Creating Sustainable Neighborhood Design for Legacy Cities: A New Framework for Sustainability Assessment

by:

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A project submitted
in partial fulfillment of the requirements
for the degree of
Master of Science/Master of Landscape Architecture
(Natural Resources and Environment)
at the University of Michigan
April 2012

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ACKNOWLEDGEMENTS

We would like to thank our advisor, Professor Joan I. Nassauer, to whom we are sincerely grateful for guidance, support and inspiration. We also want to thank Khalil Ligon and the Lower Eastside Action Plan for their generous help and continued interest in, and motivation for, this project as active players in reshaping highly vacant neighborhoods in Detroit. We would also like to thank Taubman College faculty members Margaret Dewar and Eric Dueweke for their academic support, as well as Oliver Kiley and SmithGroupJJR for technical advice and guidance.

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ABSTRACT

Highly vacant neighborhoods present challenges for balancing social, environmental, and economic considerations for land reuse. Since the 1960's, many post-Industrial cities such as Detroit have seen extreme population decline, creating severe economic loss and disinvestment in their communities. Strategies and opportunities for stabilization and revitalization, especially those that can be created and implemented by community groups, have become particularly important in these legacy (shrinking) cities. This report uses a case study site on the Lower East Side of Detroit to examine how the Community Development Advocates of Detroit (CDAD) Strategic Framework, a new land use and development framework for highly vacant cities, can be used to influence the Leadership in Energy and Environmental Design for Neighborhood Development (LEED-ND) criteria to allow it to better consider the social, economic, and environmental context of a legacy city. The land use typology described in CDAD's Strategic Framework inform the criteria in the LEED-ND valuation tool measuring the sustainability of a neighborhood in order to create a new framework: Sustainable Neighborhood Development for Legacy Cities (SND-LC). SND-LC provides recommendations to further integrate social capital, social equity, and ecological considerations into the two frameworks through various planning and design techniques. Joan Nassauer's concept of "cues to care" is instrumental for examining social capital in vacant neighborhoods and in identifying opportunities to grow social networks. Recommendations for land use reconsiderations call for the integration of social variables such as neighborhood cohesion and access to resources, as well as ecological variables such as stormwater and green space connectivity. Recommendations in SND-LC encourage retrofitting and illustrate how sustainability can be achieved through a more strategic use of vacant land areas rather than through compactness or new development. The new credit rating system applies the economic and social conditions of a legacy city to a new valuation system that can allow highly vacant neighborhoods across the country to achieve a sustainable neighborhood status.

I. Introduction

A. LEGACY CITIES & SUSTAINABLE LAND USE CONSIDERATIONS

Highly vacant neighborhoods present complex challenges for land reuse that must balance social, environmental, and economic benefits. To address the ongoing issue of highly vacant disinvested areas, cities like Detroit that have experienced extreme population decline and severe economic loss are challenged to find new solutions. While there is tremendous opportunity for neighborhood revitalization, it is imperative for redevelopment strategies to consider present conditions and future goals of local communities. Building upon wide-ranging research related to urban form and social and environmental functions, our project examines a single study area on the Lower East side of Detroit to create more generalizable recommendations for neighborhood stabilization that is applicable to other legacy (often termed 'shrinking') cities. By examining the neighborhood development frameworks of Community Development Advocates of Detroit (CDAD) and Leadership in Energy and Environmental Design for Neighborhood Development (LEED-ND) side-by-side, we have identified ways in which LEED-ND can be adjusted to be more effective in legacy cities and highly vacant residential neighborhoods. In particular, we posit that to increase consideration of social variables such as social capital and social equity in the framework would greatly increase its applicability and effectiveness at a variety of spatial scales.

As LEED-ND stands, its criteria for pilot projects disqualify or disadvantage highly vacant neighborhoods like those in Detroit (Garde 2009). Our exploration of sustainability in low-income, high vacancy neighborhoods suggests the need for a more comprehensive LEED-ND framework that can be applied to other legacy, post-industrial cities throughout the United States. Our recommendations are provided within this restructured framework, titled Sustainable Neighborhood Development for Legacy Cities (SND-LC). Representative landscape design actions showcase and display opportunities for innovation and provide a reference for decision-making.

New frameworks like the one we developed for revitalizing highly vacant areas can give neighborhoods like those in Detroit the opportunity to redefine themselves by harnessing community input and utilizing social networks. With innovative problem solving, Detroit can become a model for other legacy cities nationwide.

B. RESEARCH FOCUS

Our project proposes that the enhancement and facilitation of social capital demonstrated by our design and planning solutions can stabilize highly vacant urban neighborhoods by increasing social equity to create safe and healthy spaces that enhance ecological systems and maintain economic viability. We believe that LEED-ND can be reconfigured to address these issues and thus become a relevant and important standard for sustainability assessment in highly vacant neighborhoods.

C. RESEARCH QUESTIONS

We address the following research questions:

- How can we promote social wellbeing, social capital, and social equity in a way that increases access to resources such as transportation and quality food, and improves the natural environment?
- How can landscape care be used to reinforce social capital and build ecological and economic viability?
- How can we expand upon landscape care to facilitate a more adequate built environment in the context of highly vacant neighborhoods?
- How can we leverage social capital to increase social equity, and vice versa?
- By what means can the land use and infrastructure issues inherent to high vacancy neighborhoods be transformed into assets and be reconfigured to increase environmental sustainability, social equity, and social capital?

These questions explore the role of social capital, social equity, and landscape care in reinforcing each other and in influencing the physical components of sustainability. We have outlined a multi-disciplinary conceptual framework to begin addressing these large questions.

D. PRECEDENT CONCEPTUAL FRAMEWORKS FOR SUSTAINABLE PLANNING

This project draws upon several precedent examples of multidisciplinary conceptual frameworks for sustainable planning. One framework developed by Campbell and rooted in the 1987 Brundtland Report depicts the three fundamental goals of planning—economic development, environmental protection, and social equity—in a triangle that denotes their interactions (Brundtland, 1987; Campbell, 1996). At the center of this triangle is sustainable development, which brings together the focus of economic, environmental, and social interests. In their strategic framework released in February 2010, CDAD also suggests that the community development industry should adhere to a triple bottom line of social equity, environmental integrity, and economic prosperity (CDAD, 2010). However, Campbell holds that the three fundamental goals of planning conflict with each other to create disagreeing priorities for neighborhood development. Our project aims to illuminate how these fundamental goals of planning can work in concert towards sustainable neighborhood development.

E. COMMUNITY DEVELOPMENT ADVOCATES OF DETROIT (CDAD)

CDAD, an organization integral to the vision of this project, was founded in 1997 as an association of community development corporations in Detroit. The CDAD Futures Task Force was formed to create a new vision for Detroit neighborhoods to address the social, economic, and environmental problems that have led to the city's decline. In their strategic framework released in February 2010, CDAD acknowledged that population loss in Detroit will continue into the foreseeable future and that novel land use, planning, and policy solutions must be created in light of this prediction. The framework suggests that the community development industry adhere to a triple bottom line of social equity, environmental integrity, and economic prosperity. They also support a fully collaborative and participatory planning process based on the belief that "residents of Detroit, along with the businesses and institutions that serve them, will be willing to renew their commitment to change if they can authentically participate in this difficult process, then come away with a clear understanding of the right direction(s) for the neighborhood in which they live, work, invest, and serve." We use the CDAD framework to guide incorporation of land use, community, health, and affordability concerns into our suggestions for a revision of the LEED-ND system (CDAD 2010).

The CDAD framework suggests a powerful new land-use typology for Detroit neighborhoods. Using data-driven indicators of change, CDAD creates classifications of different areas of the city in order to determine how to invest in neighborhoods. These classifications also incorporate future visions of what these areas should become. The resulting land-use typology includes eleven land-use types, some of which are conventional urban high-density forms such as the Traditional Residential Neighborhood, and some of which are specific to the low-density reality of Detroit such as the Urban Homestead. The eleven types, or the 'proposed future directions,' are categorized in a density gradient for urban land uses: residential, commercial, and productive. Each type description is based upon current conditions, followed by a vision of future directions for each type, a matrix of short, mid, and long-term strategies for moving forward from current conditions, and finally a description of the role of the community development organizations in this process (CDAD 2010).

CDAD Land Typology	Current Condition	Future Direction
Traditional Residential Sectors	Older, single-family homes and quiet, densely-populated streets.	Mid to higher density single-family homes, along with some duplexes and quadplexes.
Spacious Residential Transition Zones	Mix of single family housing and vacant lots; Vacant lots become more noticeable; blight and fire damage is significant; obvious litter and dumping; some foreclosure and many vacant homes; mix of home owners and rentals; decreased values.	Low density single family homes along with some duplexes and quad-plexes. Yards can range from 30 ft lots to a quarter acre.
Urban Homestead Sectors	Vacant lots with some single family homes; structures on less than half of lots; limited educational attainment; bad infrastructure.	Low and extremely low density; lots can be as large as an acre or more; low-impact agricultural activities permitted by zoning.
Naturescapes	Mostly vacant lots; illegal dumping obvious; mix of ownership; low housing values; low household income; bad infrastructure.	Recreational uses and passive aesthetic uses; Naturescapes are focused in areas that have low density and are most ecologically important.
Green Venture Zones	Mostly vacant lots; illegal dumping obvious; mix of ownership; low values; low household income; bad infrastructure; delivery of city services and utilities is cost prohibitive.	Manufacturing areas with minimal negative externalities (i.e. air, water, or noise pollution).
Green Thoroughfares	Commercial zoning on thoroughfare streets; residential zoning on wider residential streets; streets are predominantly vacant.	Sections of former 5-10 lane commercial services have been reinvented as "green gateways" into the various other sectors of the city; where appropriate, marked paths allow for biking / walking as part of Detroit's Greenway / Bike Path system.
Industry Zones	Adjacent to shipping infrastructure such as freeways, major roads, and active rail; job center.	Heavier industrial areas; buffered by Naturescapes and Green Venture Zones because of their disruptive environmental impacts, such as noise, heavy truck traffic, and various forms of pollution.
Village Hubs	Medium density mix of local and regional servicing businesses; non-residential land use where adjacent residential includes single family housing of traditional density.	Medium to high density with mid and low-rise buildings connected to narrower, walkable "main street" commercial districts; occupied primarily by locally owned businesses providing retail and service amenities to surrounding residents.
Shopping Hubs	Located on a major thoroughfare; adjacent to freeway; predominately chain businesses; ample surface parking.	Focused along existing major surface commercial corridors and interstate thruways; low commercial density, low-rise shopping sectors.
City Hubs	On or adjacent to major thoroughfare; major transit links; predominately mixed-use with mid- and high-rise buildings present; predominately zero lot line setbacks; high occupancy; anchor institutions.	High density with high and mid-rise buildings.
Downtown	On or adjacent to a major thoroughfare; hub or transit; predominately mixed-use with high rise buildings present; first floor businesses; high occupancy; government and cultural center; job center.	High density with high and mid-rise, mixed-use buildings; pedestrian-oriented with zero-lot lines and no minimum parking requirements.

Table I-1. Outline of CDAD Revitalization Framework Land Use Typology (CDAD 2010).

CDAD positions the application of the framework as leading to a "new Detroit that is the first city in the United States to respond to its abundance of vacant land in such a comprehensive and positive way, by offering a unique array of choices in residential living—from rural to main street, from traditional to suburban, from single family to high rise" (CDAD 2010). Their vision for Detroit includes increased employment opportunities within the city for residents, as well as local business ownership by residents. They envision a "Detroit that is a hub of green industry […] but also boasts an abundance of natural green space" (CDAD 2010).

During the beginning stages of the LEAP process, LEAP participants approached CDAD for help in addressing the high number of vacancies in the area, an issue central to revitalization efforts (Desantis 2011). CDAD agreed to the partnership, as the LEAP neighborhood would serve as an ideal testing ground for the application of their new framework. The collaboration between the two organizations has been an extensive and iterative process, involving broad community participation as well as the input of professional organizations to comprise a Stakeholder Advisory Board. Figure I-1 is the suitability map, created by the firm SmithGroupJJR, resulting from the CDAD and LEAP collaboration in applying the CDAD typology to the LEAP area (LEAP 2012).

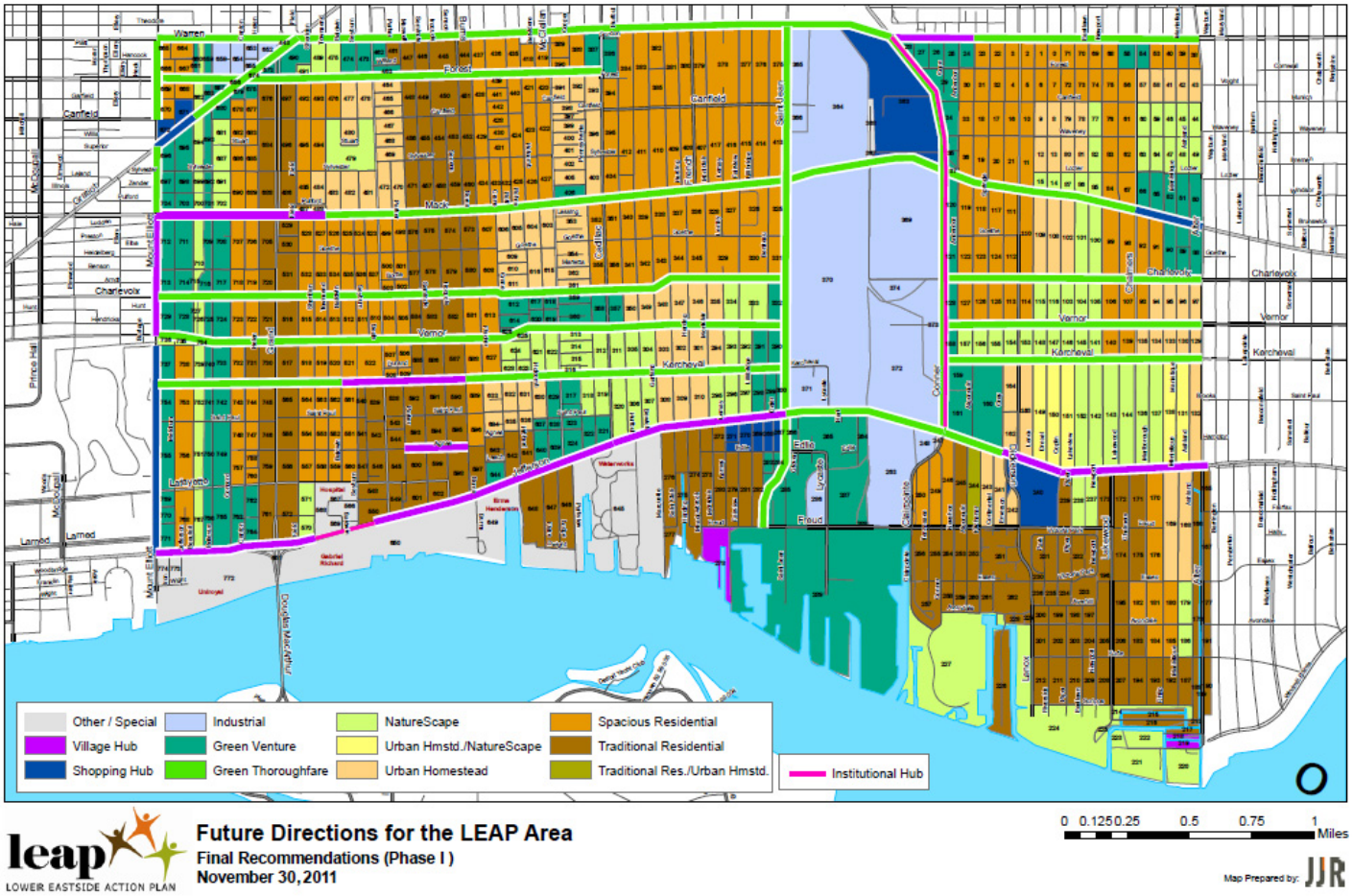

Figure I-1. LEAP Area Suitability Map. Graphic from the Summary Report of the Lower Eastside Action Plan – Phase I, 2012.

F. LEGACY CITY: DETROIT AND THE LOWER EAST SIDE STUDY AREA

Detroit's landscape has changed drastically over the past fifty years due to a steady decline in population (US Bureau of the Census 2010). Detroit is a precise example of a legacy city— one characterized by economic decline from a sustained loss of population and an increasing presence of vacant and abandoned properties— a categorical shift for which no city can adequately plan (Schilling and Logan 2008). Since the City of Detroit reached its peak population of 1,849,568 in 1950, over 1 million people have left the city (Eisinger 2003). Between 2000 and 2010, Detroit has experienced a 25% population decrease, which has also led to a significant loss of federal and state funding (US Bureau of the Census 2010). In 2009, 27.6 percent of the city's residential lots were vacant or had structures awaiting demolition (Dewar and Linn 2011). While neighborhoods in post-industrial cities have witnessed this decline to varying degrees, Detroit's pattern of vacancy is far-reaching. This spontaneous urban de-densification has led to financial strains as tax bases have decreased, commerce has slowed, and unemployment has risen, creating obstacles to maintaining safe and healthy neighborhoods with access to basic infrastructure and resources (Schilling and Logan 2008). In light of these problems, many legacy cities must plan with the prospect of never regaining their original population numbers (La Croix 2011).

Alison Eisinger reviewed the state of economic development in Detroit to find that the main cause of the struggling economy is massive disinvestment in its primary economic base, the auto manufacturing industry. This downturn has had a domino effect, causing large retailers and companies to leave Detroit, ultimately leaving behind a weak market for private office space and retail shopping. Detroit's downtown has a high percentage of abandoned office space and vacant buildings, including some properties that have been vacant since the early 1980's. One example of this extreme out-migration of business is illustrated by the fact that Detroit is the largest city in the United States with no major department store. Such disinvestment and abandonment negatively affects the tax base, limits services to residents, and leaves little to no money for reinvestment in the city's communities (Eisinger 2003).

Eisinger also points out that while there has been local optimism for redevelopment of the city, Detroit's history of illegal political handling, high racial tension, and misuse of public power has created a perception that there is little hope for private development. In response to this history, many believe that public and private investment should not go into the revitalization of Detroit, but instead into other highly sought after communities such as Grand Rapids, Birmingham, and Ann Arbor. In the face of limited funding and resources, the problems facing Detroit must be critically dissected to examine the roots of distrust, and to identify opportunities for investment in neighborhood stabilization (Eisinger 2003).

A first step to examining the problems related to disinvestment and population loss in Detroit is to understand the history of racial hostility that has shaped Detroit's landscape, spanning from housing segregation to prejudiced mayors. Historically, urban renewal projects have disproportionately affected minority neighborhoods in Detroit, and subsidies have been provided to corporate developers to encourage redevelopment of "slum" areas (Sandefur 2005). For example, In the 1950s, the Black Bottom, a black residential neighborhood that was home to the highest concentration of black businesses, was demolished for the construction of the I-75 Chrysler Expressway. While this project was deemed an urban renewal project by the city government, residents saw the expressway as an abuse of public power (NAC 1988). Projects such as these contributed to fragmenting Detroit into segregated communities characterized by large vacant areas abandoned by corporate developers.

Detroit's rapidly changing landscapes and economies have challenged the resilience of its communities and left many residents questioning the future. As it is highly unlikely that Detroit will return to its peak population size in the near future, the question now is how to sustainably stabilize a city that was once home to over 1.8 million and now has a population of less than 714,000 (US Bureau of the Census 2010). Stabilization efforts in this project focus on strategies to socially and economically strengthen Detroit for current and future residents.

G. CASE STUDY AREA: THE LOWER EAST SIDE, DETROIT

This study builds upon the work done by several planning and organizing bodies, in particular LEAP (Lower Eastside Action Plan) and CDAD (Community Development Advocates of Detroit). We provide a critique of the Leadership in Energy and Environmental Design Neighborhood Design (LEED-ND) criteria, and we illustrate how highly vacant neighborhoods can be sustainably structured and stabilized. Of utmost importance is the goal of celebrating and sustaining the community and the amenities that currently exist in the area. By applying LEED-ND and the related representative landscape design actions to the legacy city context of our study area, we aim to provide site-specific research that elucidates some of the instances of success in regards to neighborhood wellbeing and economic activity. The critiques of LEED-ND and their related representative landscape design actions are applicable throughout Detroit and to other similarly legacy cities.

The area that we used as a representative sample of high vacancy housing patterns within a legacy city is a 350-acre site on the Lower East Side of Detroit (Figure I-2). It was selected because it is the same study area delineated by two collaborative projects funded through the University of Michigan's Graham Environmental Sustainability Institute, Documenting and Demonstrating Neighborhood Care Dynamics in CDAD's 'Urban Homesteads' and 'Naturescapes' (Nassauer and Dueweke 2011) and Documenting Care and Commitment to Place in CDAD's 'Urban Homesteads' and 'Naturescapes' (Dewar and Dueweke 2011). The site works as a snapshot of a legacy city, which allows for specific, street-scale observations and suggestions that can be extrapolated to relate to other areas within Detroit and other legacy cities. Legacy cities are defined by a high number of vacant housing units that increases over time. As described by the US Census Bureau, a vacant housing unit is one in which no one is living at the time of Census surveying (US Bureau of the Census 2010). This project adds to the Cencus vacancy count all unoccupied land parcel units at the time of data collection during the summer of 2011. This study area currently has an average vacancy of 65.9% (Detroit Data Collaborative 2009), leaving approximately 24,058 vacant residential lots in an area of roughly 3.67 square miles (Detroit Data Collaborative 2009). The study area is bounded by two main arterials, Mack Avenue to the north and East Jefferson Avenue to the south. To the east of the study area is the active Chrysler Plant, and to the west is the wealthy suburb of Grosse Pointe Park.

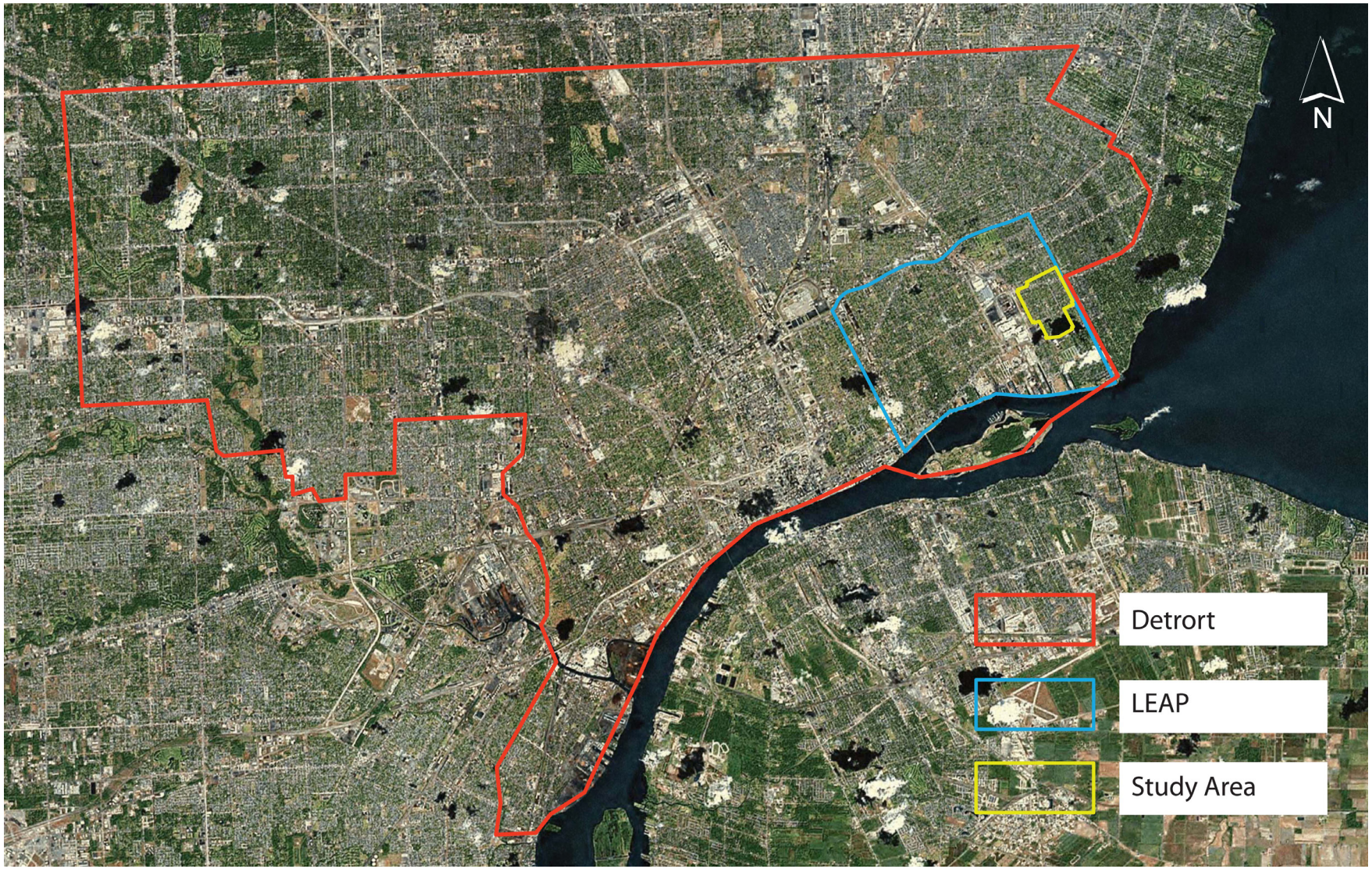

Figure I-2. Case Study Area within Lower East Side of Detroit

This high level of vacancy has left depressed neighborhoods and thoroughfares that exhibit diminished activity, rendering the neighborhood of significant and growing concern in southeast Detroit. Additional issues related to environmental and social justice stem from the adjacent Chrysler Plant and wealthier suburban edges. Of specific concern for this project is the growing imbalance between the quality of vacant space and occupied space, and how this growing disparity perpetuates the cycle of blight that diminishes community cohesion. The analysis aims to address disparity in land quality in forming potential directions towards neighborhood stabilization and future revitalization.

The study area houses both a young and aging African American population, where the majority of the residents do not own their properties. As of the 2010 Census, the racial make-up of the Lower East Side (LES) of Detroit is representative of the city as a whole, with a population that is 87.6% Black or African American and 8.7% White. With 22.7% of the population between the ages of 5 to 17 years old, and 24.8% are between the ages of 45 and 64 years old, the LES has a large number of young people and seniors. Representing less than 20% of Detroit households, the majority of households existing within the study area make an annual income of less than $10,000. Only 40% of occupied residential structures are owner-occupied, with the remaining residential occupants being mostly renters (US Bureau of the Census 2010). These characteristics are significant as we analyze neighborhood place attachment and neighborhood wellbeing in a locale that continues to experience population decline. Recommendations are made based on previous research, case studies, and data generated by *Documenting and Demonstrating Neighborhood Care Dynamics in CDAD's 'Urban Homesteads' and 'Naturescapes'* (Nassauer and Dueweke 2011) and *Documenting Care and Commitment to Place in CDAD's 'Urban Homesteads' and 'Naturescapes'* (Dewar and Dueweke 2011).

H. PROJECT CONCEPTUAL FRAMEWORK

Our conceptual framework sets the foundation for the assumed economic context of this study area, where traditional neighborhood development and revitalization may not apply (See Figure I-3).

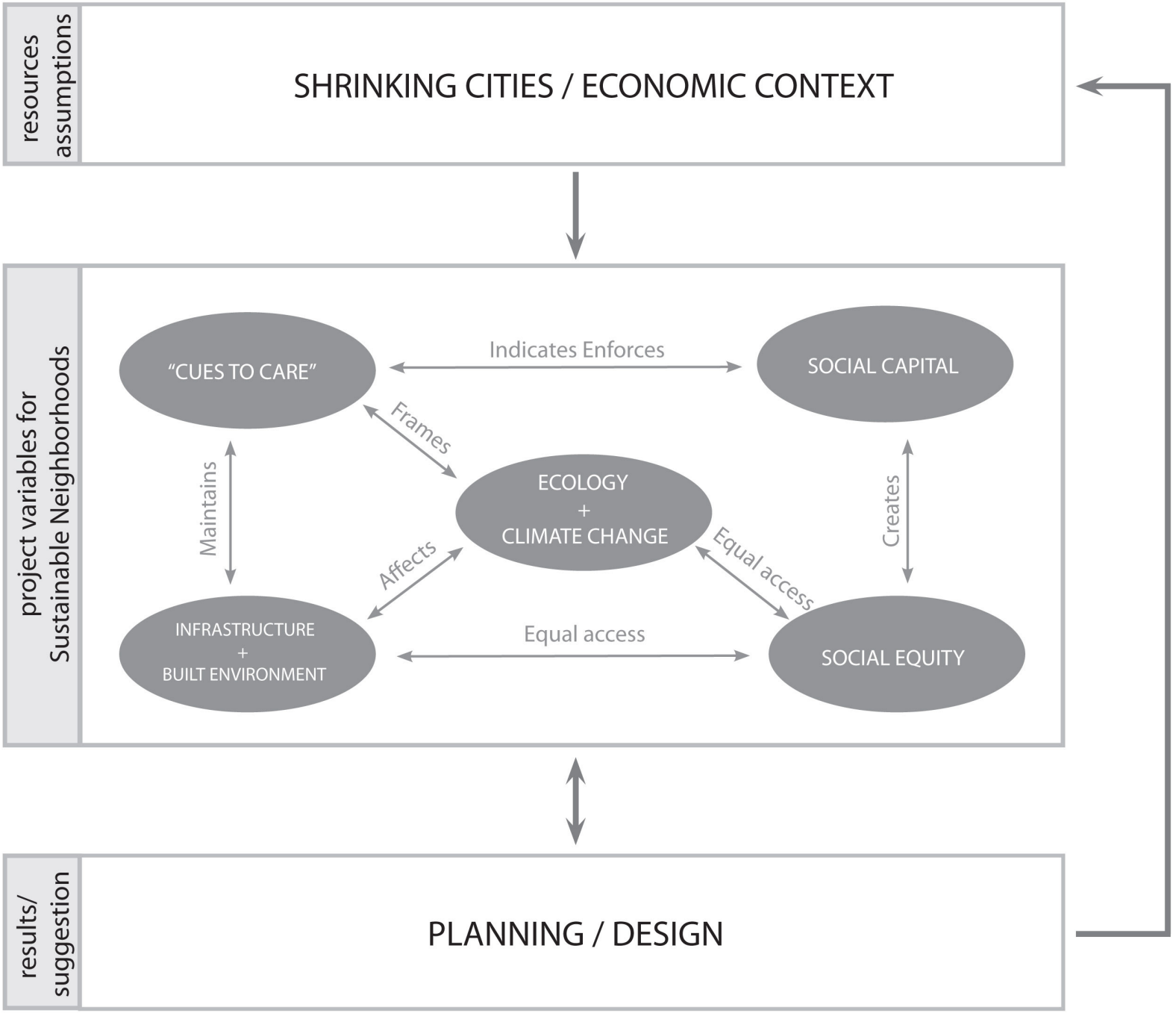

Figure I-3: Project Conceptual Framework

Our project is sensitive to the very limited capital inputs to neighborhood revitalization in Detroit, and our project assumes that most resources are derived from within the community. Additionally, our conceptual framework assumes that there are economic as well as other resources derived from social and community networks. The project variables that are informed by these resource assumptions pertain to economic, environmental, and social interests. Additionally, we build upon Scott Campbell's model of sustainable development, which illustrates the necessary balance between three conflicting interests in planning: the social, the environmental, and the economic. Building upon Campbell's model, we begin to understand other factors that are essential to stabilizing and potentially revitalizing neighborhoods within legacy cities (Campbell 1996).

Social capital is a key component of our analysis, as it acts as a form of currency to facilitate human interactions and develop social networks for community development. This in turn may increase social equity as social interactions create opportunities for neighborhood redevelopment. Key to our framework is the environmental justice perspective, which holds that social equity is greatly affected by infrastructure and the built environment. This position is illustrated by the goal of good urban planning to increase equality of access to resources for all neighborhoods. The environmental justice component is also represented in the disproportionate burden that future climate change scenarios place on low-income communities. Ecological flows and climate change effects can exacerbate social equity issues by impacting access to natural resources within communities. Infrastructure and built environment and the natural environment are closely related as aspects of the physical environment, and are most effectively addressed during ecological planning for climate change. "Cues to care" are particularly important to the social context of neighborhood appearance (Nassauer 1995b). Cues to care are a visible form of landscape intervention that indicate neighborhood investment. Cues to care can be used to support healthy neighborhoods by allowing people to understand the importance of ecology through an orderly frame. By providing this well cared-for frame for ecological functions, cues to care can promote environmental stewardship. In the literature review we will further explore how cues to care can promote a sense of wellbeing and safety and support neighborhood stabilization.

These intertwined variables greatly inform the project's recommendations. We aim to provide a set of suggestions that will allow for greater understanding and consideration of the features unique to a legacy city. We do not intend to provide recommendations for economic growth, but rather proposals that work within the current economic climate and allow for neighborhood stabilization.

I. PROJECT SCOPE

We offer recommendations that expand upon the LEED-ND precedent by further integrating social equity and social capital. While our recommendations are based upon our observations within the project study area, they attempt to be far-reaching in order to apply to legacy cities across the United States.

J. RESTRUCTURING THE LEED-ND GUIDELINES

As legacy cities are defined by shrinking populations and increasing vacancies, they must be treated differently than cities that are not facing the same problems. The planning framework within which representative landscape design actions are recommended builds upon the neighborhood design guidelines of LEED-ND and the policy and land-use planning framework of CDAD. While the LEED-ND framework serves as a valuation tool by which cities measure sustainability, the criteria do not consider the unique circumstances of legacy cities. In restructuring these guidelines, we focus on concepts of landscape care, social capital, and social equity emphasized by the *Documenting and Demonstrating Neighborhood Care Dynamics in CDAD's 'Urban Homesteads' and 'Naturescapes'* (Nassauer and Dueweke 2011) and *Documenting Care and Commitment to Place in CDAD's 'Urban Homesteads' and 'Naturescapes'* (Dewar and Dueweke 2011).

LEED has become the standard for sustainable design assessment within the built environment. In light of its recognition, our project will incorporate the principles of LEED-ND developed by the U.S. Green Building Council (USGBC), the Congress for New Urbanism (CNU), and the Natural Resources Defense Council (NRDC). These organizations are comprised of environmentalists, developers, builders, and leading design professionals. The U.S. Green Building Council is also known as a leader in green building and is widely recognized as a venue for environmental design and development. The LEED-ND rating system was developed using the combined principles of smart growth, New Urbanism, and green building and infrastructure. The rating system allots credits based on environmental impacts and human benefits within specific impact categories, and emphasizes site selection, design, and construction elements while incorporating buildings and infrastructure, chiefly transportation and utilities, into a local and regional context (USGBC 2009).

As they stand, LEED-ND criteria are not universally relevant nor are they attainable for legacy cities. While the rating system gives some points for social and public health benefits, social capital is under-counted, and the criteria focus too heavily on compact development. Overall within the LEED-ND criteria, there is a lack of opportunity for crediting retrofits. The focus on creating new developments for LEED-ND accreditation puts legacy cities and highly vacant neighborhoods at a great disadvantage. Our team seeks to demonstrate that the development patterns encouraged by LEED may not be applicable to highly vacant neighborhoods, and that the target ecological and social processes may be attained through a set of different development patterns. Some of these patterns and strategies are found in the CDAD typology, which is used to inform our critique of the LEED-ND rating system with alternative opportunities for sustainable development and to highlight the importance of social capital in neighborhood development.

Ultimately, the main lens of critique focuses on areas where the social capital promoted by CDAD could be substituted for the technological improvements promoted by LEED and also on where ecological systems could be protected and enhanced. We seek to reconstruct the LEED-ND criteria to increase applicability to both the study area and to the city as a whole. The resulting planning framework provides guidelines for neighborhood stabilization that include site-specific representative landscape design actions to elucidate and visualize the recommendations on the ground.

K. A RESOURCE SCENARIO FOR LEGACY CITIES BASED UPON DETROIT

Since the future of Detroit's economy is uncertain, this project is based on a set of reasonable assumptions that might be representative of American legacy cities. The methodology, recommendations, and case study sections are positioned within these plausible assumptions for a future scenario, which we have termed the "Low-Input, High-Impact" economic scenario (LIHI):

- Government and NGO funding from outside the neighborhood is limited. Local initiatives can be used to leverage outside investment by government, NGOs, and private sources
- Social capital is the main community resource that can be built upon and reinforced
- The "market" is mostly derived from within the neighborhood; few visitors are expected
- There will be very limited new market demands for real estate
- Municipal funding for infrastructure and services is stable or decreasing

The current LEED-ND criteria do not function under these assumptions. Our conceptual framework, diagrammed in Figure I-3, shows sustainability as comprised of the conditions of the social, the ecological, and the built environments. In reaction to the resource scenario, and through consideration of the variables outlined in Figure I-3, the framework suggests representative design actions as well as planning considerations. The representative design actions are site-specific reactions that are generalizable to the rest of Detroit and to other legacy cities. Recommendations address residential areas, natural areas, economic and community nodes, transit and corridors, and community development. The resource scenario and the outlined conceptual framework is the basis for our planning recommendations related to LEED. By considering the reality of resource availability in disinvested neighborhoods, our planning and design recommendations seek to reinforce and bolster the social and physical fabric of the neighborhood.

L. GROUNDWORK: BUILDING ON PAST EFFORTS

The design and planning recommendations that result from this project are based largely upon previous and ongoing work. We are using the Neighborhood Revitalization Strategic Framework created by the Community Development Advocates of Detroit (CDAD) to inform the LEED-ND credit rating system so that it can apply to our study area within the Lower East Side of Detroit and to legacy cities throughout the US. The "Documenting and Demonstrating Neighborhood Care Dynamics in CDAD's 'Urban Homesteads' and 'Naturescapes'" project developed an assessment framework involving cues to care, which provides an important social context for our planning and design recommendations (Nassauer and Dueweke 2011).

The Lower Eastside Action Plan (LEAP) is a community-driven project that aims to convert vacant properties into community assets that can improve the quality of life for residents. The LEAP process strives to: generate a plan that addresses the vacant land crisis in the Lower East side of Detroit, create strategies that adapt vacant land for more efficient uses, issue recommendations for best uses of vacant land based on the needs and assets of the surrounding community, and affect policy changes to support vacant land adaption (LEAP 2012).

Another organization important in informing research for our project is the Detroit Vacant Property Campaign (DVPC). Run by The Detroit Local Initiatives Support Corporation (LISC), the DVPC is a citywide initiative focusing on vacancy issues. Working to empower local residents, DVPC seeks to reduce the negative effects of foreclosures and vacancies and to encourage the productive use of derelict land. Research done by LEAP and DVCP has provided a solid foundation to inform our critiques and recommendations.

Together, all of this previous work gives us a starting point from which to ask questions and to perform our analyses.

M. LEED-ND

The U.S. Green Building Council (USGBC) LEED criteria for buildings established environmental benchmarks and standards that have been widely accepted and adopted by state and local governments as well as private and public institutions. Working toward building ecologically-minded neighborhoods, the USGBC created LEED for Neighborhood Development (LEED-ND), a set of criteria by which to assess the sustainability of neighborhood development. These criteria assign credits for different components of sustainable neighborhood design, which are weighted in a three-step process:

- A model neighborhood is used as a reference to estimate the environmental impacts of a typical neighborhood development pursuing LEED certification.
- The relative importance of neighborhood impacts in each category is set to reflect the values of the National Institute of Standards and Technology (NIST).
- Data that quantify neighborhood impacts on environmental and human health are used to assign points to individual credits (USGBC 2009).

LEED-ND credits are also assigned based on categories of certification: Smart Location and Linkage, Neighborhood Pattern and Design, Green Infrastructure and Buildings, Innovation and Design Process, and Regional Priority.

LEED-ND was adopted in 2009 as a land-use planning framework for entire neighborhoods that includes infrastructure, street design, and buildings. The LEED-ND rating system was developed with the Congress for New Urbanism and the Natural Resource Council to integrate the principles of smart growth, green building, and New Urbanism into neighborhood design while accounting for social wellbeing and public health.

The rating system is broken down into three main categories that total 100 points: Smart Location & Linkage, Neighborhood Pattern & Design, and Green Infrastructure and Buildings. Each category contains various criteria, some of which are considered prerequisites, and some of which are rated by credits. There is also an opportunity to achieve bonus credits for Innovation and Design Processes as well as Regional Priority, worth up to 10 additional points total. Neighborhoods that are certified by LEED must achieve at least 40 points to be certified, 50 points for LEED Silver Status, 60 points for Gold, and 80 for Platinum (USGBC 2009). The allocation of LEED credits is based on environmental impact as well as on human benefits, allotting the most credits to designs and plans with the greatest benefits.

LEED-ND recognizes the importance of neighborhood-scale climate change adaptation and mitigation strategies. Approximately one third of the prerequisites and credits in the rating system address climate change or provide climate adaptation or mitigation opportunities. Incorporating sustainability into neighborhood design can reduce the carbon footprint of the urban form by targeting energy use in building operations and transportation. It can also reduce the urban heat island effect while simultaneously reducing stormwater runoff and nonpoint source pollution loads. Sustainable design can be a key component of climate adaptation as it reduces sensitivity to future climatic conditions while facilitating mitigation by reducing greenhouse gases associated with transportation and building operations (Pyke et al. 2007).

While this framework can be successful in many neighborhoods, a study by Garde shows that the policy implications and the planning and design criteria for LEED-ND pilot projects disqualifies or disadvantages highly vacant neighborhoods like those in Detroit. The results of his analysis of the LEED-ND rating system show that areas with low building density, or rural areas where zoning laws do not permit high density development or public transportation, do not fit the LEED-ND prerequisites for site selection. Additionally, many of the LEED-ND projects that are certified Gold or Platinum gained the majority of credits from the Green Construction & Technology criteria, disadvantaging low income communities that cannot support this type of development without private investment. Garde's analysis of the LEED-ND rating system illustrates the importance of location-related characteristics, with the preferred location criteria having the highest mean score (6.9) among all categories, totaling over 95.5% of the surveyed project points received. The rating system also awards very few points for affordability, with only 47.9% of the projects surveyed expecting credits for affordable rental housing. Additionally, results showed that only 27.4% of the surveyed projects were expected to receive credit for local food production (Garde 2009). Furthermore, the framework does little to account for various aspects of the social environment. It is apparent that current LEED-ND criteria, though generally considered the gold-standard of sustainability assessment, may in fact not be applicable to low-income, high vacancy neighborhoods such as our study area, and that a revised set of criteria may be required.

II. Literature Review

A. INTRODUCTION

City plans and designs are made to influence the ways that people move and interact (Jacobs 1961). This influence can either entrench political and social structures, or it can help lead to improved social equity and cohesion. Understanding the effects of form, function, and aesthetics on behavior is key to creating functional and appealing neighborhoods, and examining the rules and norms that govern neighborhood landscapes is imperative to creating equitable living environments (Lynch 1964; Prange 2009). Urban form and design can also have major implications for the environment and for ecosystem services. This chapter addresses sustainability from a social, built, and ecological perspective by applying these themes to environmental justice issues in highly vacant neighborhoods. The literature review is guided by the themes outlined in the project's conceptual framework diagram (Figure I-3) discussed in the Introduction in order to highlight the intersection of sustainability with the social, ecological, and built environments. We also examine the applicability of LEED-ND as a tool to promote sustainability and to plan for potential future climate change scenarios in legacy cities. These concepts underpin our investigation of neighborhood stabilization strategies for highly vacant neighborhoods.

As more cities begin to implement "right-sizing" strategies, it is important to consider the impact of those policies and programs on objective measures of quality of life as well as on residents' subjective perceptions (Hollander 2011). While the social ramifications of right sizing require further research, its physical implications have received much attention, particularly in Germany where a number of cities in the eastern portion of the country have experienced extreme de-densification. Schetke and Haase discuss the pattern of "urban perforation" caused by random demolitions and unused infrastructure as an opportunity to incorporate new green space into existing housing, green structures, and transport networks. In a study of two neighborhoods in the legacy German city of Leipzig, which has suffered a loss of 30% of its residential population in recent years, they explore the impacts of different housing patterns on emerging green space. They find that larger expanses of medium-quality open space can be attained through uniform demolition patterns, while smaller-scale ecological improvements that enhance green spaces can be made in more heterogeneously perforated urban areas (Schetke and Haase 2008).

Among the most popular current trends in growth-centered urban and regional planning is "smart growth," a model of sustainable and regional development based on principles of mixed land use, compact building design, walkability, aesthetics, mobility, and environmental conservation (Jabareen 2006). In a study conducted in 2009, Pallagst criticizes the new focus on "smart growth" as a fragmented and inadequate method for addressing legacy cities that focuses too heavily on land use. By comparing the strategies employed by Pittsburgh, PA, Youngstown, OH, and San Jose, CA to deal with shrinkage, she concludes that cooperation and participation are essential to creating a coherent political and planning perspective that can overcome the fragmentation of conventional, growth-focused planning approaches. She calls for a shift from growth-centered planning to one that promotes sustainable regional development patterns that incorporate a broader, regional perspective to address the different actors and stakeholders involved. This new focus on "shrinking smart" emphasizes the importance of communication and consensus between competing agencies such as planning departments and redevelopment agencies (Pallagst 2007).

Schilling and Logan also call for a "right-sizing" approach to legacy cities in the article A Green Infrastructure Model for Right Sizing America's Shrinking Cities. They outline three efforts that have successfully promoted value-adding land use strategies in legacy cities: instituting green infrastructure plans and policies, creating land banks to manage the effort, and supporting community consensus through collaborative neighborhood planning. Schilling and Logan challenge academics, practitioners, and policy makers to collaborate on issues of financing, lack of legal authority, and displacement of local residents in order to both craft appropriate policy agendas and diffuse policy innovations (Schilling and Logan 2008). Catharine La Croix suggests alternative land management strategies to handle the challenges of a legacy city. She proposes that land be taken out of the development market and put into alternative, productive "green" uses. This is illustrated in Detroit where a growing grassroots movement has encouraged homeowners to acquire adjacent lots for home and garden expansion (La Croix 2011).

A study done by Joseph Schilling based on a regional vacant property policy assessment for the city of Buffalo evaluates existing policies and programs through interviews with more than sixty individuals who were identified as key

stakeholders for the city. Based upon results of the analysis, Shilling proposed the "right-size" model, recommending a combination of land banking, community driven planning, and green infrastructure to stabilize the city and to prepare for effective growth and investment. Many planning and economic development models focus on growth and growing populations; however, the "right-size" model takes into account the existing population and projected population size. To use this model, legacy and disinvested cities and neighborhoods must engage community groups, business leaders, and policy makers to allow for a transparent process. Once a "right" size is established, the group must then create a community-driven plan for the area that addresses environmental and social issues through green infrastructure. Community stakeholders may then approve the plan, at which time green infrastructure strategies can be applied to the neighborhoods. Shilling's study found that in Buffalo, houses located adjacent to stabilized designated green lots saw an average of 17% property value increases. Streetscape improvements provided another 28% increase in value, and new tree plantings provided another 9% increase in value (Schilling 2009).

Similarities between the Buffalo study site and Detroit suggest that the right-size model may lead to neighborhood stabilization in Detroit and encourage green infrastructure and investment. In Section Two of this literature review, theories of functional, legible, and sustainable urban form and land use, including those pertaining to Detroit's high-vacancy context, are further examined.

Shifting urban forms through right sizing strategies has direct implications for resource access. In Section Three of this literature review, we will explore issues of social justice from an environmental justice standpoint by examining influences on and implications of access to basic resources. Through an environmental justice perspective, we will consider direct and concrete relationships between cause and effect in order to approach the relationships between behavior, community health, and city form. Within this framework, a person's relationship to his or her environment is predicated on the quality of living and working conditions, which are inextricably linked to the allocation of resources and burdens across neighborhoods. Scott Campbell uses a justice framework to argue that sustainable development must balance three chief interests in planning that often conflict: the social, the environmental, and the economic. This conflict of interests is commonly illustrated in instances of low-income communities being targeted as locations for polluting industries, landfills, and other locally unwanted land uses (LULU). By maintaining the political and economic systems that have led to such inequitable living conditions, Campbell argues that we have neglected the health of ecological systems and their impacts on people. Campbell also maintains that economic segregation is leading to environmental segregation, rendering environmental protection a luxury. Campbell believes that in order to ultimately understand and achieve sustainable development, the public must recognize the failings of our political and economic systems to simultaneously protect people and the environment (Campbell1996). Furthermore, reexamining the components of climate adaptation, ecological function, and human quality of life in highly vacant Detroit neighborhoods thus requires looking at sustainability in the context of the legacy city. In order to contextualize and reevaluate the expectations of sustainability, we will end our literature review by examining relevant ecological issues and their formal implications in a low-density context.

B. BUILT ENVIRONMENT

Our study area is located in the Lower East Side of the City of Detroit, and is a typical example of a highly vacant area in a legacy city. The features that make this area characteristic of legacy cities, such as vacant lots and buildings, are not only examples of decline but are also active forces that both impact and are impacted by human experience and behavior. Research has shown that physical urban form and social features of an environment are closely intertwined, and can jointly affect an individual's behavior and well-being. More specifically, environmental conditions, including the aesthetic qualities of places, exert either positive or negative influences on user wellbeing (Nassauer 1995a).

Visionary planner Kevin Lynch understood the relationship between people and urban form as one that is influenced by the paths, edges, districts, nodes, and landmarks that characterize a city. In his seminal work, The Image of the City, Lynch explored spatial patterns in the American cities of Los Angeles, Boston, and Jersey City through personal documentation and interviews with residents. From this work, he defined a path as a channel of movement, an edge as a perceived boundary, a district as a section of a city distinguished by some identity or character, and a node as either a convergence of paths or a concentration of a particular physical character. These components of urban form are integrated into the mental maps of the city's users. Legibility, which Lynch defines as the ease with which these components can be recognized and organized into a coherent pattern, is a particularly important visual quality that shapes the movement and pattern of people in cities. For example, Lynch found that several components of paths, such as perpendicular intersections or the gradient of features along their sides, change the legibility of travel and reinforce the city image. In acknowledging psychological responses to urban form, Lynch's work suggests that a city's physical character influences the potential for recognition, adaptation, and stewardship of urban space by its residents (Lynch 1964).

The performance of a city and the connectivity between its different areas depends on the way in which people relate to its physical forms and to one another. In her book The Death and the Life of Great American Cities, Jane Jacobs suggested an approach to understanding the connection between city form and the inhabiting communities that is based on the concept of "placemaking." To Jacobs, a city does not serve its true function if it does not first and foremost meet its residents' needs. For this to take place, the streets must be respected as public spaces owned by empowered residents who shape the character of their neighborhoods. To engender this sense of ownership and belonging, Jacobs cites the importance of diverse landscapes that provide adequate space for interaction and for commerce (Jacobs 1961). This idea of "eyes on the street" is one of the groundbreaking concepts of the 1960s that has led to the multi-faceted approach of "placemaking" in planning, design, and management of public spaces. 'Placemaking' involves the input of community members to create a common vision for a neighborhood that reflects the needs and aspirations of those who live, work, and play in an area (Schneeklof and Shibley 1995). Resident participation in creating this shared vision increases community cohesion and affects urban form and function, organically shaping a neighborhood to reflect its social and physical features. Community empowerment and cohesion begin the process of creating networks of social capital, a critical element of revitalizing declining cities (Brisson and Usher 2005). We elaborate on the concept of social capital below.

C. SOCIAL ENVIRONMENT

C1. Social Capital

Social capital can be defined as the network of resources that can be aggregated if members of a community are linked through common interest. Social networks are composed of a variety of relationships that can affect the flow of such resources. Networks can be developed either formally or informally. Formal networks include those built from associations and groups, civic actions, and workplace relationships. Informal networks are often developed through friendship, family, and neighborhood relationships. These networks promote social coordination and cooperation between groups. They also develop trust for mutual benefit to ultimately create community level resources (Baum and Ziersch 2003).

Theorists have defined several types of social capital that exhibit different connections within and between groups in order to identify those that support healthy communities. Brisson and Usher define the difference between "bonding" social capital and "bridging" social capital respectively as the difference between the support provided between neighbors and the support provided by larger institutions to a neighborhood. Bonding social capital is critical to enhancing resident quality of life by addressing the specific needs of community members who are encumbered by eligibility requirements for government or institutional support. The research finds that resident participation, home ownership, and neighborhood stability are key indicators of bonding social capital, while neighborhood density, income, and education are not (Brisson and Usher 2005). Bonding social capital is largely independent of economic capital, and brings together individuals within common demographic groups. Other forms of social capital, termed "linking" and "bridging," involve relationships that connect people across various power levels and engender a sense of connectedness and responsibility between separately bonded groups (Baum and Ziersch 2003). In Reflections on the Use of Social Capital, Schuller discusses the importance of both bonding and bridging relationships and how they relate to policy development. He claims that a combination of multiple forms of social capital (community, social networks, etc.) is needed to achieve substantial policy development, and cites the lack of bonding and bridging relationships between community groups and government as a chief cause of ineffective policy decisions. Fostering both types of relationships can allow for effective committees that exhibit internal cohesiveness and cultivate creative values among their members. Schuller also establishes that both formal and informal social networks can lead to the different forms of social capital that affect resource flows (Schuller 2007).

Social Capital and Neighborhood Design and Appearance

Also central to developing the concept of social capital is an understanding of how it links to a neighborhood's physical appearance, including its design and maintenance. For example, neighborhood walkability is one mechanism by which design factors influence social capital. A more walkable environment and street network design have been found to promote neighborly interactions and the development of social capital. In reviewing the literature exploring the role of social capital in the psychology of health and place, Wood and Giles-Corti found that although social capital is not necessarily defined by or confined to geographical boundaries, the literature is increasingly supportive of the links between physical environment and opportunities for social interaction and recreation. For example, the authors reference a study that links an increase in the frequency of walking trips within a neighborhood to an increase in unplanned interactions between neighbors, which engenders a sense of community. Additionally, Wood and Giles-Corti cite multiple studies that identify physical dynamics of a neighborhood that can influence social capital, including the following:

- Incivilities and disorder
- Aesthetic appearance
- Housing design
- Private and public property upkeep
- Feelings of safety
- Access to nature and greenery (Wood and Giles-Corti 2008).

C2. Care

Care: Definitions and links to social capital

Landscape care is a concept involving the physical form of the inhabited environment that may be closely linked to the concept of social capital. Care can be defined as "protecting or maintaining what we pay attention to." According to Nassauer, care in the landscape is a means of communicating human intention and maintenance, and "cues to care" are visible manifestations of such care. Cues to care in the landscape can communicate engaged human presence or ownership, which connotes civility or neighborliness, safety, and marketability or productivity (Nassauer, 1995b). Thus, a physical manifestation of social capital may be seen in landscape care.

Norms of care are manifested in landscapes in a myriad of ways, some of which include:

- Mown turf
- Trimmed trees and hedges or neat rows
- Bird boxes and lawn ornaments
- Colorful flowers
- Structures in good repair
- Neatness and order (no litter, no weeds, no stray items)
- Visible and crisp edges of different patch types including gardens, cropped fields, ecological restorations, and fragments of native ecosystems (Nassauer 2011).

Nassauer also finds that care has a halo effect in which landscape appearance shapes assumptions about the people who tend to the land. A perception of good landscape care may suggest that the caretakers are good neighbors with adequate time and money to express personal pride in the landscape. Evidence of neglect in landscape may imply troubled caretakers, and has been associated with compromised perceptions of safety (Nassauer 2011). By implying knowledge about residents, landscape care can be seen as supporting and communicating social capital.

Curley explicitly links landscape appearance to social networks and interactions, finding landscape appearance to be an active contributing factor in the formation and maintenance of social capital in low-income neighborhoods. In her study of a HOPE VI project in Boston, she found that the "look" and "feel" of exterior and public spaces in the neighborhood shaped interactions with outsiders, and ultimately perpetuating a sense of isolation and stigmatization. These aspects of landscape appearance included the following perceptions of physical disorder:

- Groups of people hanging out
- Graffiti
- Lack of outdoor lighting
- Trash in parking lots, sidewalks, and lawns
- Unattractive common outdoor areas
- Lack of recreational space
- 'Ominous'-looking structures, particularly in terms of 'barracks-style' development
- Physical isolation from transportation, stores, facilities, and other conveniences (Curley 2010).

Through her interview data, Curley found that the physical form or stark appearance of the neighborhood inhibited relations between residents and nonresidents by contributing to overbearing relationships with neighbors, and ultimately to the dissolution of linking and bridging social capital (Curley 2010). In another study conducted for a Community Development Corporation (CDC) in a low-income neighborhood in New Orleans, researchers studied the relationship of residents' neighborhood perceptions to the physical conditions of the area. Results indicate that better physical conditions, such as housing conditions, property upkeep, low frequency of abandoned buildings, and neighborhood cleanliness were associated with higher levels of neighborhood satisfaction. In the spirit of placemaking, the CDC staff and board used the study results to guide their visioning and planning processes to reflect the concerns of the residents in the community (Basolo 2002).

Care: Links to landscape preference

Landscape care is also strongly linked to landscape preference. Nassauer states, "the inherently public quality of landscapes makes them a 'powerful connective tissue for the experience of cities' and neighborhoods, and the perceived care of a residential landscape is powerfully related to preference of these landscapes" (Nassauer et al. 2009).

In a 2005 study of 500 exurban Michigan homeowners, Nassauer et. al. found that preference for appearance and care techniques in residential landscapes followed a 'clumpy' pattern. This pattern showed homeowner's yard preferences as conforming to broad cultural norms as well as more specific neighborhood norms. Where cultural norms conflicted with neighborhood norms, the latter more powerfully affected individual preference (Nassauer et al. 2009). The study implies that the neighborhood scale is resilient and self-enforcing, and that designers, planners, and developers should consider introducing innovations at this scale.

The powerful concept of care can also be harnessed in residential areas of high vacancy. Because cared-for landscapes are often preferred landscapes, and because care communicates both social and economic value, care can be used to influence long-term parcel value in highly vacant residential areas (Nassauer et al. 2008).

Care: Links to ecological sustainability

Care is an important concept for promoting the long-term cultural sustainability of ecological functions in the landscape. Often what is ecologically healthy is not aesthetically attractive, and therefore may not be valued. Linking cues to care to healthy ecologically functioning areas by design can communicate long-term value, and promote environmental stewardship through design (Nassauer 2011). This is true in residential landscapes as well, where individual properties and individual management behaviors aggregate across the landscape to influence larger scale systems (Nassauer et al. 2009). The 'clumpy' nature of residential landscape preference and care norms described by Nassauer et al. implies the ability to harness the power of small-scale landscape change aggregation. For example, if yard preferences are 'contagious' within a neighborhood, the resulting 'clumpiness' provides the potential to leap more directly to larger scale landscape patterns. The concept of care can be especially powerful in residential areas of high vacancy. Because cared-for landscapes are often preferred landscapes, and because care communicates both social and economic value, care can be used to influence the long-term value of parcels and neighborhoods in highly vacant residential areas (Nassauer et al. 2008).

Care is also an important concept for promoting the long-term cultural sustainability of ecological functions in the landscape. Because what is ecologically healthy may not be attractive, and therefore may not be valued or cared for, linking cues to care to healthy ecologically functioning areas by design can communicate that these places should be valued in the long term (Nassauer 1995b). Thus, care can be linked to environmental stewardship through design (Nassauer 2011). This is true in residential landscapes as well, where individual properties and individual management behaviors aggregate across the landscape to influence larger scale systems. The 'clumpy' nature of residential landscape preference and care norms described by Nassauer et al. speak to the power of small-scale landscape change aggregation; if yard preferences are 'contagious' within a neighborhood, the resulting clumpiness can allow for more direct change towards larger scale landscape patterns. Therefore, residential parcel-scale ecological landscape changes could aggregate at the neighborhood scale to create ecologically beneficial landscape patterns (Nassauer et al. 2009).

C3. Social Equity

In a 2008 study, Talen defines social equity as equality of resource distribution across all populations and as a component of environmental justice. Talen explores the critical roles of community, diversity, and access in ensuring social equity. Talen cites access, defined in terms of distance, as a measure of equity because distance has a significant impact on the effort, time and resources required to obtain a good, service, or facility (Talen 2008).

Mohai et al. discuss urgent environmental justice issues, including unequal exposure to toxins by race, ethnicity, and economic class, the disproportionate impact of hazards on minority communities, and the unequal impacts of climate change on communities of color, indigenous peoples, and the poor (Mohai et al. 2009).

Equitable access to open space, food, transit, and housing, as well as the promotion of safe and healthy spaces, are individual components of social equity. We discuss spatial mobility in order to explore the spatial variables influencing equitable access. Additionally the 'Just City' model is compared to the 'New Urbanism' Model for city planning as a way to address social equity in urban planning.

Spatial Mobility

The physical landscape can either facilitate or inhibit mobility and access to resources. Bejleri et al. explore block length, block size, street density, intersection density, pedestrian route directness, and residential density to pinpoint distinct facilitators and barriers to walkability in four Florida school districts (Bejleri et al. 2001). They found that notable barriers include major highways, hazardous walking conditions, and fences. Facilitators of mobility include school crossing guards, informal paths, and back entrances to school sites that connect to neighborhood cul-de-sacs. Uhm similarly explored the linkages between safety, health, and the movement of children in the urban fabric of a Los Angeles neighborhood. The study found that features such as clean streets, lack of graffiti, less known crime, and safe cross-walks encouraged children to walk, while the presence of stray dogs, alleys, and freeway underpasses discouraged children from walking (Uhm 2008). This finding points towards the power of cues to care to enhance neighborhood character and improve safety and accessibility by demonstrating neighborhood social capital in the landscape.

The Just City Model

Traditional planning models often fail to incorporate equity and the fair distribution of land and property. Regardless of the economic situation of a particular area or the goals of planners, economic interests often influence planning decisions that leave minority groups disenfranchised. One new model that attempts to address land equity is the "New Urbanism" model. Criticized and celebrated in planning theory and practice, this movement promotes diverse, walkable, compact, vibrant, and mixed-use communities (Fainstein 2000). Such communities contain the elements of conventional development, but are supposedly assembled in a more integrated fashion. In his 2006 study, Jabareen critically examined conventionally prescribed forms for urban sustainability including Neotraditional Development, Compact Cities, Urban Containment, and Eco-Cities. His study concludes that each of these forms has varying influence on ecological and social design criteria, including concepts like density, diversity, mixed land use, and compactness. He suggests, for example, that dispersed living patterns with reduced density and increased areas for outdoor activities can facilitate a self-supportive economy and lead to the stabilization of neighborhoods (Jabareen 2006).

Fainstein further critiques the "New Urbanism" model, arguing that it perpetuates suburbia by failing to challenge the social and spatial inequalities that have been established by capitalism. Her study compares the theoretical and practical differences between the New Urbanism and the Just City models, further critiquing the planning process and placing an emphasis on desired outcomes. While she considers the New Urbanism model to be a backlash to the market-driven development that has destroyed community-oriented neighborhood development, she claims that the model relies too heavily on funding from private developers to adequately promote a change in the social composition of an area, and that, by deriving its core physical design from suburbia, New Urbanism has promoted an unrealistic environmental determinism that privileges spatial form over social process (Fainstein 2000).

Where New Urbanism fails, the "Just City" model may provide an alternative to the prescribed procedures traditionally proposed by developers. The model was developed as a reaction to the social and spatial inequality that has been established and perpetuated by capitalism, and analyzes the distributive outcomes of public participation of traditionally powerless groups in the decision making process. The "Just City" model goes beyond the ideal physical design

and planning of an area to address the principal concerns of environmental and social discrimination. Fainstein's critique of these two planning models raises an important consideration for the applicability of the "Just City" model to legacy cities instead of the "New Urbanism" model (Fainstein 2000).

D. ECOLOGICAL ENVIRONMENT & CLIMATE CHANGE

An environmentally sustainable vision for highly vacant Detroit neighborhoods relies on combining ecological, built and social functions of the environment. We define the ecological environment by its biophysical ecological function, including climate adaptation and mitigation. To address the ecological and climate considerations relevant to highly vacant neighborhoods, we draw upon a body of literature that supports the use of surface stormwater management systems and urban vegetation, and employs principles of landscape ecology.
The Intergovernmental Panel on Climate Change (IPCC) defines climate adaptation as an adjustment in ecological, social, or economic systems to alleviate adverse impacts of observed or expected climate variability (IPCC 2001). These adjustments often include strategies that work towards increasing adaptive capacity for communities or policy changes that lead to improved environmental care (Adger et al. 2005). Climate adaptation scenarios can include the improvement of: spatial cohesion in fragmented habitats, biodiversity resilience to temperature variability (Opdam et al. 2009), resilience strategies that mimic adaptive processes (Galatowitsch et al. 2009), and the use of alternative stormwater management systems (EPA 2011). These strategies, in conjunction with those for climate change mitigation, can provide ecological solutions to climate change impacts. Climate mitigation, as described by the IPCC, is action taken to decrease the drivers of global warming. This includes individual actions and specific policies that aim to reduce greenhouse gases and enhance carbon pools and sinks (Nakicenovic et al. 2000). In this study we will be examining the physical features of high-vacancy neighborhoods, and how urban design can produce climate adaptation and mitigation strategies.

D1. Climate Change: Local and Regional Effects

Climate variability will have far-reaching impacts in years to come, with a projected increase of 3.2°F to 7.2°F in average surface temperature of the Earth by the end of the 21st century relative to 1980-1990 (IPCC 2007a). Climate change scenarios predict that temperature in southeast Michigan will rise by approximately 5.85°F by the end of this century (NASA 2001). Consequently, water levels in the Great Lakes are predicted to decline in the face of extreme climate change conditions, which project a decrease in precipitation for the north-central United States (IPCC 2007b). Changes in precipitation are projected to occur seasonally, with changes of -30% to +40%, accounting for natural summer and autumn

precipitation declines and winter precipitation increases (IPCC 2007b). Of most importance for Detroit is Lake St. Clair. One projection shows that the volume of Lake St. Clair will decrease by 15%, a water level decline of 1.6m (Lee et al. 1996). The potential declines in lake levels could have significant effects on wetlands, fish spawning, recreational activities, commercial navigation, municipal water supplies, and exposure of toxic sediments (Rhodes and Wiley 1993). In a more recent study, Gronewold used a Great Lakes Advanced Hydrologic Prediction System (AHPS) to show that lake water levels may actually remain the same or increase in some scenarios. He holds that while urban areas proximal to the Great Lakes ecosystem should play a role in climate adaptation, solutions should not be made to explicitly address receding water levels. His research underscores the variability and uncertainty in climate models to predict concrete numbers (Gronewold 2011).

D2. Climate Change: Adaptation

In the United States, only limited small-scale adaptation strategies have been implemented, and necessary changes in the built environment are still in preliminary stages (Hamin and Gurran 2009). The state of Michigan established the Michigan Climate Action Council (MCAC) and released its Climate Action Plan in March 2009. The report recommends creating an Adaptive Plan to prepare for the effects of regional climate change (MCAC 2009). Adaptive measures specific to Detroit and relative to this study could take the form of stormwater management for variable climate projections, ecological patch management for species movement to preferable climates, and further practices to enhance ecological resilience in response to climatic change.

D3. Climate Change: Mitigation

The built environment has a tremendous impact on citywide and regional climate, as well as on ecosystem functioning (Robinson 2009). As development increases carbon outputs, local and global climate change impacts such as the urban heat island effect and increasing extreme weather events become exacerbated. Though the urban heat island effect is generally considered a major problem in cities, its effects are less relevant to legacy cities with prevalent vacant lots, where impervious surfaces are less likely to cause far-reaching effects (Zhang et. al. 2010). Due to this difference, this report focuses on measures such as stormwater management and carbon sequestration instead of mitigation of the urban heat island effect (Condon 2009; Blanco et. al 2009). In the context of climate change, forest management activities can play a key role in mitigation through carbon storage and sequestration. Forest mitigation options for urban locales include enhancing the sequestration rate in existing and new forests, increasing street tree density, and reducing emissions by decreasing forest degradation (IPCC 2007a).

Urban reforestation has the ability to provide climate change mitigation through adaptive forest management (IPCC 2007; McGinley and Finegan 2003). Reforestation is the implementation of forest plantations in areas that have been without forest cover for less than 50 years. Through changes in land use decisions, urban forestry can be applied to serve natural mitigation processes (Kabat et al, 2005). This is particularly relevant in the context of a legacy city such as Detroit, where the use of vacant land for forestry adaptation strategies can increase carbon storage while reducing external stresses on forest resources (Spittlehouse and Stewart 2003; Fischlin et al. 2007). While forests can be both sinks and sources of carbon, adaptive management techniques focused on mitigation such as regeneration and decreasing deforestation, as well as increasing forestation and substitution management, can help to sustain the carbon sink potential of forests (Watson 1996). Strategies such as species mixing, timber growing and harvesting patterns for new climatic conditions, landscaping to minimize fire and insect damage, and salvaging dead timber among other efforts can allow urban forests to adapt to and mitigate climate change (Spittlehouse and Stewart 2003). A mix of fast-growing woody pioneer species and slow-growing hardwoods can also enhance carbon sequestration in forests (Lesch 2010).

The Chicago Urban Forest Climate Project indicated that urban forests in Chicago store an annual estimated 6,145 tons of air pollutants, providing an estimated ecological value of $9.2 million dollars. In addition, the study showed that Chicago's urban tree canopy sequestered approximately 155,000 tons of carbon per year. The projected value of investment in urban trees illustrated a long-term benefit of more than double the original cost (McPherson et al. 1994). A study in Gainesville, Florida compared the ability of urban trees on different land use types to sequester carbon. The study found that 1 hectare of forested vacant land can sequester 5-6 million tons of carbon per year, while residential areas sequester 4 million tons of carbon per hectare per year (Escobedo et al. 2009). This indicates that vacant land reuse has potential to serve as a significant carbon sink through urban reforestation projects. Urban land use change decisions

that implement reforestation practices can thus allow urban locales to mitigate climate change impacts (Kabat et al. 2005).

Forest ecosystem trees are very significant short-term contributors to carbon sequestration (Lesch 2010). However, soils themselves store four times the carbon of terrestrial vegetation (Delgado and Follett 2002). Furthermore, soil carbon sequestration will be negligibly impacted by temperature and atmospheric changes. In areas with disrupted soil, such as urbanized areas, planting native, deep-rooted perennial grasses can help increase soil carbon. The large root biomass of grassland plantings aids in sequestration, but overall plant biodiversity has even more impact. The presence of legumes and C4 grasses in biodiverse plots can increase soil carbon sequestration rates by up to 363% over twelve years (Fornara and Tillman 2008). Other factors increasing carbon sequestration in soils include presence of tall herbs, nitrogen rich soil, even moisture, and low soil disturbance (Lesch 2010).

D4. Stormwater Management

Stormwater management has critical implications for water quality and quantity. In urban drainage basins with combined sewer systems, large volumes of surface rainwater runoff moving into sewer pipes at high speeds can lead to sewage overflow. Hill discusses the potential for urban infrastructure, such as roofs, roads, and rights-of-way, to employ a "kidney" function, either by increasing the permeable composition of these features or by using stormwater systems to filter pollutants before they enter the larger water system. In her discussion of urban stormwater management, Hill introduces a typology of upland, network, and shoreline sites, which respectively disperse, convey and receive stormwater runoff (Hill 2009).

Hill describes upland sites as those where stormwater is produced within the watershed. In such sites, small-scale retention of stormwater is especially effective in reducing stormwater flow lower in the watershed. She explains that the mimicry of ecological functions that existed prior to development may be the best way for an upland site to serve the purpose of improving regional infiltration and reducing downstream effects. She emphasizes that upland sites that were forested before development should be designed and regulated so that, to the greatest extent possible, these landscapes mimic the ecological functions of a forested site that contains a gradient from dry to wet soil conditions (Hill 2009).

Network sites are described as places where surface water that runs off upland sites moves into channelized networks of flow, which include curbs, ditches, underground pipes, and other systems. Hill particularly emphasizes the opportunity inherent in street rights-of-way to alter the public landscape and improve the hydrologic function of the urban environment. Because network sites are places where flow concentrates, they are excellent strategic locations for intervening in those flows to reduce the downstream impact of upstream runoff. In a study of a cul-de-sac next to a public school in a relatively low-density residential neighborhood in Seattle, students and faculty from the University of Washington found that a street right-of-way vegetated swale installation provided detention, filtration and infiltration for stormwater that runs off approximately 26 acres of land upstream. Even in resource-limited circumstances, planning and design efforts can strategically utilize open space to capture and filter stormwater (Hill 2009).

Finally, Hill discusses shorelines as the locations where stormwater meets water bodies that are the ultimate recipients of urban runoff. She explains the possibilities for urban design and planning to address additional ecological benefits in these sites that upstream interventions do not provide. As governing bodies begin to address water supply changes as a result of climate change, the physical structures associated with shorelines will become critical components of adaptation. In many cases, the hardened structures common to shoreline sites have negatively impacted the dispersal and reproductive success of aquatic species by effectively removing sub-tidal, inter-tidal, and supra-tidal ecosystems. Urban areas that can adapt their shorelines to support the biological and physical needs of coastline systems are in the best position to mitigate these significant impacts. They may also better maintain the viability of water-based economic functions related to water resources, such as tourism and real estate value. Removing roadways that function as potential barriers along shoreline areas may serve to restore their unique ecological function in the context of greater watershed and climate considerations, as is evident in the efforts of New York City activists to remove a 1960s- era segment of highway along a tidal section of the Bronx River (Hill 2009).

Of particular significance in Hill's work is the idea that urban sites should be categorized by their present hydrological function and by their relationship to the overall watershed rather than just their land use or political or historic environmental conditions. This scope is necessary to significantly alter the overall hydrological performance of cities (Hill 2009). This is especially relevant in vacant portions of legacy cities, where emerging open space can facilitate ecological function on an expanding scale.

Stormwater management can be used as a climate adaptation strategy in highly vacant urban areas. On a global scale, climate change impacts are projected to result in an increase in the variability of average annual precipitation during the 21st century (IPCC 2007a). Using a regression-based statistical downscaling tool, He et al. project changes in daily precipitation and mean temperature based on future climate change scenarios in order to predict changes in stormwater quality and quantity in Calgary, Canada. These studies show increasing trends in peak flows and runoff volumes of stormwater, as well as increased turbidity of waterways, in response to increased rainfall intensity (He et al., 2011). Increased storm intensity in urban areas with outdated infrastructure can lead to extreme flooding (Tak et al. 2010). To offset increases in precipitation, approaches which emphasize infiltration, storage, evaporation, and interception to more closely replicate pre-development watershed hydrology can provide an affordable part of the solution to updating urban stormwater infrastructure. Additionally, such systems may reduce short-term movement of urban pollutants such as suspended solids, heavy metals, chlorides, and other hydrocarbons from entering the municipal stormwater system (Tsihrintzis and Hamid 1997). The U.S. EPA recommends climate adaptation solutions such as rain harvesting, rain gardens, brownfield redevelopment, green streets, urban forestry, and green infrastructure to manage extreme weather events (EPA 2011).

Other literature supports adaptation solutions that utilize the landscape as an alternative stormwater management mechanism to avoid significant investment in new technologies. These solutions may be suitable for areas with struggling economies and large amounts of vacant land, such as those on the Lower East Side of Detroit. Using Mombosa, Kenya as a case study, Justus Kitha and Anna Lyth explored the use of urban wildscapes, green spaces, and green infrastructure as alternative urban climate adaptation strategies to conventionally employed "hard technology" solutions in resource-limited areas. They highlight the ability of these spaces to provide wildlife habitat as well as reduce stormwater runoff, ultimately diminishing the risk of flooding and improving the microclimate of the urban environment. These spaces often emerge on disturbed sites of halted development similar to those in vacant urban neighborhoods in Detroit. The authors also cite the lack of technological and institutional resource capacity as a key reason for using cost-effective infrastructure systems that respond to a wide range of climate-related events and provide other benefits to city residents. These approaches to stormwater management and climate adaptation may be applicable to other places with limited capital resources and expansive open space (Lyth and Kitha 2011).

Riparian systems, which often act as the endpoint for city stormwater systems, are another important part of city hydrology. Literature supports the effectiveness of a multitude of interventions for improving riparian systems in the urban setting. In June 2004, the Leibniz Institute of Ecological and Regional Development of Dresden (IOER) and the Dresden University of Technology researched approximately fifty urban river rehabilitation schemes, mainly in European cities. Among these projects, the following categories of riparian function and riparian improvement techniques were evaluated:

- Hydrology and water dynamics
- Modular paving blocks
- Infiltration basins
- Morpohology and connectivity
- Instream morphology
- Removing hard construction
- Fascines (bundles)
- Live willow racks
- Re-establishing and integrating floodplains
- Live stakes
- Grass, legumes, and sod
- Techniques to improve stream continuity
- Removal and bypassing flow and migration barriers
- Bypassing ecologically poor river sections
- Water quality
- Grassy vegetated filter strips
- Silt fence, trapping devices
- Sand and peat-sand filters
- Biodiversity

- Boulder clusters
- Lunker structures, or crib walls of logs and rocks (Schanze et al. 2004).

Case rehabilitation projects resulted in significant shifts occurred toward the number of moderate, good, and very good sites as indicated by the European Water Framework Directive (WFD) for ecological, social and aesthetic, and economic indicators. Ecological indicators include factors such as impacts on fish fauna and morphological condition. Social, aesthetic, and economic indicators include factors such as the presence of focal areas, frequency of use by local populations, and visitor frequency in adjacent areas. Importantly, the spectrum of rehabilitation objectives, urban settings and pressures, size of watercourses, and project costs are wide in this study, suggesting that broad-reaching riparian improvements can be reached in resource-limited cities (Schanze et al. 2004).

Literature is also used to explore the cultural implications of riparian function. Nassauer et al. found that the more culturally valued and accepted features of a riparian environment, such as mature trees, can be coupled with other important but less culturally valued features such as ephemerally inundated wetland plantings, in order to promote cultural value of important riparian systems (Nassauer et al. 2001). In an investigation of landscape perceptions of urban residents in Maplewood, Minnesota, Hartjen and Nassauer found that the use of rainwater gardens along streets could be coupled with flowers and stone walls to convey an acceptable level of beauty and care for a neighborhood while serving ecosystem functions such as cleaning and infiltrating stomwater, introducing native plants, and providing greater connectivity to an urban neighborhood (Nassuar et al. 2001; Hartjen and Nassauer 1995).

D5. Habitat and Landscape Ecology

The discipline of landscape ecology suggests a framework by which new urban form can adapt to ecological processes. Opdam and Steingrover highlight major components of landscape ecology that are particularly relevant in fragmented urban space. These components are outlined below:

- An ecosystem patch is a relatively homogenous area that differs from the surrounding matrix (Forman 1995).
- Patch quality is based on the adequacy of vegetation, soil, and water conditions for the survival of a species specific to that ecosystem.
- An ecosystem network is a group of patches connected by species dispersal movements.
- Stepping stones are small ecosystem patches that contribute chiefly to network connectivity.
- Matrix permeability is the ability of energy flows, materials, and species to cross the barriers posed by the urban landscape.
- Corridors are linear structures of an ecosystem type similar to the ecosystem network (Opdam and Steingrover 2008).

Opdam and Steingrover state that corridors contribute to the cohesion of an ecological network and that combining elements from linear habitats and key patches can bridge the gaps between ecological patches. Additionally, ecological stepping-stones can serve an important function in strengthening network connectivity in urban areas by providing necessary resources to mobile species (Opdam and Steingrover 2008).

Design and planning guidelines must integrate conditions for a range of species across spatial scales because of the wide variety of spatial scales at which ecological processes work. Given the unique and multi-scalar de-densification pattern of highly vacant Detroit neighborhoods, Opdam and Steingrover's landscape ecology design guidelines are especially relevant as a basis for expanding upon the urban features that strengthen connections between potential areas of ecological function. These guidelines are meant to inform spatial cohesion of key ecosystem components through specific interventions. For example, patch quality can be improved by creating buffer zones and changing the management strategies of open space; network density can be improved by adding stepping stones and habitat patches; matrix permeability can be improved by adding corridors, and

network area can be expanded by enlarging patches and merging two ecosystem networks (Opdam and Steingrover 2008).

Jongman and Pungetti explored the functioning of ecological networks and the potential for connecting corridors in North American and European urban environments. They found that roadways function as a barrier to wildlife movement in a variety of ways. The alteration of habitat due to construction causes short-term disruption of habitat. More problematic is the noise, vibration, and artificial lighting that results from increased traffic volumes and disrupt the behavioral patterns of key species, causing long-term habitat disruption. The impervious surfaces of roadways also separate functional areas used by species. Jongman and Pungetti explore modeling techniques and principles for designing ecological networks in the European cities of Bologna and Modena, Italy—each of which are impacted by dense road networks and exhibit problems with biodiversity. They propose a generalizable set of design principles to promote functioning ecological networks in these cities, including the following:

- Wide corridors to best serve multi-functionality
- Well-established connectivity for species and humans, which depends on the longitudinal design of the corridor and the barriers within it
- Incorporation of different uses that consider temporal dynamics of human and species use, for example night and day use
- Habitat diversity within corridors
- Accessibility to the surrounding land for ecologically functional corridors (Jongman and Pungetti 2003).

Available open spaces in urban areas can evolve into functional networks on the basis of strategic planning and careful design considerations such as these. Jongman and Pungetti also explore greenway networks in five North American cities to show that these networks can also target regional goals for recreation, neighborhood linkage, economic growth, and scenic quality (Jongman and Pungetti 2003).

Exploring the potential for these functions in a legacy city context, Dagmar Haase argues that perforation of dense built-up urban structures can lead to positive impacts on ecological function. Acknowledging the need for caution with regard to soil contamination and the legacy impact of impervious surfaces, Haase explains that green infrastructure including parks, allotments, and cemeteries nevertheless provide niches in which rare species can thrive. Demolished sites in the core inner city can be converted into such spaces to provide spots of biodiversity at the local level. He also highlights the opportunities that come with urban shrinkage, such as the deconstruction of multistory housing stock to allow for more spacious housing and higher shares of open space within neighborhoods. These changes can improve the aesthetic and functional benefits of neighborhoods to residents over time (Haase 2008).

As open space increases in de-densifying urban areas, landscape features can be expanded to strengthen ecological connectivity in existing urban frameworks. In their study of two neighborhoods in the legacy German city of Leipzig, Schetke and Haase recognized the potential to link components of ecosystem networks into patterns of vacancy. Based on ecological modeling of the Leipzig-East neighborhood, Schetke and Haase suggest that reforestation can enhance emerging heterogeneous open spaces to create stepping-stones in a larger greenway (Schetke and Haase 2008).

Flores et al. propose recommendations for a regional green space plan for the New York City Metropolitan Area (NYCMA) with the objectives of creating regional reserves, integrating existing green spaces in highly urbanized environments, and creating a regional network of green spaces. They propose various methods to acknowledge the ecological content, context, dynamism, heterogeneity, and hierarchy of green spaces in the networks. Content within the network can be improved by integrating land units that harbor rich and diverse communities of organisms. To benefit from network proximity, the network plan must address context by avoiding isolation or by buffering the network from the rest of the urban matrix. Dynamics must be addressed through the enhancement or maintenance of different ecosystem services at each successional stage of a green space over time. Heterogeneity must also be addressed, recognizing that a distribution of different types of plant communities provides opportunities for biological richness and species diversity. In other words, landscape heterogeneity must work in tandem with connectivity to enforce a resilient network. Finally, hierarchy must be addressed by working at multiple scales of connectivity to manage the wide array of environmental benefits that exist in the metropolitan landscape (Flores et al. 1998). These findings provide a basis for the effective management of diverse open spaces and corridors of movement in highly vacant Detroit neighborhoods.

Landscape ecology also holds important implications for climate adaptation in highly vacant urban space. As climate change ensues, temperature change combines with existing patterns of habitat fragmentation to compound the negative effects on biodiversity. Opdam et al. propose an improvement of spatial cohesion in habitat networks that responds to these influences as a way to promote climate adaptation. Their conceptual framework links climate change impact assessment and resilient landscape design through a multi-scalar prediction of climate impacts on landscape processes. The proposed landscape patterns can then be adapted to the local context to reinforce the landscape processes that provide valuable ecosystem services (Opdam et al. 2009).

Galatowitsch et al. look more specifically at options for adapting landscape patterns based on the movement of species in eight landscape regions in Minnesota. By creating climate change projection maps, they explored resistance, resilience, and facilitation strategies as means of climate adaptation. Resistance refers to opposing changes associated with a shifting climate; resilience refers to the maintenance of an ecosystem's health; and facilitation refers to mimicking, assisting, or enabling ongoing natural adaptive processes. The study suggests that facilitation and resilience strategies may be more effective than resistance strategies to reduce losses in biodiversity. Practices of facilitation, such as the use of seed mixes containing species from climates expected to emerge in the near future, or the provision of protected areas for common species to reduce stress on remnant natural systems, may be effective in areas where landscape corridors and conventional resistance strategies do not work (Galatowitsch et al. 2009). These facilitation and resilience strategies may provide effective climate change adaptation and mitigation tools for disturbed open spaces in highly vacant urban areas.

III. Methodology

This project was conceptualized and executed as a collaborative effort of a multi-disciplinary team of students working together combining design and planning perspectives. Through numerous iterations of designs, critiques, and recommendations, the complementary components of the project have informed one another to ultimately create a cohesive set of realistic recommendations both specific to our study area and generalizable to other post-industrial legacy cities. This methodology describes the process used to critique the LEED-ND rating system, to create recommendations for credit revisions, and to create a metric for sustainability for highly vacant cities. CDAD typologies were used to inform the LEED-ND revisions for the most vacant land use types in Detroit. LEED-ND revisions are also supported by literature and by the database provided by Documenting and Demonstrating Neighborhood Care Dynamics in CDAD's 'Urban Homesteads' and 'Naturescapes' (Nassauer and Dueweke 2011) and Documenting Care and Commitment to Place in CDAD's 'Urban Homesteads' and 'Naturescapes' (Dewar and Dueweke 2011).

A. Creating Sustainable Neighborhood Design for Legacy Cities (SND-LC)

We used a three-phase process to create a revised LEED-ND credit system titled Sustainable Neighborhood Development for Legacy Cities (SND-LC). In order to first assess the applicability of LEED for Neighborhood Development (LEED-ND) to legacy cities, we constructed a matrix to compare LEED-ND and the Community Development Advocates of Detroit's (CDAD) Strategic Framework Land Use Typology (see Table I-1). The CDAD typology was scrutinized against each LEED-ND credit to identify similarities and differences in order to discern opportunities for merging the two frameworks. The CDAD typology provides definitions of legacy city landscape characteristics, which offers a context for discerning the relevance of each LEED-ND credit in high vacancy neighborhoods. This analysis was further informed by experimenting with representative landscape design actions to highlight specific landscape qualities and opportunities for implementing SND-LC. We focused on exploring how the social capital promoted by CDAD could be substituted for the technological improvements promoted by LEED, and also on how SND-LC would protect or enhance ecological systems.

The LEED-ND credit system breaks down credits by categories (e.g. Smart Location and Linkage, Neighborhood Pattern & Design, and Green Infrastructure) based on intents and requirements. Using the assumptions of the "Low-Input High-Impact" economic scenario (LIHI) as a baseline for evaluation, we critiqued each credit to identify overlaps between the two frameworks and to determine whether the credits were applicable to cities like Detroit. By operating under the LIHI scenario, we focused the analyses on achieving credits using little to no money from private developers or government aid. In the first stage of analyses, credits were rated "should apply", "does not apply", or "needs improvement" to determine the level of applicability to legacy cities based on the CDAD typologies.

The second stage involved a full critique of each credit based on applicability to the study area. This stage was highly influenced by the design analysis' emphasis on contextually appropriate interventions that address land types, land use change, and landscape care as expressed in the representative landscape design actions. The third stage of our research translated the rationale generated in the previous two stages into specific recommendations for improvement of the LEED-ND credit system. The recommendations include revisions that reference representative landscape design actions and tailor credits to more specifically apply to legacy

cities. This stage also includes the redistribution of the point system in order to provide a more equitable and appropriate application of LEED-ND to Legacy Cities. Representative landscape design actions were used to explore fine-grained applications of these standards. Once these interventions were completed, they were used to refine the recommendations posed in the LEED-ND credit system for Legacy Cities. The system was adjusted to ensure consistent language and to provide a cohesive set of planning and design recommendations.

B. Representative Landscape Design Actions

The landscape design process was executed simultaneously with the creation of SND-LC in order to create on-the-ground examples of our recommendations. The spatial analysis and design process began with considerations of both the CDAD land use typology and the data on indicators of care in the Lower East Side area from Documenting and Demonstrating Neighborhood Care Dynamics in CDAD's 'Urban Homesteads' and 'Naturescapes' (Nassauer and Dueweke 2011) and Documenting Care and Commitment to Place in CDAD's 'Urban Homesteads' and 'Naturescapes' (Dewar and Dueweke 2011). We focused on several CDAD types to explore how their application in a highly vacant neighborhood in a legacy city can increase neighborhood social capital and benefit from the integration of landscape care. References to CDAD's typologies that include Traditional Residential Sectors, Spacious Residential Transition Zones, Naturescapes, and Village Hubs were particularly emphasized. These typologies provided a basis for the representative actions in SND-LC.

Using SND-LC as the basis for which representative landscape actions were generated, a number of the SND-LC credits show a representative landscape action in the form of a generalizable site design. These site designs incorporate SND-LC recommendations to show on-the-ground application of the assessed credit. Additionally, CDAD typologies were incorporated to both understand their implications for vacant cities as well as to strengthen the typology descriptions through incorporating sustainability concepts derived from LEED-ND.

Concepts from the literature review were used to support landscape based design decisions. Specifically, design decisions related to social capital, care, landscape perception, and climate change adaptation and mitigation link directly to the literature. This serves to strengthen and validate design decision, and to allow for a research-based analysis of LEED-ND. Research from projects funded under the University of Michigan's Graham Environmental Sustainability Institute, Documenting and Demonstrating Neighborhood Care Dynamics in CDAD's 'Urban Homesteads' and 'Naturescapes' (Nassauer and Dueweke 2011) and Documenting Care and Commitment to Place in CDAD's 'Urban Homesteads' and 'Naturescapes' (Dewar and Dueweke 2011), both conducted in the highly vacant Lower East Side area, were used to understand features related to vacant neighborhoods. The database created for these projects includes parcel-by-parcel data on 95 variables of landscape physical condition, collected using GoogleStreet View and field checks in the Lower East Side study area. This database was used to understand the complexities and scale of landscape conditions that exist in a highly vacant neighborhood, and served as a basis for representative landscape design actions. Additionally, the database provided by Graham project research includes data across a 2-year time frame, providing a temporal framework for representative landscape design actions at a critical time for neighborhood land vacancy and population decline in the city of Detroit. The representative landscape design actions highlight instances of SND-LC and provide a set of recommendations for broader application to other similar legacy cities.

IV. RECOMMENDATIONS

The recommendations below reconsider LEED-ND in light of its applicability to legacy cities and highly vacant neighborhoods. The LEED-ND criteria were measured against the CDAD land use typologies to prompt consideration of its applicability to Detroit neighborhoods. Below, sixteen of the forty-four LEED-ND credits are re-evaluated and illustrated with representative landscape design actions that are generalizable to vacant neighborhoods. Representative landscape design actions were made based on review of the literature and consideration of the data on our study area in the Lower East Side of Detroit. See Appendices A and B for the full revised rating system. The following sixteen credits are discussed below:

Regional Priority	
Smart Location and Linkage	
SLL Prerequisite 1	Smart Location
SLL Credit 1	Preferred Location
SLL Credit 7	Site Design for Habitat or Wetland and Water Body Conservation
SLL Credit 8	Restoration of Habitat or Wetland and Water Bodies
SLL Credit 9	Long-term Conservation Management of Habitat or Wetlands and Water Bodies
Neighborhood Pattern and Development	
NPD Prerequisite 3	Connected and Open Community
NPD Credit 1	Walkable Streets
NPD Credit 7	Transit Facilities
NPD Credit 10	Access to Recreation Facilities
NPD Credit 12	Community Outreach and Involvement
NPD Credit 14	Tree-lined and Shaded Streets
Green Infrastructure and Building	
GIB Credit 4	Water-Efficient Landscaping
GIB Credit 5	Existing Building Use
GIB Credit 8	Stormwater Management
GIB Credit 15	Recycled Content in Infrastructure

Table IV-1. Categories, Prerequisites, and Credits derived from the LEED-ND Rating System selected for analysis and recommendations for SND-LC.

Sustainable Neighborhood Development for Legacy Cities (SND-LC)

Regional Priority Credit:

Intent of LEED-ND credit: To encourage strategies that address geographically specific environmental, social, and public health priorities. LEED regional priority credits vary based upon zip code. The Regional Priority Credits for high vacancy neighborhoods in LEED-ND are:

Smart Locations and Linkages	Credit 1 - Preferred Locations
	Credit 6 - Steep Slope Protection
Neighborhood Pattern and Design	Credit 1 - Walkable Streets
	Credit 4 - Mixed-Income Diverse Neighborhoods
Green Infrastructure	Credit 1 - Certified Green Buildings
	Credit 14 - Wastewater Management

Rationale: The Regional Priority credit should be expanded to emphasize ecological and social issues that are unique to the geographic context of highly vacant areas and other blighted areas. Regional priority that focuses on building community and social capital and improving public and ecological health is imperative to stabilizing and revitalizing legacy cities. The credit can be further developed to adequately encourage redevelopment in highly vacant areas by incorporating regional ecological contexts and considering the effects of location on access to basic resources. An analysis of the area's ecological features can be conducted in order to appropriately tailor intervention techniques. Projects can include context and geographic-specific requirements that consider natural habitat, local water bodies, and watersheds. The criteria can address access to amenities by including affordable housing, and considering proximity to food, open space, and transit connections. Projects can be awarded bonus points for economic development, safety improvements, and positive image promotion.

Recommendation: *This credit should be made a prerequisite for the SND-LC rating system. Regional priority should include a prerequisite for all projects to conduct a city-wide analysis of ecological features, such as topography and land cover so that all interventions may be tailored to the specific surrounding ecological context and design decisions can be prioritized should funding be insufficient. The prerequisite should also include a measure of preferred location relative to basic amenities such as affordable housing, healthy food, open space and transit connections.*

As shown in Figure IV-1, a systematic ecological analysis of geographic features can lead to the delineation of zones with specific features and corresponding design and planning recommendations. For example, close proximity to a river, high slope, and low local road density can delineate preservation zones around river ecosystems. Highly vacant neighborhoods in those areas can be strategically reconfigured to allow for attenuation of stormwater flows into the river and for cohesion of the river's ecosystem network (Figure IV-1, example 1). Areas with high local road density and high impervious surface cover can delineate another zone with recommendations for preserving existing open spaces for aesthetic and recreational function for city inhabitants (Figure IV-1, example 2).

A thorough ecological analysis can also provide educational opportunities, particularly for community leaders to understand how Naturescapes can promote ecological function and connectivity. Providing ecological contexts to community leaders and residents can engender effective environmental stewardship of residential spaces. This will allow all densities of residential land uses, including Traditional Residential, Spacious Residential, and Urban Homestead typologies, to adopt effective ecological functions.

In addition to the ecological analysis, the prerequisite should include an analysis of a neighborhood's proximity to basic amenities. In legacy cities, this means that more weight should be given to credits that award close proximity to basic amenities, such as awarding bonus points to areas maintained within a 1-mile radius of healthy food vendors and community institutions.

FigureIV-1. Example of how analysis of ecologically relevant features could lead to the delineation of zones within the city

SLL Prerequisite 1: Smart Location

Intent of LEED-ND credit: To encourage development within and near existing communities and public transit infrastructure in order to limit the expansion of a region's development footprint. This will further LEED's goal to reduce vehicle trips and vehicle miles traveled (VMT), which will in turn improve public health by encouraging daily physical activity associated with walking and bicycling. The prerequisite contains specific stipulations pertaining to the distances between intersections, boundaries, rights-of-way, and community assets such as commercial corridors and transit centers that improve connectivity.

Rationale: As a prerequisite, the conditions of this criterion are too strict to adequately address highly vacant neighborhoods in legacy cities. To address this, the requirements should emphasize the concentration of occupancy around sources of care. Consolidating occupancy near existing sources of care can improve the adjacencies between people and their necessary goods and services, while retaining vacant open spaces for ecological function. Additionally, the option for strict location near commercial assets can be revised to require that commercial areas be in good condition, with commercial owners who are invested in the neighborhood. The criterion can include and encourage cottage industries and entrepreneurship that would increase residential adjacencies to neighborhood assets. Another way to address distance to commercial assets would be through a consolidation program that would require relocating businesses to be in a more centralized and accessible location.

Recommendation: *This prerequisite should continue to be required for all SND-LC projects. The prerequisite should incorporate cared-for landscapes as areas desirable for adjacenc, and should consolidate human movement corridors to allow under-utilized corridors to facilitate wildlife connectivity, carbon storage, and groundwater recharge. The criteria should also reevaluate transit access by emphasizing the strategic location of transit centers in very low-density areas such as the Urban Homestead and Spacious Residential types, rather than requiring a minimum distance to transit centers.*

The strategic planning of corridors to facilitate human movement encourages smart location and linkage by consolidating housing patterns near existing sources of care along conventional and thoroughfare streetscape corridors. Retaining features of safety, legibility, and navigability in streetscapes near existing sources of care will encourage residents to stay in these areas. Additionally, encouraging transit centers in low-density areas can lead to the stabilization of neighborhoods surrounding transit centers.

Different from human movement corridors, ecological corridors and ecosystem patches on the periphery of these clusters can be used to improve ecological function. These corridors can also be widened to improve ecological multi-functionality (Jongman and Pungetti 2003). Corridors of expansive open space emerging along the street network could be promoted by community leaders as zones of ecological connectivity that work on a broader and more effective scale than Green Thoroughfares.

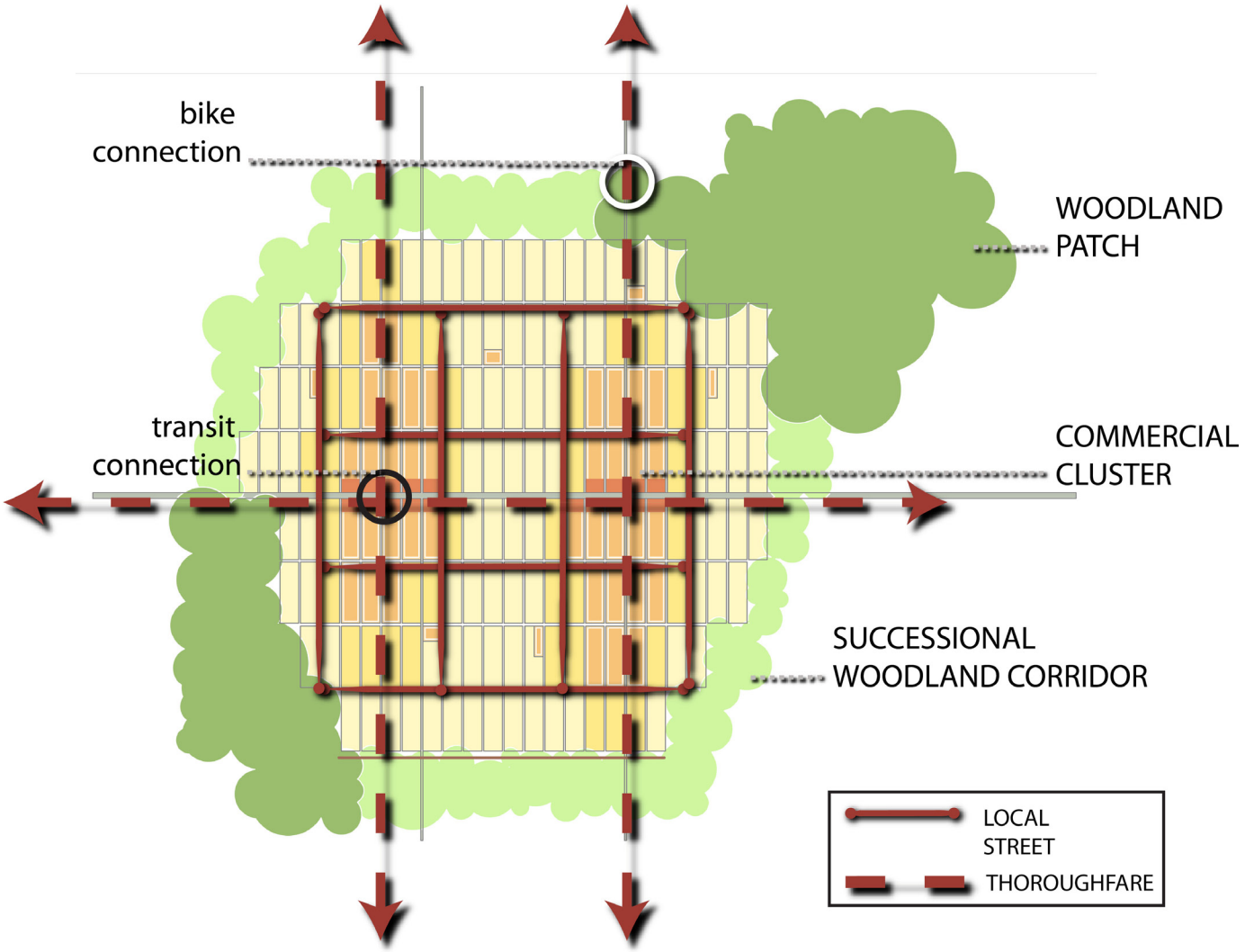

Figure IV-2. Example of how smart location and linkage in highly vacant communities can involve the maintenance of the human-dominated street network near commercial clusters, while opening opportunities for ecological connections outside of these clusters.

SLL Credit 1: Preferred Locations

Intent of LEED-ND credit: To encourage development within existing cities, suburbs, and towns, in order to reduce the impacts of sprawl and to conserve natural and financial resources required for construction and maintenance of infrastructure. The requirements for the credit ask that new development projects be located on a previously developed site or adjacent to a previously developed site, with higher points awarded to projects that are located on in-fill sites and areas designated as high priority locations.

Rationale: This credit adequately encourages infill development and limits adverse impacts on surrounding natural areas. If new development is feasible, the requirements for this credit will almost always apply to legacy cities due to the availability of existing infrastructure and the frequency of previously developed sites. The credit should also expand its definition of high priority areas, which are identified as providing a portion of new rental and/or for-sale dwelling units priced below the area median income. The definition does not include any discussion about locating projects near areas that are identified by other important indicators such as crime rates, poorly-performing schools, or high unemployment. These metrics may be most appropriate in effectively targeting high priority areas for encouraging community development and social capital.

Recommendation: *The weighting for this credit should remain the same. However, to prevent neighborhood fragmentation, the credit can encourage close proximity to areas with high social capital and acceptable infrastructure conditions to encourage projects to be located near or adjacent to existing neighborhoods. The credit can also discourage development near large sources of industry, and encourage development near sources of high-quality food such as large grocers, open space, and community institutions.*

Development should be clustered in areas with suitable existing city infrastructure such as transportation and utilities, and in proximity to community amenities. For example, Figure IV-3 shows how areas with higher care could be delineated to allow for the prioritization of the limited resources that are available. Locating projects in these delineated areas would promote the efficient use of infrastructure by concentrating commercial activity and residential occupancy. This will also support community development by promoting bonding and bridging social capital through the consolidation of people around sources of care. Within these areas, vacant land could be more thoroughly maintained or converted for active use by residents, increasing the signs of care and social capital. Additionally, ample land and existing infrastructure availability can encourage equitably safe and healthy lifestyle opportunities for residents by discouraging development near large sources of industry.

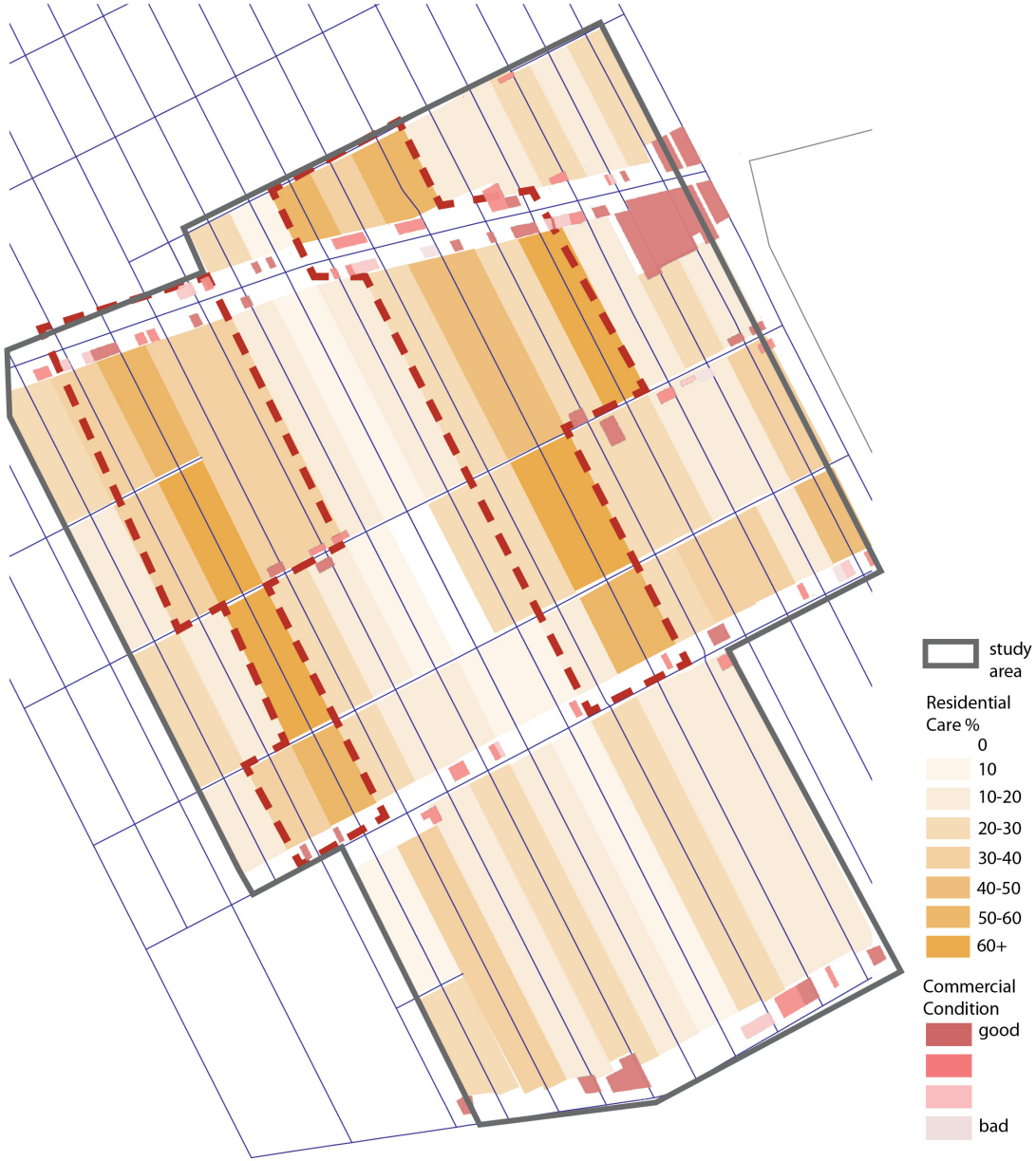

Figure IV-3. This map shows how areas that exhibit higher care could be delineated to allow for the prioritization of limited resources to this area. Within these areas, vacant land could be more thoroughly maintained or converted for active use by residents. Such prioritized islands of care would not necessarily support physical or infrastructure development, but would support community development through landscape improvement.

SLL Credit 7: Site Design for Habitat or Wetland and Water Body Conservation

Intent of LEED-ND credit: The intent of this credit is to conserve native plants, wildlife habitat, wetlands, and water bodies. This credit requires that development either take place on land with no existing significant habitats, or that it not disturb significant habitats, particularly wetlands and water bodies. The credit specifically excludes previously developed land and man-made habitats from being considered wetlands, water bodies, or buffer land that must be protected.

Rationale: This credit addresses only the preservation and conservation of existing significant habitats defined by an objective set of criteria, without considering the possibility of creating significant habitat. While preservation of existing sources of habitat is important, in post-industrial cities, the presence of high quality existing habitat may be scarce.

Recommendation: *This credit should have a potential of two points instead of one, and should be revised to account for the creation of habitat and natural areas on vacant or abandoned land.*

Available vacant land can be productively reused through habitat creation and can provide high functioning ecological amenities such as water infiltration and carbon storage. These areas most closely mirror the Naturescape type, but may be refined to specify the ecosystem types that are created. These areas can include early successional woodlands with fast growing pioneer species, intermixed with slow growing hardwood species to ensure long-term carbon capture and other ecological functions. Appendix C provides a tree species list that contains species native to the region that may be resilient to climate change flux. Employing this species guide may support the long-term sustainability of these ecosystems.

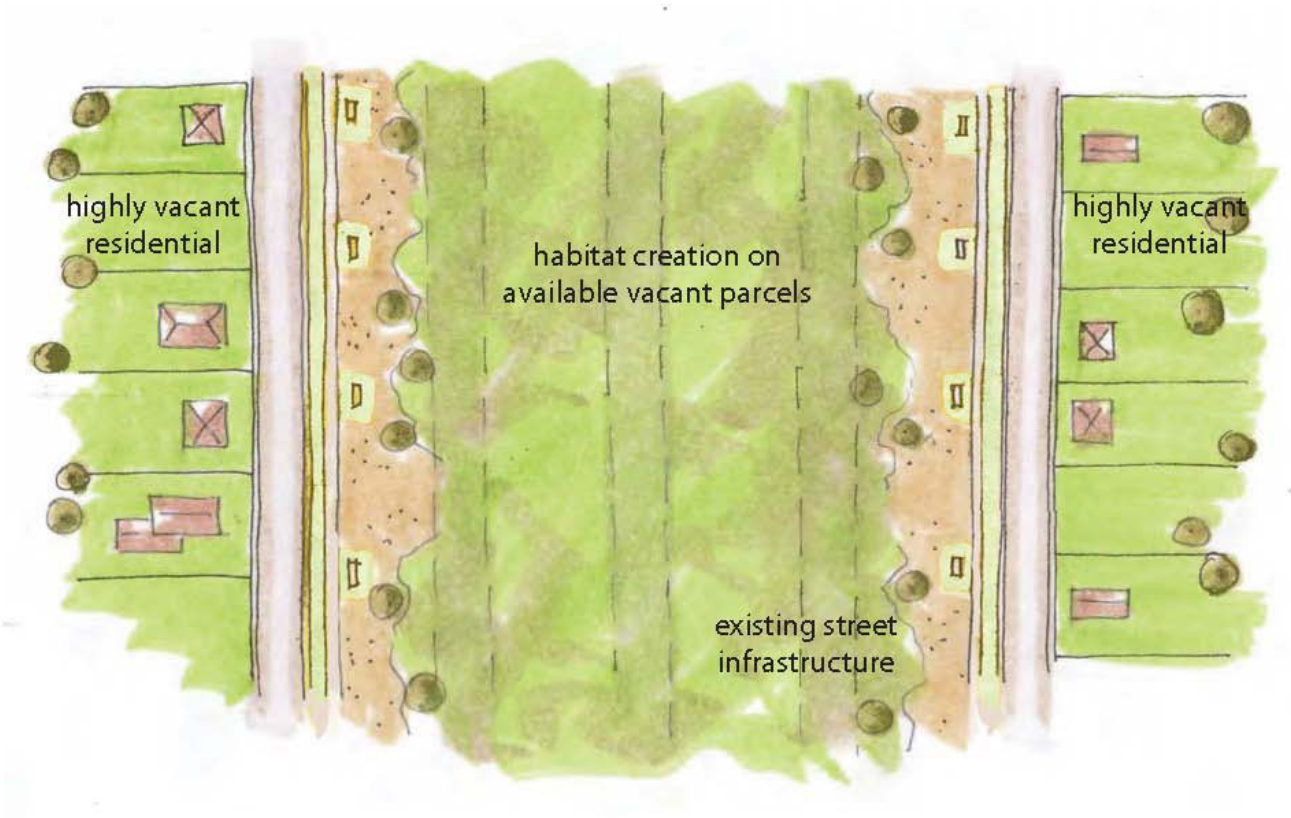

Figure IV-4. Example of site design for potential habitat creation using available vacant parcels as an ecological amenity

SLL Credit 8: Restoration of Habitat or Wetlands and Water Bodies

Intent of LEED-ND credit: To restore native plants, wildlife habitat, wetlands, and water bodies that have been harmed by previous human activities. This credit requires the use of only native plants to restore predevelopment native ecological communities, water bodies, or wetlands on the project site in an area equal to or greater than 10% of the development footprint.

Rationale: Considering the long history of disturbance in the soils and plant communities of legacy cities, full restoration of native communities is often an expensive and implausible goal. However, the high amount of available land in legacy cities promotes the expansion of plant communities, open space, wildlife (including pollinators) and plant habitat, wetlands, and water body ecosystems. The requirements for such expansion can be made stricter for SND-LC neighborhoods in lieu of requirements for restoration. This credit can be expanded to give more points for open spaces that have been retained in highly vacant communities. Credit can also be given for clustering development near sources of social capital and care that exist away from rivers or other water bodies. The credit can also encourage actions to promote the function of river ecosystems through the retaining of existing trees and herbaceous vegetation, and removing impervious surfaces in close proximity to rivers. The open spaces that emerge near wetlands and rivers and other water bodies will promote ecosystem services. SND-LC can effectively promote ecosystem services and wetland and water body habitat connectivity by dropping requirements for restoration and requiring a higher percentage of land to be used to promote these functions.

Recommendation: *This credit should be given an option for three points instead of one. This credit should also be revised to replace the amount of land required for restoration with a tiered system that allots more credits for higher percentages of land being reallocated for ecosystem services near existing wetlands and water bodies. Additionally, the credit should incorporate habitat connectivity and emphasize ecological amenities provided by emerging open space near wetlands and water bodies.*

Specific landscape design actions can reallocate land available for functional wetland or water body ecosystems in highly vacant communities. Ecological indicators such as steep slope and close proximity to streams and wetlands provide opportunities for promoting renewed ecosystem services. Streets, rights-of-way, and open spaces can be configured as corridors designed to filter stormwater runoff and minimize impacts on stream hydrology. Along with Green Thoroughfares, corridors can be used for the restoration of wetland and water body functions.

In corridors designed to promote wetland and water body function, streets can be decommissioned as residents relocate to higher-density housing clusters (Figure IV-5). Existing tree plantings should be retained parallel to waterways, and gravel can take the place of hard paving on decommissioned streets. Successional plantings can be applied to the margins of the formerly paved surfaces, with a 12' wide gravel path for emergency access. Stabilization techniques, such as the use of fascines and live stakes, can be utilized where bank erosion has taken place due to disturbance from urban development (Schanze et al. 2004). These stabilizing materials can be composed of low-cost recycled materials, and can be constructed in groups as a community restoration effort. In many cases, constructed stabilization techniques such as these will not be necessary, while retaining a vegetative buffer near the river will be the top ecological priority for promoting riparian ecosystem services such as water infiltration. Points should also give credit toward cases where residents contribute to the restoration of wetlands or water bodies through increasing and maintaining vegetation along rear rights-of-way, and using stabilization materials where erosion is evident on their property.

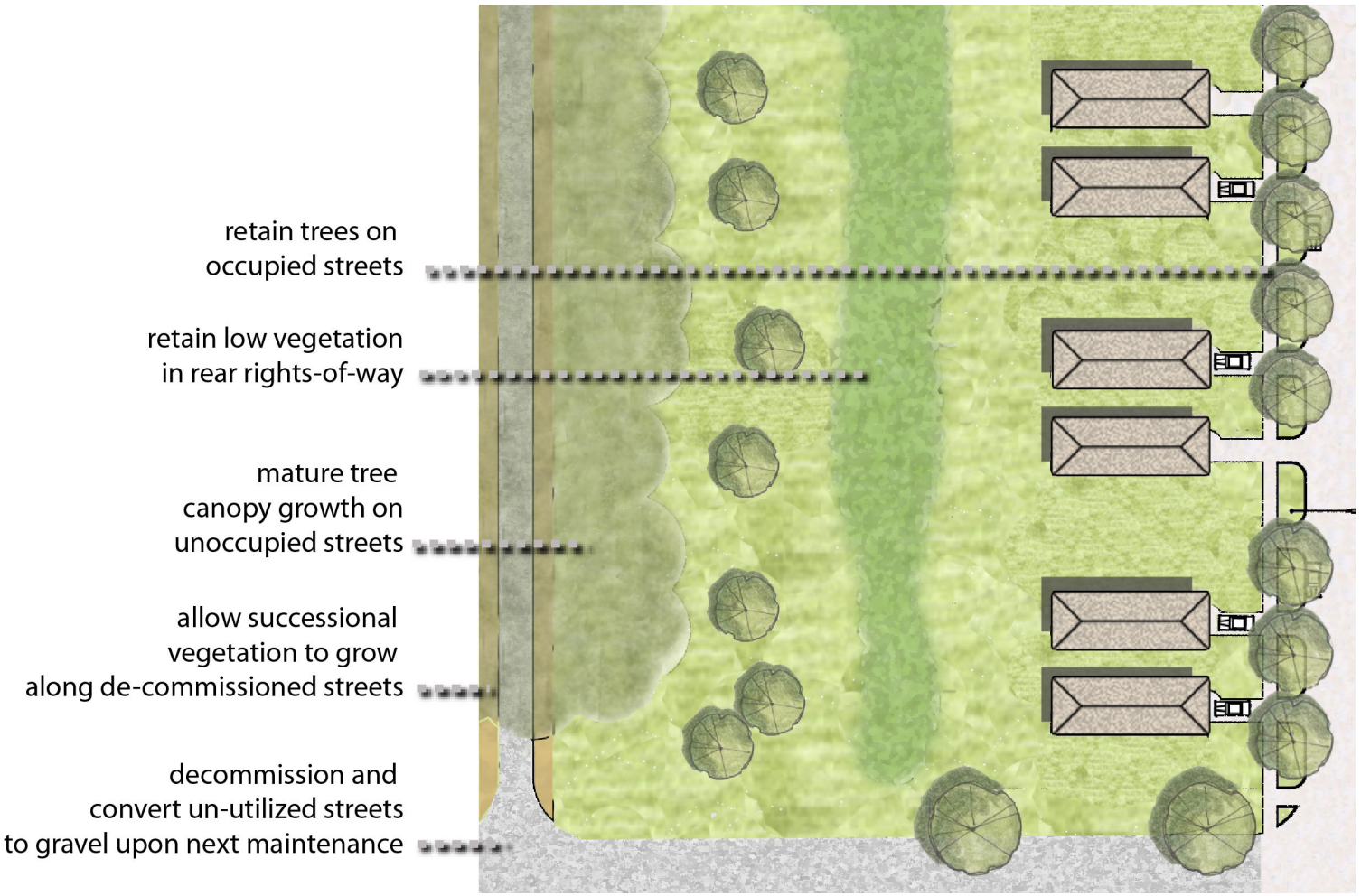

Figure IV-5. Example of treatments near a river ecosystem used to expand open space and increase restoration functions for the water body.

SLL Credit 9: Long-Term Conservation Management of Habitat or Wetlands and Water Bodies

Intent of LEED-ND credit: To conserve native plants, wildlife habitat, wetlands, and water bodies. This credit requires a long-term implementation management plan for new or existing onsite native habitats, water bodies, and/or wetlands and their buffers, which includes a guaranteed funding source for 10-years into the future.

Rationale: To adequately address long-term conservation of habitat and water bodies, this credit must include climate change adaptation and mitigation components. Potential climate change scenarios, such as variable precipitation patterns and increased temperatures, may impose a strain on requirements within the credit. Additionally, as there are limited native habitats left in most urban areas, this credit can focus more on creating healthy new urban ecosystems.

Recommendation: *This credit can be increased from one point to two points. This criterion should be revised to incorporate the potential effects of climate change by requiring use of native species that are adaptable to warmer climates and variable precipitation patterns.*

Incorporating climate change considerations into long-term management of Naturescape or other vegetated areas is essential to ensure that these spaces provide continued ecological functions. Due to the lack of native habitat in many urban areas, vacant land can be repurposed as urban ecosystems to both provide habitat and climate change adaptation and mitigation measures. Contiguous urban forest cover can provide a number of climate adaptation strategies, such as water infiltration, cooling effects for surrounding land uses, and provision of habitat for species migration due to climatic shifts (IPCC 2007a). Recommended by the Intergovernmental Panel on Climate Change (IPCC 2007a), proper street tree selection can also enhance long-term management strategies through carbon sequestration (see Appendix C). This is particularly important in urban areas where climate change effects may be heightened (Zhang et. al. 2010).

The long-term habitat management requirements proposed by SND-LC can be incorporated into the to the CDAD Naturescape typology definition. A definition that incorporates a successional forest mix (see Appendix C) can serve as a long-term management tool by ensuring high quality habitat and ecological function. Additionally, street trees can enhance edge treatments where Naturescapes or vegetated areas interface with the urban matrix. This provides climate adaptation and mitigation strategies through carbon sinks that can extend throughout the urban matrix.

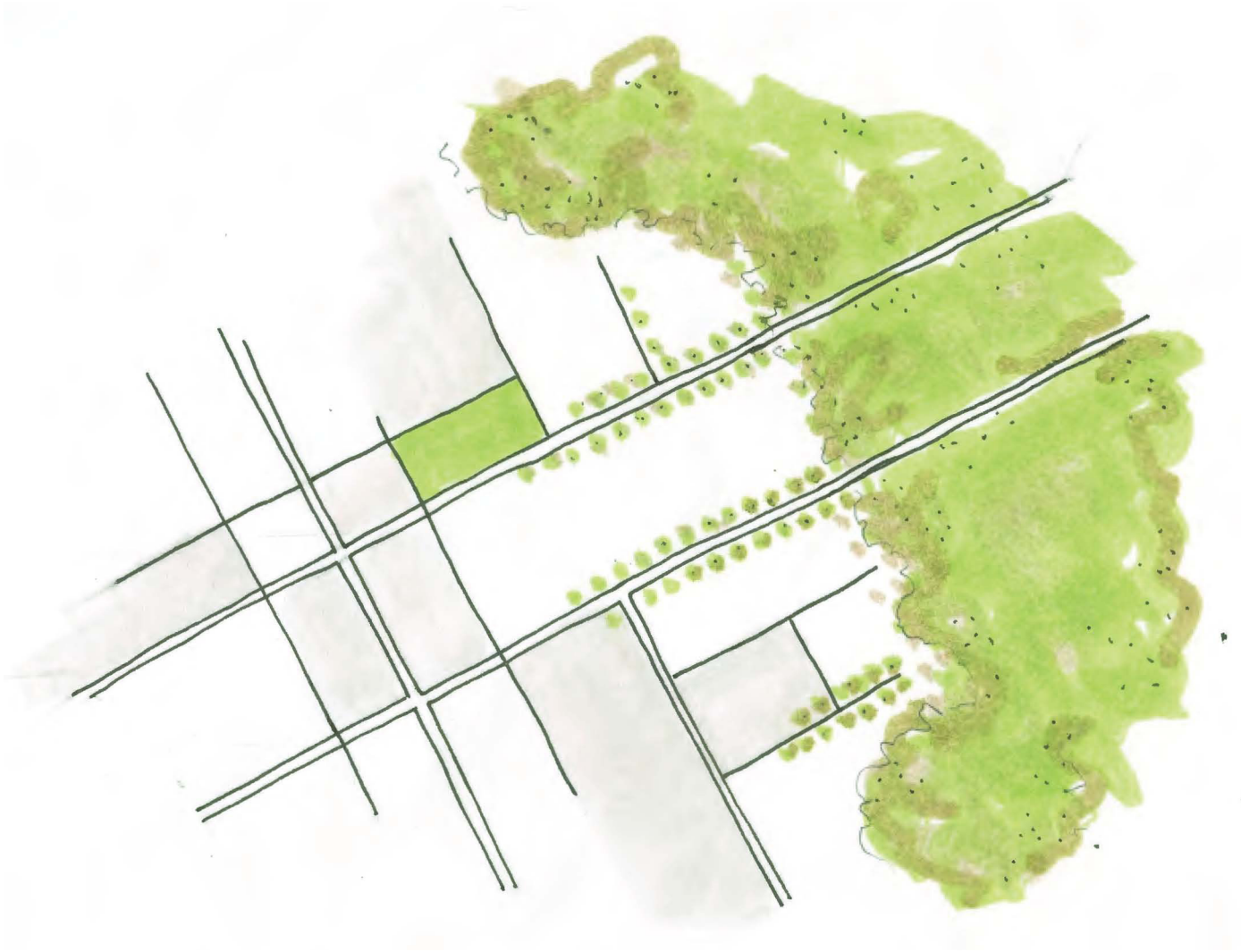

Figure IV-6: Example of a Naturescape within the urban matrix that introduces street trees as an extension of the vegetated space.

NPD Prerequisite 1: Walkable Streets

Intent of LEED-ND credit: To promote walking and to reduce vehicle miles traveled (VMT) by providing safe and appealing street environments that support public health as well as transportation efficiency. This prerequisite requires a number of design specifications for streets, sidewalks and buildings that contain strict size and ratio conditions.

Rationale: The criteria for this credit deal directly with the streets in front of buildings and not with streets in front of gardens, parks, or vacant lots, which are very common in legacy cities. The prerequisite also excludes alleyways and reconstructed existing sidewalks, which are important to consider in the context of a declining urban area. Additionally, this credit requires that 100% of non-motorized rights-of-way have a minimum building-height-to-street-width ratio of 1:1, which may not be feasible in a location where it is most sensible to reuse existing buildings that may not fit this criterion. The requirements do not place any emphasis on street lighting or maintenance of street trees, lots, and right-of-ways, all of which are important for creating appealing streets and neighborhoods. The specific sidewalk widths required are also dependent upon the type of buildings adjacent to the walkways, a detail that is probably less important for the stabilization of a declining neighborhood in a legacy city. In order to fit this context, the requirements must be less strict about exact height and width requirements to account for retrofitted buildings.

Recommendation: *This should not be considered a prerequisite for the SND-LC rating system. The requirements can be merged with the Walkable Streets credit to create more robust criteria for walkable streets.*

NPD Credit 1: Walkable Streets

Intent of LEED-ND credit: To promote transportation efficiency by providing safe, appealing, comfortable street environments that support public health. The credit requires design changes to the street façade such as windows restrictions, parking designs, and building setbacks. The credit also encourages slower speed limits through various design strategies.

Rationale: The credit focuses too heavily on density and should consider other factors when evaluating walkable streets. Since many legacy city neighborhoods have high potential crime, Walkable Streets should focus on higher levels of street safety. For this reason, the Walkable Streets credit should encourage more street activity to increase neighborly interactions that lead to more vibrant and safe communities.

Recommendation: *The weighting for this credit should be reduced to 6 points maximum. The credit can be revised to include more opportunities for enhancing street safety through increased neighborhood activity.*

The idea and meaning of walkable streets is very different for a legacy city than for a place with normal or high density. LEED should develop alternative standards to encourage neighborhood activity on city streets as well as pedestrian safety. Additionally, this credit should be merged with the Walkable Streets prerequisite to create more robust criteria for walkable streets. The requirements should focus less on height and width requirements, and more on the qualities of the street that make the neighborhood safe and appealing. Street lighting, for example, has been found to be a key factor in increasing perceptions of safety for children walking to school (Uhm 2008). Other features, such as maintenance of street trees, lots, and easements next to paths of high foot traffic can also be employed. The criteria should also include all streets, as well as alleyways and reconstructed sidewalks, and should emphasize the use of the right-of-way.

A representative landscape design action might describe how a commercial corridor could be narrowed adjacent to a cluster of high care residences to increase the corridor's walkability and improve the level of comfort for residents. Increasing on-street parking can increase the perception that the space is well populated, and outdoor seating for commerce can equally increase 'eyes on the street.' Street narrowing from angled parking and the replacement of lanes with street trees increases pedestrian friendliness and aesthetic appeal. Bike lanes should be incorporated to support multi-modal transportation from the adjacent high-care residential areas and from further away along the commercial corridor. Regular cues to care could give such stretches of road a sense of social capital and modest prosperity even in a high-vacancy environment.

NPD Prerequisite 3: Connected and Open Community

Intent of LEED-ND credit: To promote high levels of internal connectivity, as well as external connectivity to the larger community. Similar to the above prerequisites, this criterion seeks to encourage development within existing communities that promotes transportation efficiency and improves public health by encouraging daily physical activity. These goals are met through requirements for connected internal streets and intersections within the project area.

Rationale: While these conditions are important for physically connecting communities, this prerequisite does not address community cohesion, which is a more relevant measure of internal and external connectivity for legacy cities. This type of connectivity builds social capital to create networks that enhance communities and make them resilient in the face of a struggling economy. Without this element of community connection, the use of streets and intersections is inadequate to address the social and economic needs of vacant neighborhoods. The credit can expand the definition of "internal connectivity" to include pedestrian traffic not only on sidewalks but also on open-space trail systems that cut across long blocks via vacant parcels. Additionally, this prerequisite discredits the right-of-way, which can not only serve as important channels for connecting ecosystem networks, but which can also contribute to the character of a neighborhood if maintained properly.

Recommendation: *With the recommended changes outlined, this prerequisite should stay as a requirement for all SND-LC neighborhoods. This prerequisite can be revised to incorporate means for community cohesion that increase neighborhood social capital. The credit should award the use of emerging narrow corridors of open space to provide recreational opportunities and safe, aesthetic routes for biking and walking between commercial corridors and areas of high social capital.*

In highly vacant communities, there is great opportunity for increasing ecological connectivity along emerging corridors of open space. Open space corridors can expand along unoccupied or minimally occupied streets to provide ecological and recreational functions. In addition to Green Thoroughfares, more expansive emerging corridors of open space can serve recreational functions and can serve to connect Naturescape areas.

The strategic placement of these open space corridors can connect vehicular traffic as well as pedestrians within and outside of the community. Utility and service access should be maintained along routes adjacent to and running through clusters of high residential care. Public transportation access should also be maintained along major thoroughfares in these areas.

Paths can provide connections between groups of residents and between residents and commercial activities in low-density residential areas. This can be an effective way of promoting internal connectivity in transitional residential spaces within Spacious Residential and Urban Homestead typologies. Paths can be specifically designed on vacant land on long blocks to increase internal connectivity within and between communities. Such pedestrian crossing paths not only shorten the spatial distance between high social capital areas, but also provide a sense of care on unused property through low maintenance landscape design actions. Cues to care such as trimmed hedges and trees and mown turf can increase perceptions of safety in these areas (Nassauer 1995b).

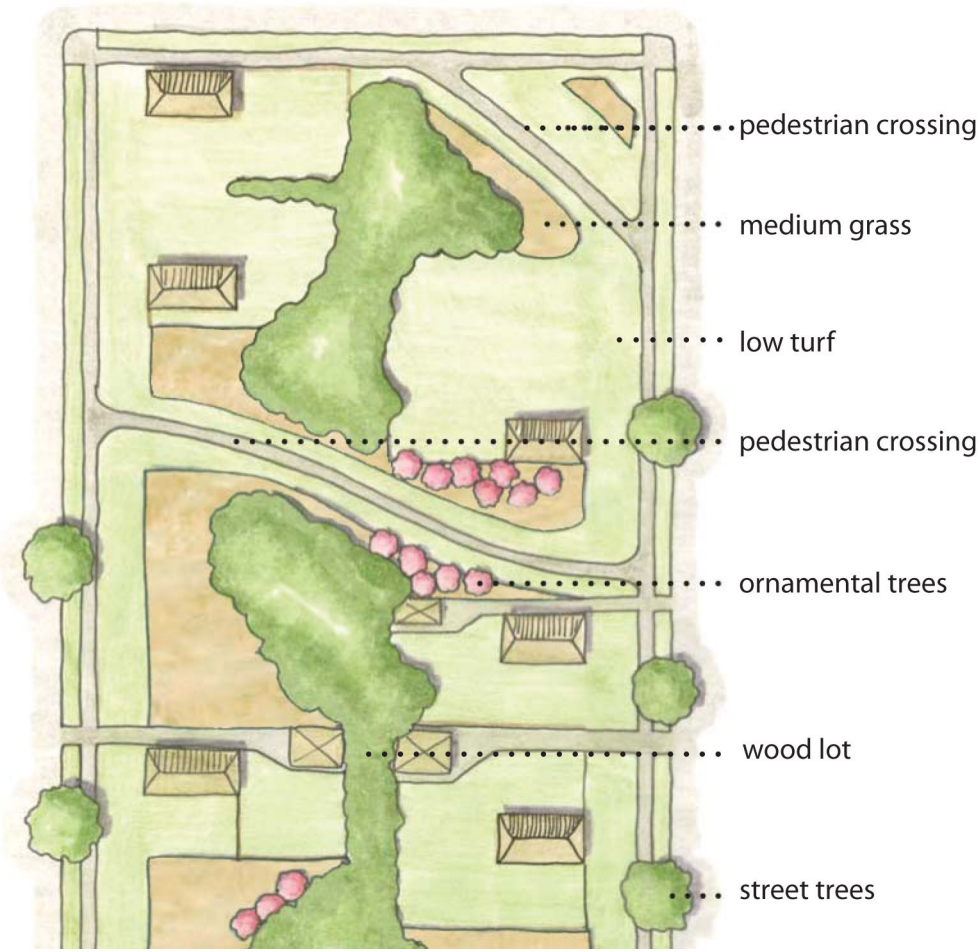

Figure IV-7. A fine-grained example of safe and legible internal connections in highly vacant neighborhoods across maintained vacant parcels.

NPD Credit 7: Transit Facilities

Intent of LEED-ND credit: To encourage transit use by providing safe, convenient and comfortable transit waiting areas. The credit requires that the developer work with the transit agency to identify existing or planned transit stop locations within or bordering the project boundary.

Rationale: In legacy cities, there may be limited resources available to maintain and beautify transit stops. Public transportation is particularly important in low-income neighborhoods, as it allows residents to have access to food, jobs, entertainment etc. It is crucial that transit facilities not only exist near occupied residential areas, but also that the transit stop be properly maintained and actively used, and that it connect residents to important nodes within the neighborhood and the city.

Recommendation: *This credit should be given up to two points for locating transit facilities near areas that allow low-income residents to connect to various neighborhood nodes.*

The revised credit should encourage the improvement and use of transit facilities near sources of high social capital where an institution or a cluster of properties can maintain the surrounding landscape. Locating transit stops near institutions and places with existing patterns of care will help make transit stops safer and more useful for the community. Figure IV-8 shows how bus facilities can be located along major corridors to create connections between amenities and areas with high signs of care and high occupancy. If new development occurs, the developer can be required to help maintain nearby transit stops, and to update the transit agency on the condition of facilities.

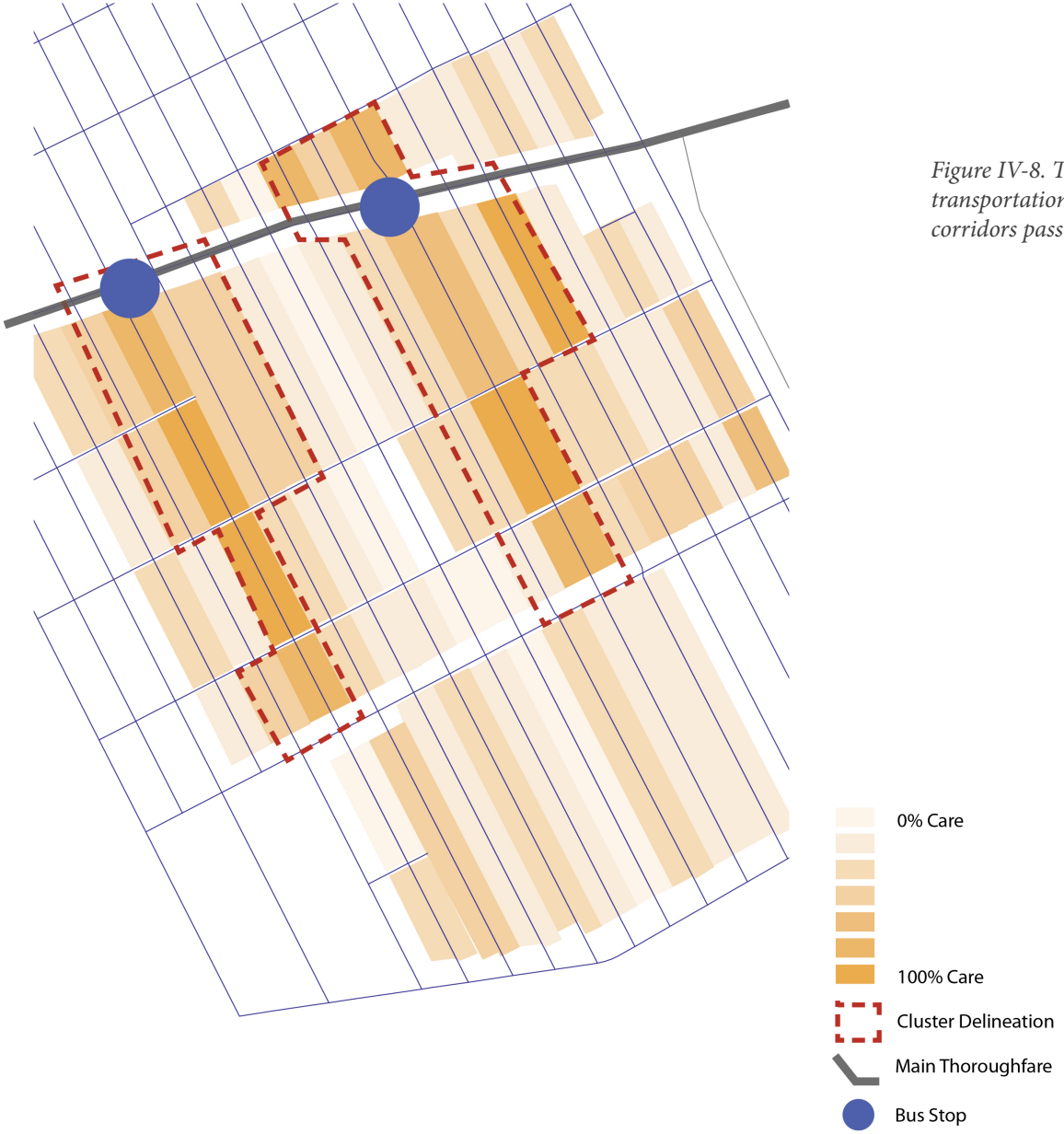

Figure IV-8. This Figure shows how bus routes (as an example of a public transportation option) could be streamlined by planning stops along major corridors passing through clusters of high care and high occupancy.

NPD Credit 10: Access to Recreation Facilities

Intent: To improve the health and social capital of a neighborhood by providing a variety of recreational facilities close to home and work. The requirements for this credit involve locating projects in proximity to an outdoor recreation facility of at least one acre in area, or an accessible indoor recreation facility.

Rationale: This goal is especially important for vacant neighborhoods because recreation facilities can foster community involvement and social capital. With ample open space in shrinking cities, vacant areas can be transitioned to recreational green spaces, while simultaneously providing other benefits such as connectivity for woodland and wetland patches and storm water retention. The criteria for this credit do not specify whether institutional spaces such as school playgrounds can provide recreational opportunities. Creating and maintaining recreational green space can sometimes also produce other ecological benefits. CDAD has identified several typologies that provide green space and could potentially serve as recreational areas such as Green Thoroughfares, Naturescapes, and Green Venture Zones.

Recommendation: *This credit should be worth up to two points instead of only one. This credit can be revised to include mown open spaces as recreational spaces and to encourage transitions of vacant land to recreational green space by allotting credits for the cleanup and maintenance of vacant land. The credit should also include institutional green spaces at churches and schools as public open spaces.*

Vacant parcels in legacy cities have potential to serve as low-cost and low-maintenance recreational amenities. Contiguous vacant parcels can be aggregated to serve as open spaces and recreational amenities for the surrounding neighborhoods. Low maintenance solutions such as turf grass mixes including fescues and highly floristic meadows plantings can serve as vibrant, low maintenance borders to the more open usable spaces. This credit can also include mown open spaces that are adaptable for sports activities. A mowing schedule will ensure a maintained space and will discourage ecological succession.
As open spaces for recreational facilities do not directly relate to a CDAD type, it is recommended that CDAD incorporate the concept of outdoor recreational amenities into its typology. This can serve as a productive re-use of vacant land and provide a valuable social amenity for neighborhoods.

NPD Credit 12: Community Outreach and Involvement

Intent of LEED-ND credit: To further involve community members in project design and planning and in decisions about changes and improvements over time. The criteria within this credit address the important role of community members in the process of plan development, including methods such as open community meetings with property owners, residents, business owners, and workers, and local planning and community development officials as well as establishing ongoing means for communication between the developer and the community. The criteria additionally mention conducting a design charrette or an interactive workshop, as well as requiring the design to be endorsed by an ongoing local or regional nongovernmental program.

Rationale: While it is important to involve the community directly in planning processes, the criteria do not address community building and resident cohesion, which are imperative to creating and maintaining social capital. CDAD mentions a number of strategies to empower the community and create cohesion, which are not mentioned in LEED's community involvement criteria. Some of these strategies include land banking, collective ownership, community organizing around blight reduction, home repair, house boarding, as well as education outreach about foreclosure prevention, home weatherization and partnering with specialty organizations. Additionally, a number of CDAD recommendations include the creation of a community benefits agreement, as well as community education sessions.

LEED can draw heavily from the community involvement measures outlined within the CDAD land use typologies. CDAD cites community based land use and housing strategies as short-term systematic strategies, coupled with community engagement as a matching intervention strategy to create cohesion among residents, particularly in low-density neighborhoods. Another short-term approach is community planning/visioning sessions, community education sessions, and the suggested matching intervention strategy of community organizing to build relationships among residents to prevent crime. In the Urban Homestead type, CDAD mentions the need to use existing structures to create spaces for community gathering, as well as community gardens. Another creative solution for community building is the creation of public art on abandoned buildings. This is a plausible solution in legacy cities with large amounts of vacant property available for community gathering space.

The CDAD typology also mentions the need to assemble existing residential lots and facilitate home purchasing in the community, as well as general vacant land management. The Green Venture Zone CDAD type addresses the difficulties of land assembly that may require the potential relocation of community members, which is a salient issue that should also be addressed in the LEED criteria for community engagement. In the Village Hub type recommendations, CDAD and LEED are similar in specifying a process for community stakeholder involvement and input. However, while LEED does not deal directly with community assets or with relationships, CDAD directs community engagement towards enhancing the bonds between residents and businesses, as well as strengthening the community's advocating power on behalf of school reform.

All of these strategies incorporate community at a deeper level than the LEED criteria do by addressing community cohesiveness and not just community input. As all of the CDAD typologies outline the role of a Community Development Organization, it is clear that while community input into plans and designs is important, it is insufficient without strong efforts towards community cohesion and community development.

Recommendation: *The points allotted for this credit should be increased from two points to eight points. The credit can include more specific language and examples, such as land banking and community benefits agreements, which encourage the development of cohesion among residents, and the connection of institutional anchors. Additionally, this credit should address land assembly and include strategies such as collective ownership, community organizing around blight reduction, home repair, house boarding, and art creation as well as education outreach about foreclosure prevention, home weatherization, and partnering with specialty organizations.*

In order for SND-LC to be successful in areas such as our study area on the Lower East Side of Detroit, partnerships must be explored and residents must be directly involved. SND-LC features can be integrated into the different land typologies and through neighborhood or citywide initiatives. Existing avenues for change such as non-profit organizations, private organizations, block groups, and other associations and groups can facilitate the proposed land use changes by harnessing the potential of cues to care in the landscape.

NPD Credit 14: Tree-lined and Shaded Streets

Intent of LEED-ND credit: To reduce the urban heat island effect, improve air quality, increase evapotranspiration, and reduce cooling loads in buildings. This credit also aims to discourage motoring speeds by encouraging walking, bicycling, and transit use. The criteria contain specific threshold requirements for the amount of trees and shade on sidewalks.

Rationale: The credit does not recognize the value of well-maintained trees as "cues to care" that demonstrate aesthetic and social values, which are very important for creating safer and more accessible neighborhoods. Additionally, the credit does not consider the type of tree species that can allow for the creation of habitat corridors and increase climate change adaptation and mitigation efforts.

Recommendation: *This credit can award an additional point to meet the revised criteria. The criteria should be revised to consider the aesthetic, social, and ecological value of trees.*

Selection of the appropriate street trees can create habitat corridors that connect Naturescapes and improve local urban ecology. By including criteria for tree selection, this credit can also provide climate change mitigation measures by optimizing carbon storage as well as adaptation measures through stormwater retention. Street trees can also improve perceptions of the neighborhood, particularly in the CDAD Spacious Residential Transition Zone, where residents benefit from an improved street environment. Regular street trees provide a strong impression of human intention, particularly in a low-density residential landscape (Figure IV-9). Such continuous care features can help to unify areas with greater social capital. Trimmed trees in the landscape are among the cues to care that connote neighborliness, safety, and marketability or productivity (Nassauer 1995b).

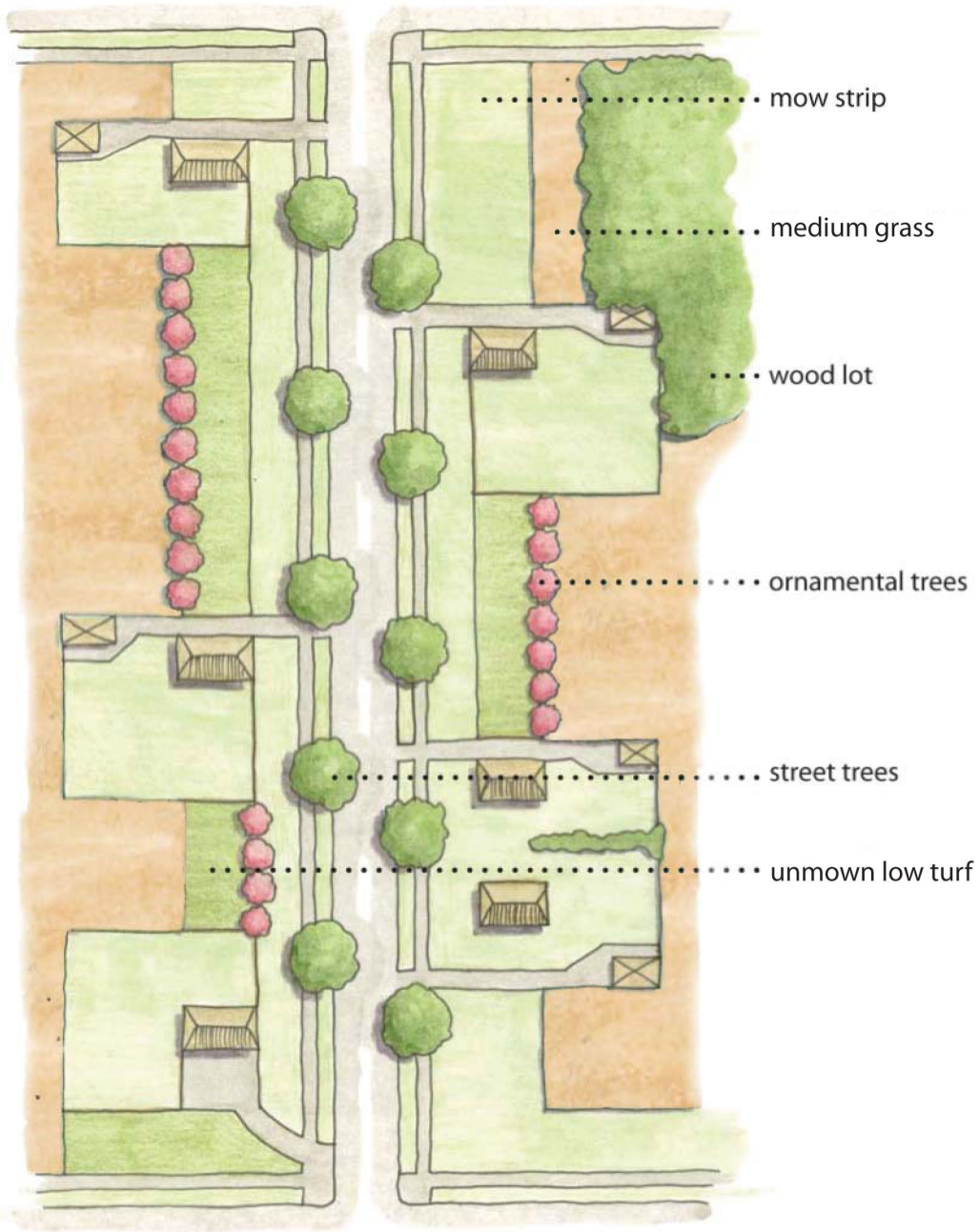

Figure IV-9. Example of low maintenance turf, meadow with heavy floral displays, and ornamental trees to convey care.

GIB Credit 4 - Water-Efficient Landscaping

Intent of LEED-ND credit: To limit or eliminate the use of potable water and other natural surface or subsurface water resources on project sites. To achieve points from this credit, outdoor water consumption must be reduced by 50% below the current midsummer baseline.

Rationale: This credit can apply in legacy cities where residents maintain vacant lots on their blocks. Efforts to plant native vegetation on vacant lots can allow for minimal maintenance and can also provide wastewater management functions such as water infiltration. Vacant lots are often grown with native and non-native vegetation or turf grass, and areas with tree cover surround many sites. Wherever possible, carefully selected seed mixes that reduce requirements for maintenance and water input can be used in open spaces, and can be incorporated throughout the various CDAD typologies. Tree plantings and seed mixes can be also be used to enhance vegetated communities in areas that directly impact water bodies.

Recommendation: *The weighting of this credit should remain the same. This credit should be revised to consider the importance of plant selection for habitat creation, aesthetic value, and climate change mitigation and adaptation.*

Within urban settings, especially if they are highly vacant, human perceptions of 'natural' areas need to be carefully considered to ensure that social capital is not degraded and that landscape stewardship is maintained. Therefore, cues to care for natural areas should be emphasized; plant selections should be guided not only based on their nativity, but also based on aesthetic factors such as showy flowers and neatness of appearance within a planting context.

Furthermore, when considering cost and management requirements, human-dominated environments need not necessarily or realistically be restored to native or pre-settlement habitat. Instead, non-invasive, naturalized species can be used to enhance ecosystem services beyond solely the creation of habitat. These include climate change adaptation services such as staggered and overlapping flowering times for pollinators (Hunter 2011; Galatowitch et. al. 2009), and climate change mitigation services, such as carbon sequestration increases from legumes and C4 grasses (Lesch 2010). Native vegetation can be incorporated throughout the various CDAD typologies by requiring constructed landscapes such as yards, gardens, and greenways to use native vegetation that needs minimal water, and to harvest rainwater for irrigation. An example plant list that would demonstrate heavy flowering, low stature, and high carbon sequestration potentials is shown in Table IV-2.

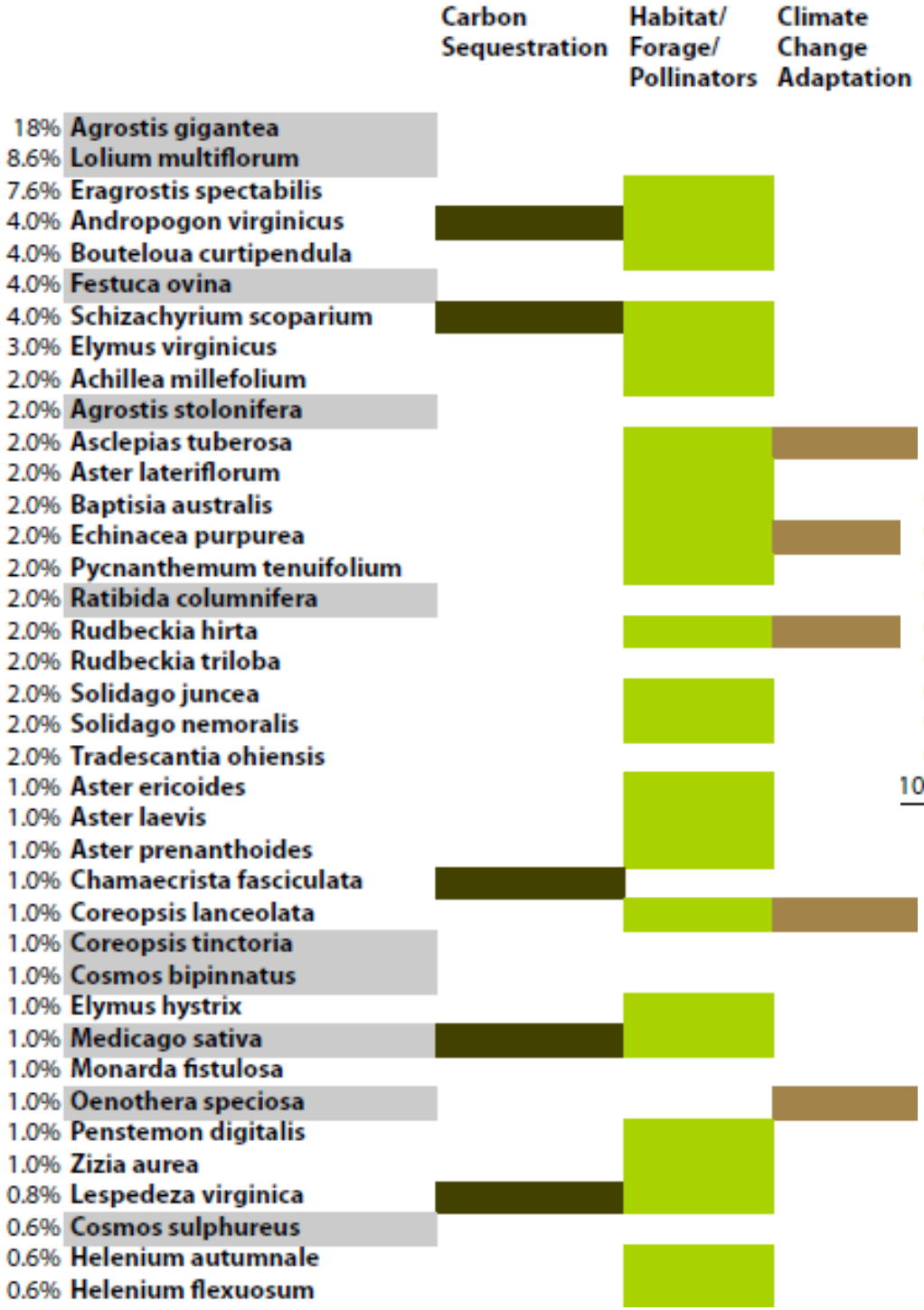

Table IV-2. Example of a plant list using both native and non-native species that provide ecosystem services such as food for pollinators and high visual appeal, as well as climate mitigation and adaptation strategies. The grey highlighted species are not native to the Southern Peninsula of Michigan (michiganflora.net; plants.usda.gov). However, many are naturalized, already appear in Wayne County, are native to adjacent states, or are native to other areas of the USA and may or may not already be present in Michigan. Additionally, some are native directly south of Michigan and could be seeded for climate change. Greyed species should be used conservatively and with caution and some species could be removed for wider-scale applications. Careful selection of non-native species is especially important to reduce the likelihood of introducing new invasive species to the area. The usage of naturalized species referred to here implies that even if they are not native they are already widespread and do not appear to have an adverse affect on their non-indigenous environment.

GIB Credit 5: Existing Building Use

Intent of LEED-ND credit: To extend the life cycle of the existing building stock and to conserve material resources. To achieve this credit, construction must include 50% of one existing structure as well as 20% of the total existing building stock. Projects cannot demolish any historic building or cultural landscape without approval by the appropriate review body.

Rationale: This credit is very relevant in the context of a legacy city with an abundance of vacant buildings and building shells. Projects that do not reuse existing building stock should not be favored in the rating system. Existing buildings located within the site boundary can be used to provide salvageable building materials, and should be reused or preserved before demolition. The credit should be expanded to encourage the use of salvaged materials reused from existing buildings.

Recommendation: *In the SND-LC system, up to 5 points are given to projects that use existing buildings, and more points are given to projects that preserve a higher percentage of the existing building, or that reuse materials from existing buildings.*

This credit is revised to further encourage the use of existing buildings within legacy cities. Reusing buildings or using salvaged materials from buildings can decrease the amount of construction waste sent to landfills while also encouraging the reuse of materials. Additionally, the reuse of deconstructed or salvaged material should be awarded bonus points for reducing waste and cleaning blighted land.

GIB Credit 8: Stormwater Management

Intent of LEED-ND credit: The goal of the Stormwater Management credit is to reduce pollution from stormwater, to reduce flooding, to promote aquifer recharge, and to emulate natural hydrologic conditions. The credit awards points for the retention of stormwater on site based on the size of the development footprint. Additional points are allotted if the project is located on a previously developed site or on a previous brownfield, or if the project is designed to be transit ready based on other NPD credits.

Rationale: This credit does not account for the ecosystem services provided by blotting and does not encourage the transition of vacant properties to publicly used open spaces. New broad-scale opportunities exist in legacy cities to expand open space corridors and ecosystem patches as a way to promote aquifer recharge and to enhance water quality through filtration. The credit should encourage the creation of additional open space and the reduction of impervious surface area. This credit should focus less on expensive technological solutions for stormwater management, and more on the emerging patterns of open space. This credit should require an analysis to determine where areas of low topographic change and water accumulation occur.

Recommendation: *This credit should be reduced to three points from four to simplify the requirements for stormwater management and to focus on the low cost option of removing impervious pavement. This credit should also focus less on technological solutions for stormwater and more on preserving open space as natural filtration systems, particularly in proximity to developed areas. Additionally, a regional analysis should be required to determine the direction of stormwater to identify where development should not occur.*

In highly vacant communities, patterns of occupancy can be concentrated near existing residential and commercial clusters of high care and high social capital. Residents leaving transitional areas can remain in clusters around these sources of care. This concentrates the infrastructure required for human movement and economic activity, while opening new areas of open space. Utilizing large portions of emerging open space along existing urban infrastructure to capture stormwater runoff is of particular importance in light of the lack of technological and resource capacity (Lyth and Kitha 2011). Emerging open space resulting from depopulating transitional areas can therefore be used as a natural filtration and infiltration system for stormwater runoff from areas of higher development.

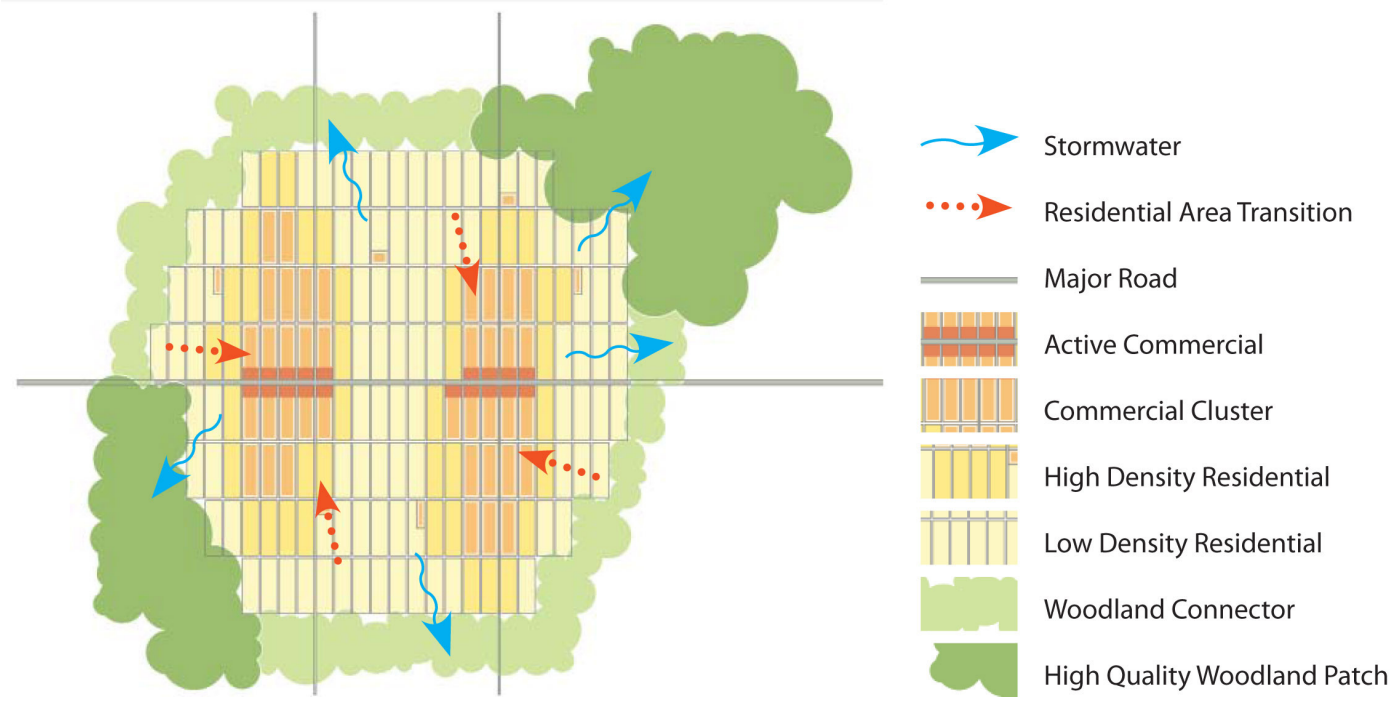

Figure IV-10. This figure shows how the surrounding open space can capture the runoff generated by clustered residential areas.

GIB Credit 15: Recycled Content in Infrastructure

Intent of LEED-ND credit: To reduce the adverse environmental effects of extracting and processing virgin materials. This credit requires the use of recycled and reclaimed materials in at least 50% of the construction of new buildings on the project site.

Rationale: This credit only specifies projects where new construction is taking place, and therefore does not account for alternative uses of salvaged material. Structures in good condition and well-maintained fences are among the ways that landscape can be used to convey care (Nassauer 2011). The reuse of salvaged material serves as a low-cost and sustainable way to construct these features in individual or neighborhood projects. Projects that use salvaged materials provide great potential for growing social capital through neighborhood projects and for improving overall neighborhood perceptions.

Recommendation: *This credit can award an additional point for the use of recycled content. This criterion can be revised to focus less on the construction of new buildings and more on the reuse of locally salvaged material to demonstrate care in the landscape.*

Whenever possible, salvaged materials should be used in the construction of features such as fences, artwork, and signs, which serve as manifestations of social capital that promote positive perceptions of neighborhoods. Asphalt or concrete reclaimed from decommissioned roads can be used to make seating, environmental structures, or retaining walls. This credit can also incorporate community development by requiring a certain level of resident participation in landscape care projects such as blotting or community gardens. As there is a large quantity of unused materials in many vacant Detroit neighborhoods, this credit provides a great opportunity to use materials from decommissioned streets and infrastructure for neighborhood or individual projects.

V. CONCLUSION

This paper examines a highly vacant neighborhood located in the Lower East Side of Detroit as a case study for the applicability of LEED-ND as a valuation standard for sustainable neighborhoods. Grounded in previous work, this project utilizes the data collected from the *Documenting and Demonstrating Neighborhood Care Dynamics in CDAD's 'Urban Homesteads' and 'Naturescapes'* (Nassauer and Dueweke 2011) and *Documenting Care and Commitment to Place in CDAD's 'Urban Homesteads' and 'Naturescapes'* (Dewar and Dueweke 2011) projects as well as CDAD's Neighborhood Revitalization Strategic Framework typologies to inform a critique of the LEED-ND framework. The report provides recommendations to both the USGBC and to CDAD that integrate concepts of social capital, social equity, landscape care, and ecological performance. Based on our research and previous work, our recommendations stem from the assumption that further integration of social and ecological variables significantly increases the applicability and effectiveness of the LEED-ND framework and the CDAD typologies to legacy cities.

The role of design in this project has been to provide a vision for translating the rationale of particular LEED-ND credits to present tangible, site-based solutions for increasing social and ecological function in a legacy city. These representative landscape design actions contribute to a framework for promoting social capital through low-cost landscape design actions that encourage interaction and stewardship. We aim to provide generalizeable solutions based on landscape considerations such as utilizing vacant land for habitat connectivity and fostering social capital through the improvement and maintenance of vacant land. Using the study area on the Lower East Side of Detroit focused the scope of the recommendations to a vision that speaks to the economic realities and the ecological contexts of a legacy city. Ultimately, the representative actions identify important implications for habitat connectivity, hydrology, and climate adaptation and mitigation and suggested tangible ways to promote social capital within an ecologically viable urban landscape.

The overarching critique of the LEED-ND rating system focuses on its lack of consideration for retrofitting existing neighborhoods and on its untapped potential for growing neighborhood social capital. Tailoring the rating system to explicitly address neighborhood retrofits in LEED-ND reduces pressure for new development and provides an opportunity for non-profit organizations, city governments, and community organizations to get involved in achieving more sustainable and equitable neighborhoods. Furthermore, our analysis finds that the heavy emphasis on New Urbanism in LEED-ND, and to a lesser extent, the CDAD framework does not adequately address the environmental and social equity issues intrinsic to a legacy city.

More specifically, we found that two categories of important variables were not adequately addressed in the LEED-ND framework. The first category of missing variables includes social considerations such as the creation of social capital, social equity, and landscape care as indicators for sustainability. We recommend that considering social variables and their implications for neighborhood cohesion and access to resources will greatly enhance the credit rating system. Secondly, land use issues such as density of development and ecological context (e.g. adjacencies to rivers and habitat patches) were found to be missing variables in both frameworks. Ecological context was largely missing from both frameworks, and density of development was too critical to the LEED-ND rating system to realistically apply to a legacy city. Our recommendations suggest that sustainability may be more appropriately and economically achieved through the strategic use of vacant land areas rather than through compactness or new development. The new credit rating system that we developed (SND-LC) factors in the economic and social conditions of a legacy city to offer realistic opportunities for vacant neighborhoods to achieve credits through the LEED-ND rating system.

This project reconsiders design and planning of land use in its current state to propose low impact solutions that account for Detroit's significant losses in population and in federal and state funding. As land use patterns evolve, fine-grain social and ecological solutions can help to stabilize Detroit neighborhoods, ultimately aggregating to creating a sustainable city. A major challenge for legacy cities is the strategic and efficient use of resources that maintains or improves the quality of life for residents. A particularly important resource is social capital, which can be harnessed by giving residents the opportunity to control the conditions that engender neighborhood stabilization and social utility. Another integral resource is landscape, which can be reclaimed for ecological services to improve habitat connectivity and protect natural resources. Legacy cities can employ these opportunities for environmental sustainability through the use of social capital as an imperative management tool.

VI. APPENDICES

Smart Location and Linkages (SLL)		Possible Points 27	
		LEED ND	SND-LC
Prereq 1	Smart Location	Required	Required
Prereq 2	Imperiled Species and Ecological Communities	Required	Required
Prereq 3	Wetland and Water Body Conservation	Required	Required
Prereq 4	Agricultural Land Conservation	Required	Required
Prereq 5	Floodplain Avoidance	Required	Required
Credit 1	Preferred Locations	1-10	1-10
Credit 2	Brownfield Redevelopment	1-2	1-3
Credit 3	Locations with Reduced Automobile Dependence	1-7	1-5
Credit 4	Bicycle Network and Storage	1	1-2
Credit 5	Housing and Jobs Proximity	1-3	1-3
Credit 6	Steep Slope Protection	1	1-2
Credit 7	Site Design for Habitat or Wetland and Water Body Conservation	1	1-2
Credit 8	Restoration of Habitat or Wetland and Water Bodies	1	1-3
Credit 9	Long-term Conservation Management of Habitat or Wetlands and Water Bodies	1	1-2

Neighborhood Pattern and Design (NPD)		Possible Points 44	
		LEED ND	SND-LC
Prereq 1	Walkable Streets	Required	Removed
Prereq 2	Compact Development	Required	Removed
Prereq 3	Connected and Open Community	Required	Required
Credit 1	Walkable Streets	1-12	1-6
Credit 2	Compact Development	1-6	1-3
Credit 3	Mixed-Use Neighborhood Centers	1-4	1-4
Credit 4	Mixed-Income Diverse Communities	1-7	Prereq
Credit 5	Reduced Parking Footprint	1	1
Credit 6	Street Network	1-2	1-2
Credit 7	Transit Facilities	1	1-2
Credit 8	Transportation Demand Management	1-2	1-2
Credit 9	Access to Civic and Public Spaces	1	2
Credit 10	Access to Recreation Facilities	1	2
Credit 11	Visitability and Universal Design	1	1
Credit 12	Community Outreach and Involvement	1-2	1-8
Credit 13	Local Food Production	1	1-3
Credit 14	Tree-Lined and Shaded Streets	1-2	1-3
Credit 15	Neighborhood Schools	1	1-2

A. The SND-LC rating system

	Green Infastructure and Buildings (GIB)	Possible Points 29	
		LEED ND	SND-LC
Prereq 1	Certified Green Building	Required	Removed
Prereq 2	Minimum Building Energy Efficiency	Required	Required
Prereq 3	Minimum Building Water Efficiency	Required	Required
Prereq 4	Construction Activity Pollution Prevention	Required	Required
Credit 1	Certified Green Building	1-5	1
Credit 2	Building Energy Efficiency	1-2	1-2
Credit 3	Building Water Efficiency	1	1
Credit 4	Water-Efficient Landscaping	1	1
Credit 5	Existing Building Reuse	1	1-5
Credit 6	Historic Resource Preservation and Adaptive Reuse	1	1-3
Credit 7	Minimized Site Distrubance in Design and Construction	1	1
Credit 8	Stormwater Management	1-4	1-3
Credit 9	Heat Island Reduction	1	1
Credit 10	Solar Orientation	1	1
Credit 11	On-Site Renewable Energy Sources	1-3	1-3
Credit 12	District Heating and Cooling	1-2	Removed
Credit 13	Infrastructure Energy Efficiency	1	1
Credit 14	Wastewater Management	1-2	1
Credit 15	Recycled Content in Infrastructure	1	1-2
Credit 16	Solid Waste Management Infrastructure	1	1
Credit 17	Light Pollution	1	1

	Innovation and Design	Possible Points 6	
		LEED ND	SND-LC
Credit 1	Innovation and Exemplary Performance	1-5	1-6
Credit 2	LEED Accredited® Professional	1	1

	Regional Priority Credit	Possible Points 4	
		LEED ND	SND-LC
Credit 1	Regional Priority	1-4	Prereq

Certified	40-49 points
Silver	50-59 points
Gold	60-79 points
Platinum	80 points and above

Appendix B - Revised LEED-ND Credits

Below is a complete list of the revised LEED-ND credits that includes the new point distribution and brief recommendations. It is important to note that an overarching critique of the LEED-ND credit rating system is that it applies largely to new development, and allows little room for retrofits. Retrofits can be conducted on existing buildings to provide savings in water and energy cost, providing long-term savings for owners and reducing rental prices. Leaving out the opportunity for retrofitting neighborhooods makes it extremely difficult for legacy cities to achieve a green neighborhood status under LEED-ND. To consider how SND-LC might be more appropriate to highly vacant neighborhoods, we are addressed each credit under the assumption that retrofits can be considered in the rating system. As building retrofits present a large investment, the involvement of third party organizations such as Better Buildings for Michigan, Michigan Saves, and Habitat for Humanity. Retrofit rebates can also be found at www.dsireusa.org. Additional assistance can also be provided by organizations such as the WARM Training Center or Green Garage Detroit to encourage education around energy issues.

Regional Priority			**Recommendation**
RPC Credit 1: Regional Priority	*1-4*	*Required*	All projects must conduct an analysis of surrounding ecological features to tailor interventions specifically for the ecological context.

Smart Location & Linkages	LEED-ND	SND-LC	Recommendation
SLL Prerequisite 1: Smart Location	*Required*	*Required*	Incorporate cared-for landscapes as areas desirable for adjacency
SLL Prerequisite 2: Imperiled Species and Ecological Communities Conservation	*Required*	*Required*	Include habitat enhancement in addition to conservation.
SLL Prerequisite 3: Wetland and Water Body Conservation	*Required*	*Required*	Have stricter development requirements, to better protect wetlands and water bodies.
SLL Prerequisite 4: Agricultural Land Conservation	*Required*	*Required*	Include conservation of areas that are not necessarily considered prime agricultural land, but have been designated as neighborhood garden spaces.
SLL Prerequisite 5: Floodplain Avoidance	*Required*	*Required*	Eliminate options to build on floodplains
SLL Credit 1: Preferred Locations	*1-10*	*1-10*	Include condition of existing infrastructure and expand definition of high priority areas.
SLL Credit 2: Brownfields Redevelopment	*1-2*	*1-3*	Keep requirements as they are. This is important for the prevalence of brownfields in vacant neighborhoods.
SLL Credit 3: Locations with Reduced Automobile Dependence	*1-7*	*1-5*	Incorporate traveling via Green Thoroughfares and pedestrian trails as alternative travel corridors, and incorporate bus and bike lanes for travel within and between nearby neighborhoods.
SLL Credit 4: Bicycle Network and Storage	*1*	*1-2*	Expand options to receive points, such as enhancing the bicycle network by creating bike routes or bike lanes on roadways.
SLL Credit 5: Housing and Jobs Proximity	*1-3*	*1-3*	In Spacious Residential and Urban Homestead typologies, this credit should increase the distance requirements and focus on improving safety to make the pathways more accessible to pedestrians.
SLL Credit 6: Steep Slope Protection	*1*	*1-2*	Reward existing housing areas that maintain vegetated slopes adjacent to river ways or streams.
SLL Credit 7: Site Design for Habitat or Wetland and Water Body Conservation	*1*	*1-2*	Revise to account for the creation of habitat and natural areas on vacant or abandoned land.

SLL Credit 8: Restoration of Habitat or Wetlands and Water Bodies	*1*	*1-3*	Incorporate habitat connectivity and emphasize ecological amenities provided by emerging open space near wetlands and water bodies. Revise the amount of land required for restoration, with points allotted based on the percentage of habitat land being restored.
SLL Credit 9: Long-Term Conservation Management of Habitat or Wetlands and Water Bodies	*1*	*1-2*	Incorporate the potential effects of climate change by requiring the use of native species that are adaptable to warmer climates and variable precipitation patterns.

Neighborhood Pattern & Design	LEED-ND	SND-LC	Recommendation
NPD Prerequisite 1: Walkable Streets	*Required*	*Not Required*	Combined with NPD Credit 1: Walkable Streets
NPD Prerequisite 2: Compact Development	*Required*	*Not Required*	Do not require as a prerequisite.
NPD Prerequisite 3: Connected and Open Community	*Required*	*Required*	Incorporate community cohesion by promoting the use of corridors of narrow open space for recreation, routes for biking and walking, connecting areas with high social capital.
NPD Credit 1: Walkable Street	*1-12*	*1-6*	Decrease points and focus on street quality and safety. Include all streets, alleyways, and the use of the right-of-way.
NPD Credit 2: Compact Development	*1-6*	*1-3*	Exclude strict requirements for distances between buildings, and redefine "compact" to include less dense neighborhoods, and "walkable" to include routes via path systems and trails related to green spaces. This will prevent penalizing lower density areas that contain a high amount of open space.
NPD Credit 3: Mixed-use Neighborhood Centers	*1-4*	*1-4*	Expand to include cottage industries and other economic assets. Revise to accommodate the lower density found in highly vacant neighborhoods.
NPD Credit 4: Mixed-Income Diverse Communities	*1-7*	*Required*	Provide affordable units and a wide range of housing sizes for various economic levels to help those who live in the neighborhood to stay in the neighborhood, and to address issues of gentrification.
NPD Credit 5: Reduce Parking Footprint	*1*	*1*	Promote alternative uses for travel that are advanced through the CDAD greenway typology.
NPD Credit 6: Street Network	*1-2*	*1-2*	Decrease the number of intersections required for legacy cities, especially in Urban Homestead and Spacious Residential typologies. Include green spaces and trail systems as connective routes.
NPD Credit 7: Transit Facilities	*1*	*1-2*	Locate transit facilities near areas that allow low-income residents to connect to various neighborhood nodes.
NPD Credit 8: Transportation Demand Management	*1-2*	*1-2*	Offer more points for transit passes and vehicle sharing instead of requiring that 50% of dwelling units be located by ride share cars.

NPD Credit 9: Access to Civic and Public Space	*1*	*1-2*	Distinguish whether institutional spaces such as schools and churches count as public open space, and encourage diversity of spaces to promote social capital.
NPD Credit 10: Access to Recreation Facilities	*1*	*1-2*	Expand to include mown open spaces to encourage transitions of vacant land to recreational green space, giving an additional credit for the cleanup and maintenance of vacant land.
NPD Credit 11: Visitability and Universal Design	*1*	*1*	Incorporate building retrofits and include community gathering spaces as areas for universal design.
NPD Credit 12: Community Outreach and Involvement	*1-2*	*1-8*	Expand to include specific language on collective ownership, land assembly, and homeownership education.
NPD Credit 13: Local Food Production	*1*	*1-3*	Exclude requirements for land ownership and revise to address the issue contaminated soil, encouraging alternative food production such as hydroponics and aquaculture.
NPD Credit 14: Tree-lined and Shaded Streets	*1-2*	*1-3*	Incorporate consider the aesthetic, social, and ecological value of tree, including climate mitigation and adaptation potential.
NPD Credit 15: Neighborhood Schools	*1*	*1-2*	Focus on school reform and community outreach efforts, and consider dispersed student bodies characteristic of vacant neighborhoods.

Green Infrastructure	LEED-ND	SND-LC	Recommendation
GIB Prerequisite 1: Certified Green Building	*Required*	*Not Required*	Do not require as a prerequisite.
GIB Prerequisite 2: Minimum Building Energy Efficiency	*Required*	*Required*	Require development and retrofits to meet or exceed the current energy and water efficiency guidelines set forth in the latest federal and state building codes.
GIB Prerequisite 3: Minimum Building Water Efficiency	*Required*	*Required*	Allow building retrofits to meet current building water efficiency codes.
GIB Prerequisite 4: Construction Activity Pollution Prevention	*Required*	*Required*	Encourage safe deconstruction of buildings to prevent harmful bulldozing that creates airborne pollutants and expand standards for protecting water bodies and other natural habitats.
GIB Credit 1: Certified Green Buildings	*1-5*	*1*	Include EPA definition of low-impact development, and standards based on regional priority of the National Green Building Standards, or standards established in LEED for Homes Rating System.
GIB Credit 2: Building Energy Efficiency	*1-2*	*1-2*	Keep requirements.
GIB Credit 3: Building Water Efficiency	*1*	*1*	Buildings sold for any major renovation can be retrofitted to meet and/or exceed standards set forth in latest federal and state energy codes, and meet a portion of the criteria set forth in the LEED Rating system or in a third party rating system.
GIB Credit 4: Water-Efficient Landscaping	*1*	*1*	Plant selections should not only be based on their nativity, but also aesthetic factors, habitat creation, and climate change mitigation and adaptation.
GIB Credit 5: Existing Building Use	*1*	*1-5*	Add points to account for the number of existing buildings present in highly vacant or legacy cites.
GIB Credit 6: Historic Resource Preservation and Adaptive Reuse	*1*	*1-3*	Add points to account for the number of historic vacant buildings and building shells that remain within highly vacant or legacy cities.
GIB Credit 7: Minimized Site Disturbance in Design and Construction	*1*	*1*	Keep requirements.
GIB Credit 8: Stormwater Management	*1-4*	*1-3*	Reduce points to encourage and preserve the use of open space that is in close proximity to developed areas to serve as a natural filtration system.

GIB Credit 9: Heat Island Reduction	*1*	*1*	Offer an option for reforestation and replanting on vacant land to improve the surrounding habitat and reduce the urban heat island effect.
GIB Credit 10: Solar Orientation	*1*	*1*	Include orientation of windows through retrofitting as an energy reduction tool.
GIB Credit 11: On-Site Renewable Energy Sources	*1-3*	*1-3*	Include strategies that repurpose vacant land, such as biomass creation, instead of solar or geothermal energy sources.
GIB Credit 12: District Heating and Cooling	*1-2*	*Removed*	Not applicable.
GIB Credit 13: Infrastructure Energy Efficiency	*1*	*1*	Employ infrastructure downsizing to operate and deliver services more efficiently.
GIB Credit 14: Wastewater Management	*1-2*	*1*	Encourage alternative black water management such as composting toilets.
GIB Credit 15: Recycled Content in Infrastructure	*1*	*1-2*	Expand to focus on the use of locally salvaged materials in the landscape.
GIB Credit 16: Solid Waste Infrastructure Management	*1*	*1*	Encourage alternative waste management strategies such as composting or the reuse of locally salvaged materials.
GIB Credit 17: Light Pollution Reduction	*1*	*1*	Consider safety aspects of street lighting in poorly lit areas of highly vacant neighborhoods.

Innovation and Design Process	LEED-ND	SND-LC	Recommendation
INP Credit 1: Innovation and Exemplary Performance	*1-5*	*1-6*	Do not limit the innovation and exemplary performance to only green building, smart growth, or New Urbanist categories. Expand the options to include innovation in ecological enhancements as well as community organization and collaboration.
INP Credit 2: LEED Accredited Professional	*1*	*1*	Expand to include integrated collaboration, for teams that can demonstrate a multi-disciplinary collaborative process.

	Plant Type	Genus	Michigan Species	Latin	Aesthetic Value	Notes/conditions
Fast Growing / Short Term Carbon Sequesters	**Trees**	Alder	Red Alder	Alnus rugosa	Small tree, up to 13' in height	N-enriches with heavy leaf fall, increases carbon sequestering potential
		Aspen	Trembling aspen	Aspen tremuloides	Vibrant yellow fall color	Fast growing pioneer species, propogates itself freely
		Aspen	Big-toothed aspen	Populus grandidentata	Yellow fall color	Fast growing, but short lived (60-70 years)
		Birch	Paper birch	Betula papyrifera	Yellow fall color	Can stand wind exposure, does not regenerate well in shady conditions, can tolerate dry soils & periodic inundation
		Catalpa	Catalpa	Catalpa speciosa	Unique bean pods	Highly resistant to rot, can be harvested and used for fencing
		Poplar	Poplar	Populus alba	Glossy green leaves	not suitable for smaller sites
		Poplar	Balsam poplar	Populus basamifera	Tall verticle shape	Fast growing pioneer species, do not thrive in windy sites, aggressively rooting, not suitable for smaller sites
	Shrubs					
		Blackberry	Blackberry	Rubus occidentalis	Shrub, colorful fruit	Useful for establishing native woodland, best planted with other trees the mature trees where there will be root competition
		Elder	Common elderberry	Sambucus canadensis	Shrub, showy white flowers	Best at edge of woodland, had edible fruit for wildlife especially good for wildlife
		Willow	Sandbar willow	Salix exigua	Shrub, fine textured	Very tolerant of extreme exposure, extensive root system, cannot tolerate too much shade, can be used to prevent erosion
Slow Growing / Long Term Carbon Sequesters	**Trees**	Beech	American beech	Fagus americana	Tall non-showy shade tree	Not suitable as a street tree
		Hickory	Shagbark hickory	Carya ovata	Tall ornamental shade tree	Suitable as street tree - highly salt tolerant
		Maple	Red maple	Acer rubrum	color	Suitable as street tree and for shading
		Maple	Sugar maple	saccharum	tree	Not suitable as a street tree
		Oak	Red Oak	Quercus rubra	Red fall coloring	Suitable as street tree and for shading
		Sycamore	American sycamore	Platanus occidentalis	Very large tree canopy	Best if 10% of total tree quantity, let grow for 10 years then gradually remove and use wood, not suitable as street tree

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