. Klima.: An inspiration for Liberty State Park

The Wald. Berlin. Klima. exhibition can be used as an inspiration for the interior of Liberty State Park. A trail is essential for the interior, so users can access the site. Besides that, there is an opportunity for users to learn about the landscape. Users can

[216] Ibid.
[217] Ibid.

learn about what makes the site so unique, and they can learn about various elements of urban ecology. Installing an exhibition like Wald. Berlin. Klima. would allow for the unseen processes occurring within the interior to be shown. Having “room” spaces within the interior provides the opportunity for visitors to sit and rest, but to also take the time to learn and appreciate the environment. Also, the trail through the interior is functioning as a connection point between the Nature Interpretive Center and the Liberty Science Center. Both centers have established teaching elements and have exhibitions themselves. Adding to this existing educational structure through an exhibition within the landscape strengthens the centers’ missions and can connect them, creating one cohesive educational landscape.

Design

The design component of this project is influenced by the culmination of research, analysis, and identification of various case studies. There are various design elements that are incorporated. In terms of circulation, the design incorporates an accessible trail system with educational components. The trail functions to move users through the site while also connecting the Liberty Science Center to the Nature Interpretive Center. Considering the vegetation, the design leaves as much of the existing vegetation as possible and incorporates new plantings in select areas were new landscape elements are being proposed. New vegetation will be incorporated within the existing vegetation and will increase the biodiversity of the site. Lastly, the design will incorporate and enhance views and sightlines, and provide destinations for park users. The summation of these elements is an educational trail that provides access for park users and an opportunity for people to learn about urban ecology and interact with nature in an urban environment.

The Trail System

Fig. 42: Plan of the trail system .

Figure 42 shows a plan of the trail system. The trail system features two loops connecting at the center by a boardwalk overlooking the proposed freshwater wetland. The two loops function as circulation throughout the site and connect the Nature Interpretive Center to the Liberty Science Center. Users can start at either site and walk in a loop through and return to their starting destination, walk from one side of the site to the other, or loop throughout the entire system. The more linear portions of the trail are along past rail lines and reflect the industrial history of the site. The trail passes through several key moments on the site, including the distinct birch forest and the existing wetland. Two entrances are offered from the parking lot across from the Nature Interpretive Center, so when there are multiple groups for programs, the groups can split up and enter the site from two different locations. The entrance from the Liberty Science

Center incorporates a bridge that goes directly from the center, over a roadway, and into the interior. The trail is a combination of pathways on top of clean soil or a boardwalk.

Maintenance and Planting Strategies

Designing within the urban "Wildland" of Liberty State Park offers a unique situation wherein new plantings can be incorporated with the existing fabric of spontaneous vegetation and/or the existing spontaneous vegetation can be edited through maintenance, such as tree removal or mowing. The novel plant assemblages are unique and thus, traditional planting and maintenance strategies are not necessarily the best solution for the area. The existing vegetation is already characteristic of the site because of its tolerance to the site's conditions. It also offers the opportunity for visitors to be exposed to urban nature. Through minimal planting and maintenance, the site can be edited and enhanced. Some studies have been conducted on planting and maintenance strategies in areas that contain spontaneous vegetation. These studies offer strategies for these unique sites.

Editing Through Selective Maintenance

Ingo Kowarik, through his work at Naturpark Südgelände, outlines several maintenance strategies conducted on the site in the article, "Linking Conservation and Recreation in an Abandoned Railyard in Berlin". He notes the efforts taken to not only conserve the existing vegetation, but to also enhance the biodiversity of the site through different forms of editing. For the project, a concept of zoned spaces was realized, where

certain areas were controlled, and others were left to their own dynamics.[218] In areas where the species composition was left without interference, the characteristic urban vegetation is accepted and unmanaged.[219] In other areas, succession is arrested in order to maintain grasslands and other non-woody vegetation communities.[220] This was done to support rare species found in these communities, but also to allow for the old railyard to stay visible.[221] The strategy of maintaining non-woody communities has an effect on the biodiversity of the site as well as the cultural and aesthetic qualities. Another reason for arresting succession in certain areas is the creation of different "rooms" within the landscape. According to Kowarik, "In order to make clear…the transformation from railyard to urban wilderness over time, the natural dynamics of some areas are arrested. In this way, three types of spaces or "rooms" were defined: "clearings" are to be kept free of shrubs over the long term. Stands that are light and open are to be maintained as "groves," while in the "wild woods" the natural dynamics can proceed fully unfettered."[222] This strategy offers solutions in terms of both species composition and aesthetic qualities. The clearings and groves provide a pre-defined room structure for visitors to experience while also maintaining the biodiversity of the site. Sight lines are also supported through the maintenance strategy. The open character of maintained "rooms" is accomplished through mowing and the removal of trees.[223] Overall, a maintenance strategy of selectively arresting succession within the vegetation

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[218] Ingo Kowarik et. al, "Natur-Park Südgelände: Linking Conservation and Recreation in an Abandoned Railyard in Berlin," *Wild Urban Woodlands. New Perspectives for Urban Forestry.* (2005): 287-299, accessed Feb. 16, 2019, https://www.researchgate.net/publication/270277260_Natur-Park_Sudgelande_Linking_Conservation_and_Recreation_in_an_Abandoned_Railyard_in_Berlin.
[219] Ibid.
[220] Ibid.
[221] Ibid.
[222] Ibid., 295-296.
[223] Ibid., 287-299.

composition to create a room typology is realized at Naturpark Südgelände. This strategy can be utilized within the interior of Liberty State Park as well. There is a need to establish this type of maintenance strategy because two of the main planning objectives for the site are to enhance biodiversity and to create different views and sightlines. This maintenance strategy supports both planning goals.

Planting Within Spontaneous Vegetation

Although the novel plant assemblages of the site will largely be left intact and the presence of the vegetation is supported, there is a need to establish new plantings within the interior as well. During installation of the restoration elements as well as the installation of the trail system, disturbance will occur on the site and parts of the existing vegetation may be destroyed. The affect will depend on the extent of construction in the various parts of the landscape. The disturbance of the vegetation leaves an opportunity for new plants to be planted. Some of the existing vegetation will need to be removed to make way for new site elements and as a result new vegetation can be put in.

Regardless of where exactly the disturbance occurs, the new plants will be incorporated into the larger matrix of the existing vegetation. According to Norbert Kühn, a professor at technische Universität Berlin, "The starting point…is to use plants that can clearly build stable communities under the given conditions of a site and try to transform the plant communities according to a design perspective."[224] This thought supports leaving the unique plant communities within the interior and using them as a framework

[224] Norbert Kühn, "Intentions for the Unintentional: Spontaneous Vegetation as the Basis for Innovative Planting Design in Urban Areas," *Journal of Landscape Architecture* (2006): 46, accessed Feb. 16, 2019, https://www.tandfonline.com/doi/abs/10.1080/18626033.2006.9723372.

in which to incorporate new design elements. The design perspective can be based off goals of the site. Kühn outlines four different ways of dealing with spontaneous vegetation. He proposes to 1. maintain its current state, 2. allow succession to proceed naturally, 3. change succession through intervention, and 4. to improve the aesthetic value by changing the species composition.[225] It is in the last way that the idea for new plantings is proposed.

New plantings offer other benefits as well besides simply re-vegetating disturbed areas. Additional plantings can make spontaneous vegetation more attractive to the people observing it.[226] Choosing species with striking colors or forms can enrich the existing vegetation.[227] However, there are several limitations when it comes to these types of plantings. The success of the plantings will depend greatly on whether the species are able to coexist with the existing species and whether they can tolerate the conditions of the site.[228] The species competitive ability and adaptability must be considered.[229] Within the article, "Intentions for the Unintentional: Spontaneous Vegetation as the Basis for Innovative Planting Design in Urban Areas", Kühn describes several studies in which ornamental native plant species are added to stands of spontaneous vegetation.[230] These native species include *Salvia nemorosa, Centranthus major, Solidago canadensis, and Monarda fistulosa*, among others.[231] There were many mixed results. For example, *Solidago canadensis* was found to establish less well under

[225] Ibid., 46-52.
[226] Ibid., 46-52.
[227] Ibid., 46-52.
[228] Ibid., 46-52.
[229] Ibid., 46-52.
[230] Ibid., 46-52.
[231] Ibid., 46-52.

competitive conditions, but over time, the survival rate was constant.[232] Overall, the conclusion from the experiments and observations was that the use of spontaneous vegetation in urban planting design has great potential, but there is a need for more research.[233] Strategically planting areas within the interior can contribute to the overall aesthetic quality of the landscape and offer a replacement for vegetation that is disturbed. The potentials and challenges described by Kühn can be considered and implemented on the site.

Vegetation Typologies

Another key element of the design is to leave the existing vegetation while also increasing biodiversity. The trail system passes through several different vegetation typologies. At various points along the trail, the borders of the trail can be enhanced with new plantings that serve as an addition to the existing vegetation structure, but also increase the biodiversity of the area. The new plantings will utilize native species that have been seen growing within the interior. Using such species will increase biodiversity and will also utilize species that can tolerate the soil conditions of the site.

Figure 43 shows four section cuts taken at different points along the trail. The existing sections show how the vegetation exists on the site currently. The proposed sections show how that same area works with the new plantings. The trail is on either one foot of clean soil or on a boardwalk and the plantings are within 15 feet from the edges of the trail. The new vegetation can serve as a border for the trail but can also work to

[232] Ibid., 46-52.
[233] Ibid., 46-52.

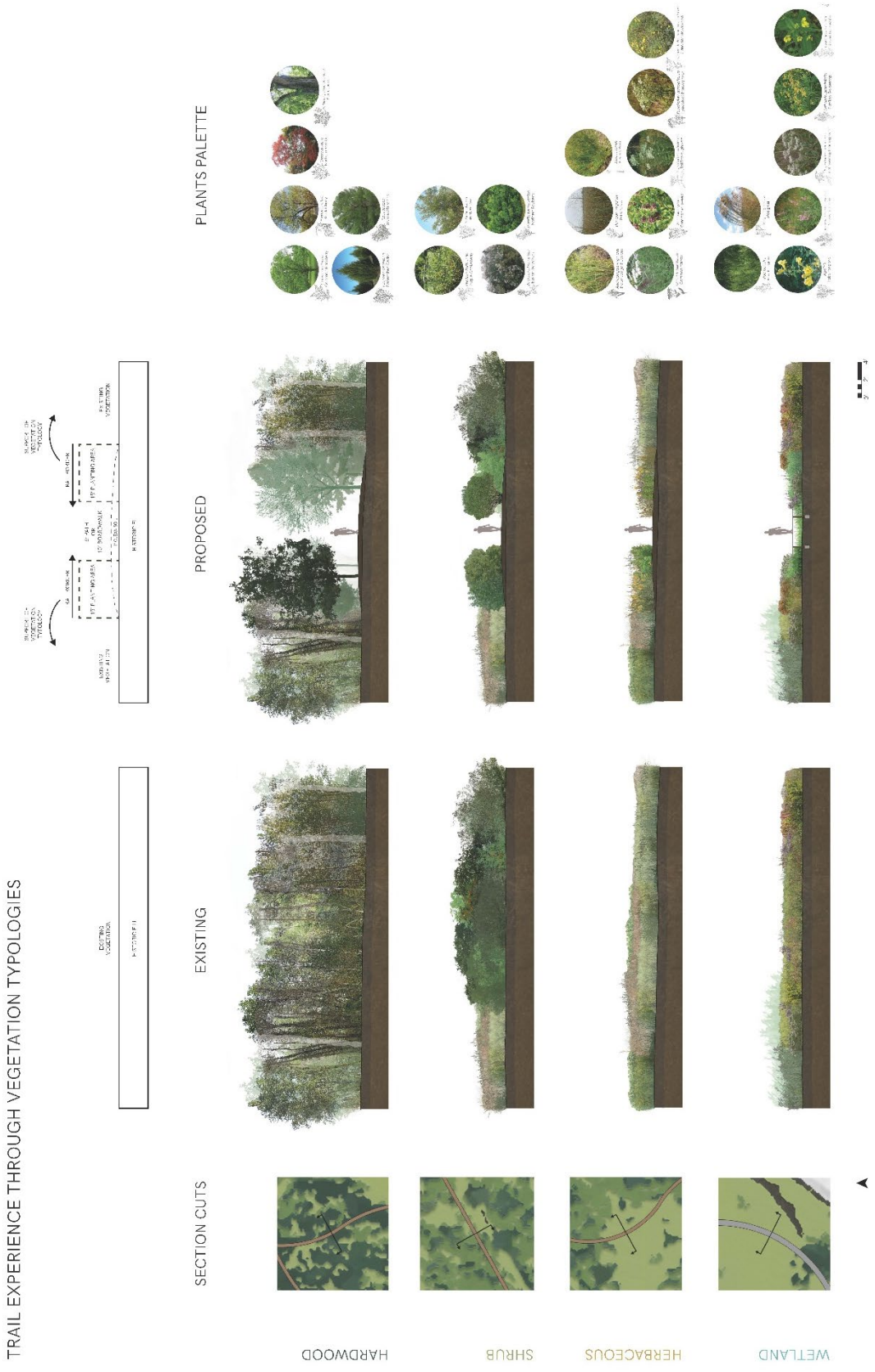

Fig. 43: Planting strategies along the proposed trail system.

support the existing vegetation and can increase the biodiversity. Seeds of the native plants can spread and create a more diverse species composition. It also provides a dynamic trail experience for users. By planting native plant species of different vegetation typologies, the existing vegetation is enhanced. Also, the new plantings serve to provide a barrier to the trails after construction is complete, ensuring users stay on the pathways within the interior.

Figure 44 shows a complete plant palette of species that can be planted on the site. Each of the plants in this palette can be utilized within the trail border plantings. Deciduous trees that recommended for planting include Common Hackberry (*Celtis occidentalis L.*), Black Cherry (*Prunus serotina Ehrh.*), Northern Red Oak (*Quercus rubra L.*), and Black Locust (*Robinia pseudoacacia L.*). Evergreen trees include Eastern Red-Cedars (*Juniperus virginiana L.*) and Eastern White Pine (*Pinus strobus L.*). Deciduous shrubs include Purple Chokeberry (*Photinia floribunda*), Bebb Willow (*Salix bebbiana*), and Steeplebush (*Spiraea tomentosa L.*). Semi-evergreen shrubs include Eastern Baccharis (*Baccharis halimifolia L.*) and Northern Bayberry (*Morella pensylvanica*). Dry grass species include Broomsedge Bluestem (*Andropogon virginicus L.*), Poverty Rush (*Juncus tenuis)*, and Switchgrass (*Panicum virgatum*). Dry forbes that can be planted include Common Yarrow (*Achillea millefolium L.*), Common Milkweed (*Asclepias syriaca L.*), Tall Thoroughwort (*Eupatorium altissimum L.*), Hyssopleaf Thoroughwort (*Eupatorium altissimum L.*), Canadian Hawkweed (*Hieracium kalmii L. var. fasciculatum),* Roundhead Lespedeza (*Lespedeza capitata*), Heartleaf Four O'Clock (*Mirabilis nyctaginea*), Common Evening Primrose (*Oenothera biennis*)*,* Talus Slope Penstemon (*Penstemon digitalis*), Common Cinquefoil (*Potentilla simplex*), Black-Eyed

Susan (*Rudbeckia hirta L.*), Canada Goldenrod (*Solidago altissima L.*), Early Goldenrod (*Solidago juncea*), Anisescented Goldenrod (*Solidago odora*), Wrinkleleaf Goldenrod (*Solidago rugosa*), Seaside Goldenrod (*Solidago sempervirens L.*), Virginia Spiderwort (*Tradescantia virginiana L.*), Forked Bluecurls (*Trichostema dichotomum L.*), Clasping Venus' Looking-Glass (*Triodanis perfoliata*), and Hoary Verbena (*Verbena stricta*). Wetland grass species include Fowl Bluegrass (*Poa palustris L.*) and Woolgrass (*Scirpus cyperinus*). Wetland forbes species include False Foxglove (*Agalinis*), Showy Ticktrefoil (*Desmodium canadense*), Lateflowering Thoroughwort (*Eupatorium serotinum*), Flat-Top Goldentop (*Euthamia graminifolia*), Fringed Loosestrife (*Lysimachia ciliata L.*),

Fig. 44: Proposed plant palette.

Swamp Verbena (*Verbena hastata L.*), and Eastern Marsh Fern (*Thelypteris palustris*). This selection of species can be utilized in various locations along the trail.

Overall, by planting native species within the interior, in areas along the trail, the existing vegetation typologies are enhanced, and a border is created where needed. Selectively adding plants along different parts of the trail system creates a situation more native species can be introduced to the site and the biodiversity in enhanced.

Educational Opportunities

Along the trail, several educational opportunities exist. There are distinct nodes were visitors can learn about different elements of urban ecology. By taking users through these nodes, a full-story of the site is created, and people can learn about how the

Fig. 45: Educational nodes along the trail.

site became what it is and about the value of the landscape is within the urban fabric. Figure 45 shows the locations of the three main educational nodes.

The first node is where the birch forest is located. At this node, there is a boardwalk passing through the forest. Visitors, at this location, can learn about the birch forest and why the site is primarily dominated by birch trees. Users can also learn about how the birch forest is slowly transitioning into an oak forest. The successional patterns of the site can be highlighted. The second node is where the proposed freshwater wetlands are. At this node, users can learn about ecosystem restoration and bird wildlife. The wetland construction project by the U.S. Army Corps of Engineers can show visitors the possibilities of ecological restoration. Also, through an observational bird tower, users can view the many bird species that will visit the wetlands. The third node is the area of high soil metal load. The trail passes through this area, so users can learn about the phenomena that hardwood species on the site tend to colonize in areas with high soil metal load. At this node, users can also learn about the industrial history of the site. Overall, by having nodes along the trail in different areas, visitors have dynamic experience and can learn about the various types of landscapes within the interior.

The Freshwater Wetland

Of the various nodes outlined, the one that was focused on the most was the freshwater wetland. This area is at the center of the site, links the two loops of the trail, and is the area where there will be the most significant modifications made to the landscape. Figure 46 shows an enlargement plan of the freshwater wetland area. The design for this area incorporates a bird tower that projects out onto the water of the

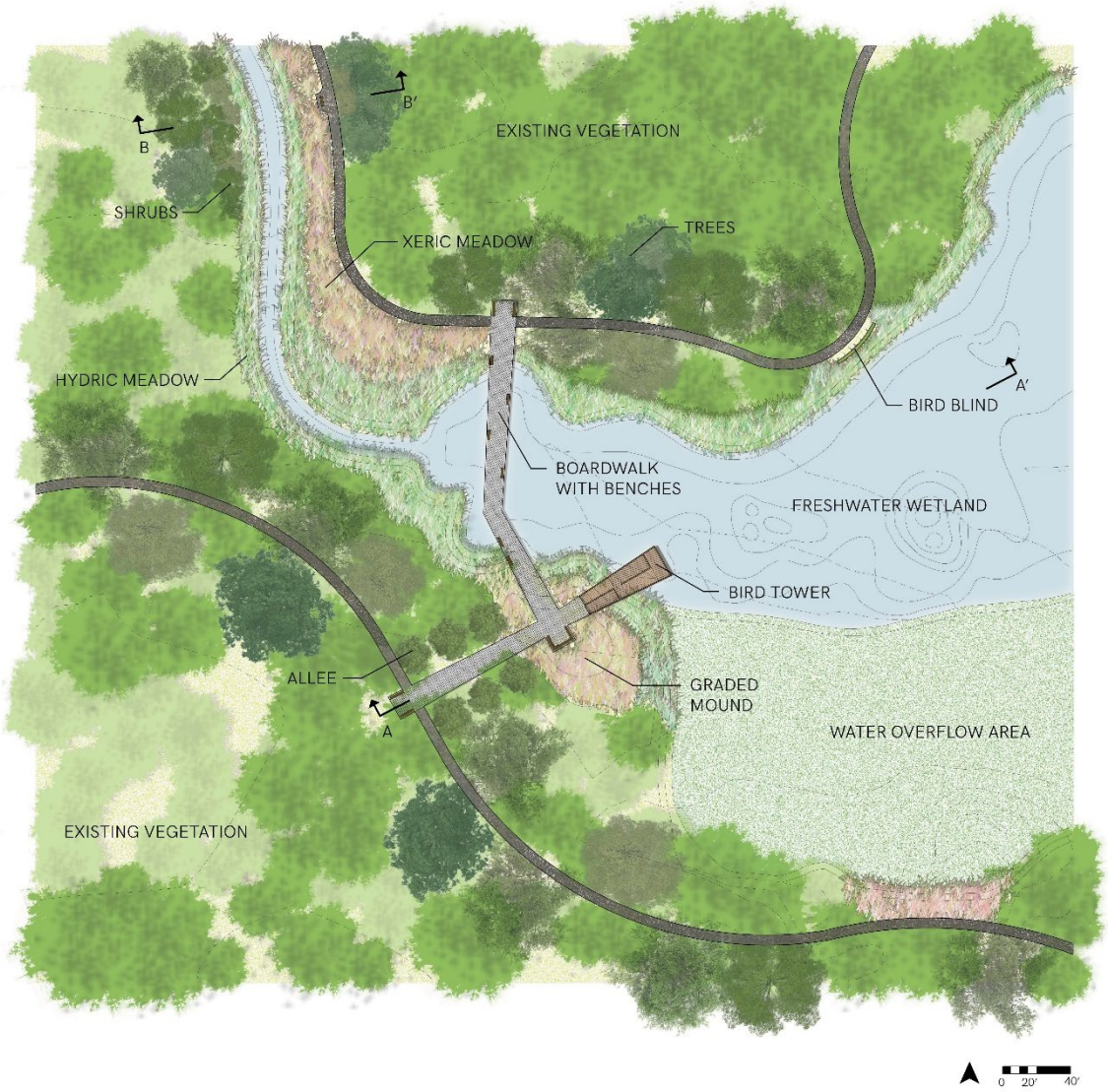

Fig. 46: Plan of the freshwater wetland area.

freshwater wetland and allows users to view the landscape from a different perspective. Visitors can view the many different bird species that visit Liberty State Park from the bird tower. Because of Liberty State Park's position along the Atlantic flyway, many species of birds visit the area at different times throughout the year. There are three levels of the bird tower, so users can be close to the water or high above it, looking out over the landscape and towards New York City. The land is re-graded into a mound beneath the walkway leading up to the bird tower, so a more dynamic experience is achieved when

approaching the tower and the water. The area includes a boardwalk that leads up to the tower and lays across the water. Users can walk over the water on the boardwalk and enjoy a view of the wetland and the stream feeding the wetland. Several benches provide seating on the boardwalk and allows users to sit and enjoy the area. A seating area on the boardwalk before the bird tower offers a space where groups can come together for programs. The paths leading up to the boardwalks are on one foot of clean soil. Openings in the vegetation along the paths provide intentional sight-lines to the wetland. A bird blind is positioned along the water as well.

Plantings are also incorporated within the plan. It will be essential to provide plantings within this area because of the disturbance that will occur when the freshwater wetlands are constructed. Along the edges of the wetland, a mix of wetland grasses and forbes species will be planted. A mix of dry grasses and forbes will be planted on the re-graded mound, along the higher banks of the stream, and along the trail where an intentional sight-line is proposed. An allee of Eastern Red Cedars along the

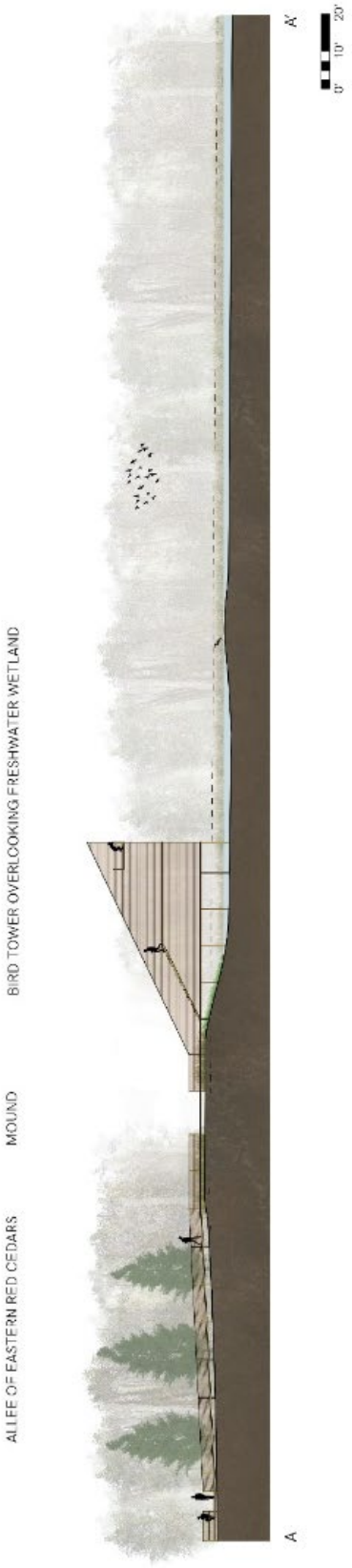

Fig. 47: Section of freshwater wetland area.

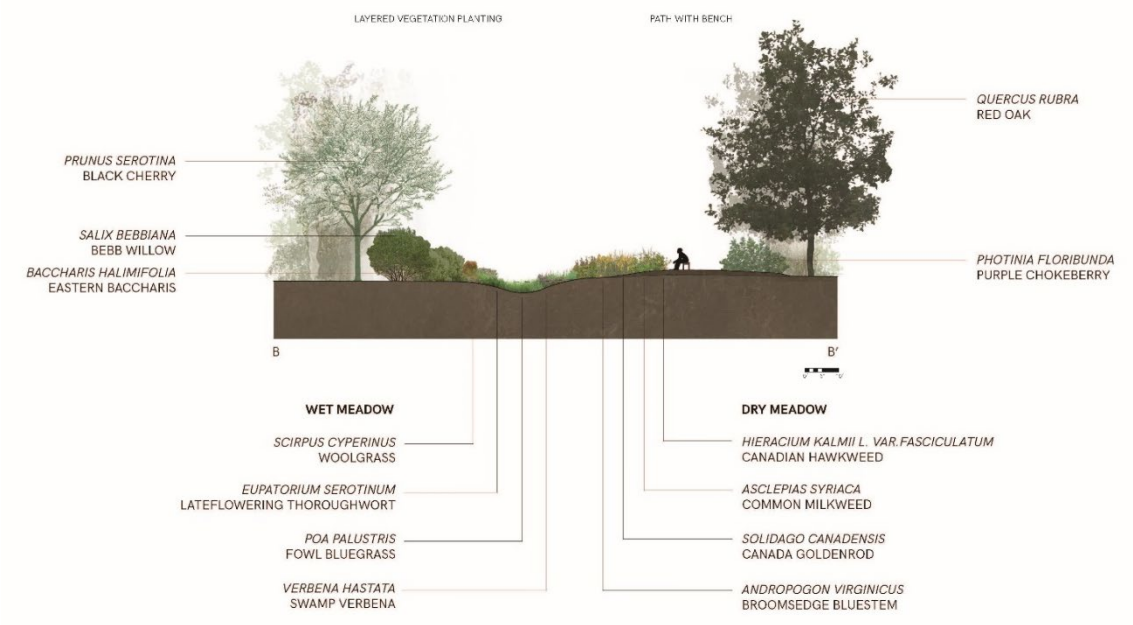

Fig. 48: Section through stream corridor.

boardwalk leading up to the bird tower provides a more structured planting design and leads users to the bird tower, as shown in Figure 47. Along the trails leading to the boardwalk, trees are planted within the existing vegetation where there are herbaceous and shrub communities. This is done so users pass through a dense forest before arriving at the open wetland. Where trees already exist along the trail, new plantings are not proposed. The existing vegetation is left intact.

Figure 48 shows a section through the stream feeding into the freshwater wetland. A new planting will be incorporated in this area, as known on the plan in Figure 46, that

Fig. 49: Seasonal color palette of stream corridor planting.

offers a visually compelling experience for visitors of the space. The section cuts through the planting which features various vegetation typologies. A bench is placed along the trail and, when the visitor sits at the bench and looks out, a layered planting is seen. Dry meadow grass and forbes species are planted along the trail. Wet meadow grass and forbes species are planted within the stream bank. Shrubs are planted on the other side of the stream and trees are planted next to the shrubs. On the other side of the trail, shrubs and trees are planted as well. This layering of vegetation draws attention to the space and also serves functionally to support the stream corridor. Figure 49 shows the seasonal colors of the planting along the section. Overall, the freshwater wetland area is a space where visitors can learn about ecological restoration and the variety of wildlife that visits Liberty State Park.

The Birch Forest

Fig. 50: Red Oak seedling growing in the birch forest. Source: Photo taken by author.

Fig. 51: Proposed boardwalk through the birch forest.

The birch forest is where another educational opportunity exists. Within the birch forest, a transition is occurring, and more and more red oak seedlings are emerging. This provides an opportunity for visitors to see how the landscape is continuing to evolve and change over time. Users can learn about both species of plants. A metal grate boardwalk with wooden edges, as shown in Figure 51, provides an opportunity for users to move through the forest. The boardwalk itself is linear, tracing the path the old rail lines that used to exist. The birch forest offers an opportunity for people to visit a unique site with interesting vegetation. Users can learn about the changes occurring on the site and see over time how the place evolves.

Conclusion

Overall, this project explores the urban "wildland" of Liberty State Park and proposes potential design strategies that allow several planning goals to be accomplished. This thesis explores the complexities of urban ecology and looks at post-industrial landscapes as an opportunity to create unique landscape experiences. Spontaneous vegetation is recognized as an inherent part of fourth nature and provides these sites with an opportunity to stabilize contaminants. It also offers a chance for people living in urban environments to experience self-organizing nature in their own backyard.

The analysis portion of this thesis reveals the various site elements of the interior and takes a more in-depth look at the vegetation on the site. The vegetation is analyzed over time, which revealed where certain vegetation typologies tended to colonize on the site and the rate at which the urban "wildland" developed. The vegetation was also analyzed in terms of species. The plants that exist in the interior are a mixture of native and non-native plant species, making it a novel community. Through on-foot analysis around and through the interior, different areas were identified, and a richer understanding of the site was achieved.

The design offers several strategies that can be integrated into the interior that achieve the goals intended for the site but do not change the character or composition of the site. The circulation of the trail system allows for users to move from the Nature Interpretive Center to the Liberty Science Center, or vice versa. It moves through various vegetation typologies so that users can experience the diverse plant communities that exist. The trail also passes through specific areas in the interior, where educational

opportunities can be realized. By planting in select places along the trail, the overall vegetation structure in left intact, however, disturbed areas can be re-vegetated, and the overall biodiversity is increased. The freshwater wetland area allows for users to interact with nature and see the benefits of constructed wetlands. By incorporating a bird tower, new views are created and there is an opportunity for visitors to observe and learn about wildlife.

There are additional opportunities for design within the interior along the proposed trail. More site elements can be integrated that give users additional opportunities to connect with the site. But overall, the novel communities that exist in the interior are functioning in a positive way, both ecologically and aesthetically. The various design elements that can be incorporated in the future are an addition to the landscape and edit the overall composition rather than alter.

At a time where contamination has become a common occurrence in the landscape, and post-industrial landscapes inhabit the urban framework, there is a need to consider alternative design strategies. This thesis project is an example of the types of opportunities that can be achieved on sites that may not be considered as viable landscapes. The design of an educational trail system through the interior portion of Liberty State Park allows residents of Jersey City and visitors from around the world to experience novel plant communities and learn about the complex systems of urban ecology.

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