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Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Dakota Lewis

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Shrinking Cities in the Rust Belt
An Ecological Urban Design Intervention in Cairo, Illinois
Dakota Lewis
Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

This final project is presented to the faculty of the Department of Architecture by

Dakota A. Lewis

In partial fulfillment of the requirements for the Degree of

Bachelor of Architecture

Kennesaw State University, Marietta, Georgia
Spring Semester 2018
Shrinking cities are those which have experienced sustained depopulation over time. This phenomenon typically occurs in industrialized countries around the world as a result of economic downturn, social tension, or climate related change. When depopulation occurs, remaining communities are often met with unsustainable conditions as they are forced to function in a city designed for many times their population. While these conditions could be seen as negative, this design thesis aims to re-frame urban shrinkage as a condition that reveals unprecedented sustainable design opportunities. The United States Rust Belt region contains many shrinking cities such as Cairo, Illinois which due to its rich cultural heritage and ecological context presents itself as an ideal site for investigation. Through a systematic analysis of historical context, regional characteristics and existing conditions that may be used for other shrinking cities, this thesis proposes an ecologically inclusive design response in Cairo that addresses the specific needs and strengths of its community. A series of public space and building typologies that investigate regionally specific sustainable design strategies are proposed and strategically sited through analysis of Cairo’s street network. By prioritizing community engagement, historical context, ecological connections, re-purposing existing infrastructure, and design flexibility, this thesis proposes the city of Cairo as university campus.
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Chapter 1  Thesis Relevance
Abstract

Shrinking cities are those which have experienced sustained depopulation over time. This phenomenon typically occurs in industrialized countries around the world as a result of economic downturn, social tension, or climate related change. When depopulation occurs, remaining communities are often met with unsustainable conditions as they are forced to function in a city designed for many times their population. While these conditions could be seen as negative, this design thesis aims to re-frame urban shrinkage as a condition that reveals unprecedented sustainable design opportunities. The United States Rust Belt region contains many shrinking cities such as Cairo, Illinois which due to its rich cultural heritage and ecological context presents itself as an ideal site for investigation. Through a systematic analysis of historical context, regional characteristics and existing conditions that may be used for other shrinking cities, this thesis proposes an ecologically inclusive design response in Cairo that addresses the specific needs and strengths of its community. A series of public space and building typologies that investigate regionally specific sustainable design strategies are proposed and strategically sited through analysis of Cairo’s street network. By prioritizing community engagement, historical context, ecological connections, re-purposing existing infrastructure, and design flexibility, this thesis proposes the city of Cairo as university campus.
What is a shrinking city?
Shrinking cities are those that have experienced depopulation, or a significant population decrease in a relatively short period of time. This depopulation can typically be linked to economic downturns, social tension, climate related changes, or a combination of these. In the United States (U.S.), a common example would be Detroit, Michigan which experienced depopulation following automobile manufacturing jobs leaving the region. In St. Louis, Missouri, historical social tension has contributed to depopulation. In New Orleans, Louisiana, increasingly common flood events have forced many to relocated to safer regions.

Re-framing Shrinkage
While these conditions could be interpreted as negative, this design thesis aims to re-frame these conditions as presenting unprecedented sustainable design opportunities that may set the standard for future development in other cities.

Design Investigation of Responses
While the issues contributing to urban shrinkage are complex and require analysis by numerous fields of study, this thesis focuses primarily on potential design considerations in response to depopulation. Rather than prioritizing typically practiced growth strategies, this thesis considers depopulation an inevitable phase in the cyclical life of urban environments. In doing so, the function of communities currently residing in depopulating cities may be prioritized over encouraging population growth. While growth is not the primary goal in the consideration of shrinking cities, the possibility shall be viewed as a welcome potential of successful design response implementation.

Theorem + Practicum
In an effort to appropriately position a potential design response within a strategically selected shrinking city, this thesis begins by prioritizing research of a selected city (Theorem) that subsequently informs a design proposal (Practicum).

Figure 1.2 / Employment fell in five states between 1995 and 2009

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois
Chapter 1 / Thesis Relevance

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Population Loss
Cities with more than 100,000 loss between 1900-2000

>50%
40-50%
30-40%
20-30%
10-20%

Figure 1.3 / World Map of Shrinking Cities
Types of Change
Shrinking cities around the globe typically encounter depopulation upon experiencing one or more of the following types of change:

- Economic Change / Loss of Jobs
- Structural Change / Suburbanization
- Political Change / Collapse of Political Constructs

Observation and Response
Responding to shrinking cities is a unique issue as it requires simultaneous observational learning and city specific response. While the conditions present within shrinking cities may share similarities, each city is unique and requires its own conditional response.

Remaining Populations
Populations remaining in cities experiencing depopulation should be valued as the city’s greatest asset. It is often the case that these populations are highly invested in their communities, understand the needs and desires of the population, and may provide creative solutions to complex issues.

The U.S. Rust Belt
The U.S. Rust Belt contains many of the countries’ shrinking cities once being a highly prosperous region with abundant manufacturing and coal mining industries. Due to its high concentration of shrinking cities and widespread economic decline, the Rust Belt is an ideal region for design response investigation.
Chapter 1 / Thesis Relevance

Historical Context and Crowd Sourcing
When beginning analysis of a shrinking city in pursuit of a design response, it is critical to first understand the cities’ unique economic and cultural history. This allows for the positioning of a response that contributes to the continuously developing narrative of the city. Additionally, the future trajectory of the city should be informed primarily by the desires of the present community members as to encourage support and adoption of proposals. Due to these measures, proposed interventions will have greater success by understanding where the city has been and how its communities wish to see it transform.

Sustainable Design
In developing a potential design response for a shrinking city, it is important to practice sustainable design strategies that will ensure a lasting impact rather than a short term solution. Sustainability in urban design and architecture is essential to future design endeavors around the world. The re-structuring and development opportunities in shrinking cities allows for an example to be set for future development in all cities.

Re-purposing, Retrofitting, and Regenerating
Shrinking cities inherently reference those cities that once supported large populations that warranted an appropriately paced response of development. As depopulation occurs, the remaining populations are challenged with the task of functioning in a city designed for many times their population. Maintenance of the resulting excess infrastructure can be not only cumbersome, but pose a threat to the health, safety, and well-being of the public. In support of sustainable responses within shrinking cities, re-purposing existing infrastructure can lessen the environmental impact resulting from potential new construction and eventual demolition costs to accommodate future functions. Retrofitting existing infrastructure such as uninhabited buildings can result in a significantly lower environmental impact by extending the lifespan of the Carbon Dioxide (CO₂) emissions resulting from the initial construction process.

Ecological Connections
While community provisions are primary when considering interventions within shrinking cities, consideration should also be given to promoting ecological inclusivity. Typically, human development functions only to serve humans with little regard for the impact on the local ecosystem. Ecological connection should be accounted for in the sense that design interventions should not only acknowledge regionally specific context, but encourage communities to engage directly as stewards of the environment through learning and preservation.

Design Flexibility
Given that urban design and planning is inherently a practice that takes time for implementation, flexibility should be built into the structure of any design intervention. Flexibility allows planning of an intervention to shift as the needs of communities change over time.

Design Hypothesis
Urban Design Principles

Four Generators of Diversity that Create Economic Pools of Use (Jacobs, 1961)

Mixed Use
Ensuring program diversity such as including offices, retail, residential in the same region allows for the presence of people during various times throughout the day.

Block Size
The dimensions of urban development must be at a scale ensuring walkable environments.

Building Condition
Mixing of building age allows for unique conditions that ultimately results in varying scales of businesses and income levels to occupy the same area.

Density
High density in both people and buildings encourages business diversity and specialization.

Scalar Investigation

Street
Many streets in shrinking cities struggle to encourage pedestrian movement as destinations are frequently great distances apart.

Block
Blocks in many shrinking cities are designed for functions no longer present.

Building
Buildings in shrinking cities are often left to decay, but should be analyzed for their ability to accommodate contemporary functions.

Figure 1.5 / Photo Montages Showing Detroit Then and Now
Chapter 1 / Thesis Relevance

Precedent Analysis

Street
- Regional Characteristics
- Streets as Public Space
- Self-Sustainable Interventions
- Flexible Systems

Town Branch Commons
Scape Studio

Block
- Community Needs
- Planning Regulations

Blotting
Interboro

Building
- Existing Assets
- Vernacular Design

Civic Commons
Studio Gang

Figure 1.6 / Town Branch Water Walk

Figure 1.7 / Blots and New Suburbanism

Figure 1.8 / Civic Commons

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Chapter 2 Site Introduction
Chapter 2 / Site Introduction

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Cairo, Illinois as Site for Investigation
Cairo, Illinois was selected as a site for investigation as it embodies urban shrinkage in the Rust Belt having experienced economic shifts, social tensions, and environmental concerns that have historically contributed to its initial growth and depopulation. Remaining Cairo community members are committed to exploring solutions to enhance the function of their city for future generations.

Significant Historical Events
1. Riverboat and Rail Development
2. City founded with Levee System
3. Civil War
4. Peak Population (15,203 in 1920)
5. Segregation
6. Increased Flooding
7. Civil Rights Movement
8. Lowest Population (2,359 in 2016)
9. Record Setting Flood Heights

Historical Context

Figure 2.1 / Significant Historical Events

18
Economic
Cairo experienced its initial economic growth due to its pivotal role in the Civil War due to its regional river and rail transportation. As the southern-most point of the Northern states, an estimated 12,000 troops remained in Cairo after the war.

Social
Due to the city’s location along the Mississippi River, many escaped slaves followed the river from Southern states to find safety in Cairo during the war. This resulted in one of the most racially diverse cities following the war, however inequality resulted in growing tensions that were fueled during the Civil Rights movement throughout the 1960’s when boycotts and riots resulted in many businesses closing and much of the population leaving the city.

Environmental
Being located at the confluence of the Mississippi and Ohio Rivers, flooding is a primary concern for the success of the city. Cairo is surrounded by an extensive levee system that allows the city to exist, but recent floods increasingly threaten the city reinforcing depopulation.
Chapter 2 / Site Introduction

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Cairo, Illinois: History by Photograph

Figure 2.3 / Cairo, Illinois

Figure 2.4 / Brief History
Chapter 2 / Site Introduction

Mississippi and Ohio River Confluence

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois
Chapter 2 / Site Introduction

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Illinois Central Railroad / 1855

Figure 2.6 / Illinois Central Railroad

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Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Illinois Central Railroad on Levee / 1855

Figure 2.7 / Illinois Central Railroad Levee
Chapter 2 / Site Introduction

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Fort Defiance / 1862

Figure 2.8 / Cairo, IL, 1862
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Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Figure 2.9 / Magnolia Manor in Cairo

Magnolia Manor / Est. 1872
Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Cairo Ohio River Bridge / Est. 1937

Figure 2.10 / Cairo Ohio River Bridge
Chapter 2 / Site Introduction

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Cairo Historic Downtown District

Figure 2.11 / Historic Downtown Cairo
Chapter 2 / Site Introduction

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Ohio Levee Marked with Flood Heights / 2011

Figure 2.12 / Cairo Levee Flood Heights

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois
Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Ohio Levee During Flood / 2011

Figure 2.13 / Cairo, Illinois Levee During Flood
Chapter 2 / Site Introduction

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Levee Flood Gate / 2011

Figure 2.14 / Cairo Flood Gate
Chapter 2 / Site Introduction

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Cairo During Flood / 2011

Figure 2.15 / Cairo Flood 2011
Chapter 2 / Site Introduction

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Sand Boil During Flood / 2011

Figure 2.16 / Cairo Sand Boil

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Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Figure 2.17 / Riverlore
Chapter 2 / Site Introduction

Local Community - 2018

Figure 2.19 / Local Community
Chapter 2 / Site Introduction

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Abandoned Structure / 2018

Figure 2.20 / Abandoned Structure
Chapter 2 / Site Introduction

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Figure 2.21 / Collapsed Residence
Chapter 2 / Site Introduction

Street Conditions / 2018

Figure 2.22 / Street Conditions

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Abandoned Residence / 2018

Figure 2.24 / Abandoned Residence II

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Chapter 2 / Site Introduction

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Abandoned Southern Medical Center / 2018

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois
Chapter 3  Site Analysis
Regional Context

Site Context

Demographics

Existing Conditions

Spatial Analysis
Accessibility
Cairo’s positioning at the confluence of the Mississippi and Ohio Rivers places it in line with other significant riverine cities such as Memphis, Cape Girardeau, and St. Louis. While riverboat travel has shifted from tourism to support primarily commercial barge traffic, Cairo could still perform as a significant destination if cared for properly in a design response.

Economy
The city still has notable positioning for potential benefit from agricultural functions of the Midwest and remaining industries in the Rust Belt region. In fact, the primary source of river traffic is the Bunge Oil Seed processing facility within Cairo that accepts agricultural goods from nearby farmers to be processed and shipped south by barge.

Ecology
Cairo is positioned in the migratory paths of several species. Potential design proposals could include responses that accommodate these species during migration periods. Cairo offers a unique ecological context with several wildlife reserves nearby.
Chapter 3 / Site Analysis

Site Context

River Confluence
At the confluence of the Mississippi and Ohio Rivers, Illinois, Missouri, and Kentucky meet using the rivers as natural borders.

Transportation
Bridges spanning the rivers during the city’s growth allowed Cairo to become a major transit destination for both rail and river transportation. Interstate 57 was constructed just northwest of the city during the 1950’s. This provided automobile traffic that would have previously driven into the city an alternative that bypassed Cairo.

Development
The levee system that is the reason for the city’s existence, creates a distinct boundary between the man-made and natural world. While the levee is protecting the city from flood events, it can simultaneously be seen as divisive infrastructure that creates separation that preventing engagement with the unique natural surroundings such as the Ballard Wildlife Reserve and Angelo Towhead.

Figure 3.2 / Site Context
Chapter 3 / Site Analysis

Demographics

Median Household Income
$21,705

Primary Industries
1. Educational Services and Healthcare
2. Arts, Entertainment, Recreation, Accommodation, Food Services
3. Finance, Insurance, Real Estate
4. Manufacturing
5. Retail Trade

Occupational Skills
Many of the current population’s occupational skills are related to public education, healthcare, and the service industry

Population Age Range
For a large portion of the population in the age range of 5-17, Cairo has little to offer in terms of continuing education or professional development

Figure 3.3 / Cairo Age Distribution
The city of Cairo has two arteries dividing the city. Movement throughout the city is primarily vehicular with few destinations within walking distance due to low density.

A primary economic function within the city is the Bunge soybean oil processing plant near the Ohio River giving easy access to passing barges.

A large portion of the riverfront is undeveloped and lacks engagement with the Ohio river due to the concrete levee wall.

What little development present along the once commercial riverfront, Commercial Avenue now serves primarily industrial functions.

The city is protected from rising river water by a levee system combining use of earthen dykes and concrete levee walls.

Many remaining historical landmarks within the city occur primarily along a secondary artery.

Detached single-family homes are located throughout the city with the highest percentage of the city’s population residing in underfunded multi-family housing developments that were demolished in 2017.

The junior and high schools were recently combined into one facility located near the periphery of the city.

Cairo, IL Remaining Institutions
Chapter 3 / Site Analysis

Existing Conditions

Uninhabited Buildings
By analyzing the existing infrastructure within Cairo, it can be seen that nearly 40% of structures are uninhabited. While these buildings exist throughout the entirety of the city, they primarily occur along the periphery near the urban boundary.

Existing Core
In valuing existing structures by their residential, non-residential, or uninhabited status, a struggling economic core can be observed occurring along the primary artery through Cairo. This could prove to be a successful location for dense commercial and residential development ensuring a strengthened mixed-use core.

Accessibility

Inhabitability

Figure 3.5 / Existing Building Accessibility

Property Map
Cairo, Illinois

Property Map - Merged
Cairo, Illinois

Figure 3.5 / Existing Building Accessibility

Figure 3.6 / Existing Building Conditions

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

48
During the Civil War, the northern general Ulysses S. Grant was stationed at Fort Defiance at the confluence of the rivers. This positioning provided Northern states strategic access to many Southern states along the Mississippi river. Cairo’s increase in population at this time was largely due to the stationing of troops in the area which encouraged economic growth and development along Commercial Avenue. Although Cairo, Illinois was a Northern city during the civil war, the black population that arrived seeking freedom from Southern states did not receive equal rights as they were forced to use separate facilities than the white population. This inequality caused growing racial tension in Cairo into the mid to late-20th century with boycotts of white business owners resulting in many store closures and further decline.

Today, there is very little development along Commercial Avenue. What is present serves primarily industrial functions. The barge dock just outside the Ohio Levee presents the primary interface between riverine traffic and the city of Cairo. Much of the land surrounding the entrance to the city remains either completely empty or contains buildings being slowly reclaimed by nature. This reclamation reveals a city that once required space to accommodate a population upwards of 15,000 struggling to function with a much smaller population.
Spatial Analysis

Terms
Street - Path of movement
Street Network - All streets in a considered system
Intelligibility - Way-finding potential of a street network
Urban Shape - Total urban area being analyzed
Urban Boundary - Outermost edge of Urban Shape
Periphery - Approaching Urban Boundary
Core - Area comprised of highly integrated streets

Intro
Space syntax analysis is a collection of techniques developed by Bill Hillier and Julienne Hanson as a way of quantifying existing conditions and the impact of new interventions within a given urban configuration or network. (Hillier & Hanson, 1964)

Analysis
Integration is a value based on the number of turns it takes to reach all other streets from the street being analyzed. Streets with high integration values are accessible by many and act as collectors shown with warmer colors (red) while streets with low integration values require more energy to access and are shown with cooler colors (blue).

Application
Intelligibility when considering street networks is a correlation of the connectivity and integration values of streets comprising the network. Intelligibility is typically valued on a scale of 0 to 1 with intelligibility values ($R^2$) above 0.5 being considered generally intelligible. It is possible to impact the intelligibility of a street network by eliminating streets that skew the total distribution.

Significance
It can be observed that Cairo’s existing street network has a low intelligibility, but eliminating outlying streets (typically near periphery) and extending highly integrated streets to make more connections (typically near core) increases the overall intelligibility of the system. With Intelligibility often being associated with way-finding in a city, increasing intelligibility is critical in cropping the urban boundary and reinforcing the existing weak core.

Streets that have been eliminated may be re-vegetated to accommodate migratory species and flood preparation infrastructure. As many of these streets occur along the periphery of the urban boundary, the urban shape is cropped resulting in city more appropriately scaled for its population while reinforcing critical streets ensuring their success.

Proposed program and public space is suggested to occur along the highly integrated Washington Avenue in an effort to reinforce the already existing economic core by encouraging movement along these streets.
Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Figure 3.8 / Space Syntax Axial Analysis

Chapter 3 / Site Analysis

Low

Existing Street Network
Levee Wall Road Removal
Periphery Road Removal
Primary Road Extension
Secondary Road Extension

Levee Wall Removed due to lack of common use
Eliminate Roads That Skew Distribution
Extend Primary Artery for More Connections
Extend Secondary Artery for More Connections
Chapter 4 Design Proposal
Proposed Master Plan

Considerations

Occupational Experience
Cairo’s current community occupation experience is primarily related to public education and retail services. This calls for a programmatic response meeting their unique skill set.

Adolescent Population
Currently, 18.3% of Cairo’s population is between the age of 5-17. It is important to respond to the potential of retaining this portion of the population as they approach adulthood and may be forced to leave in search of continued education and professional experience.

Regional and Ecological Accessibility
Cairo has a unique regional positioning at the confluence of the Mississippi and Ohio Rivers and lies in the paths of several migratory species. This should be considered an indispensable resource that can be used to generate learning opportunities and respect for the environment.

Proposal

City as Campus
A satellite campus of Southern Illinois University such as the College of Science at Cairo will provide relevant job opportunities for the adult population while offering continued education opportunities for the adolescent population. As a satellite campus of Southern Illinois University with a focus on ecology and environmental sustainability, this campus will take advantage of Cairo’s unique regional positioning and context.

Development

Flexibility
As an urban planning proposal, it is critical to allow for flexibility and development over time. Plan flexibility ensures that as the needs of the community change, specific program and response location may shift accordingly.

Time
To promote campus development over time, strategic destinations along the highly integrated core have been identified based on their accessibility and potential success for accommodating anchor program that may inform district development.

Integration
Due to their location along the highly integrated core, these districts will spur further development towards one another and encourage density and movement along the core. Additionally, the periphery will act as ecologically inclusive destinations accommodating re-vegetated nature trails towards the Mississippi River (West) and landscaped levee walls towards the Ohio River (East).
2018 **Existing**
- 40% Unoccupied Structures
- Low Density
- Weak Core

2030 **Anchor Program**
- Revegetated Boundary
- Walkable Districts
- Core Establishment

2040 **Campus Integration**
- District as Connector
- Boundary as Destination
- City as Campus

Figure 4.1 / Proposed Master Plan Phasing
Existing Core Street Characteristics

Figure 4.2 / Existing Core Street Characteristics
**Proposed Core Street Characteristics**

**Desired Qualities**
- Framing of Street
- Program Diversity
- Mixed Building Age
- Shared Use
- Vegetation

---

**Figure 4.3 / Proposed Core Street Characteristics**
Existing Core Adjacent Street Characteristics

Figure 4.4 / Existing Core Adjacent Street Characteristics
### Proposed Core Adjacent Street Characteristics

#### Desired Qualities
- Mixed Residential (Single-Multi)
- Public Walkway
- Front Patio
- “Eyes on the Street”

#### Scale 1/8” = 1’ - 0”

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<th>Private Single-Student Residence</th>
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Chapter 4 / Design Proposal

Existing Periphery Street Characteristics

Figure 4.6 / Existing Periphery Street Characteristics
Proposed Periphery Street Characteristics

**Desired Qualities**
- Cropped Urban Boundary
- Accessible Re-vegetated Paths
- Ecologically Inclusive
- Flood Prep

Figure 4.7 / Proposed Periphery Street Characteristics
Proposed Public Space Typologies

**Connect**
New development should support the goal of improving connections between man-made and natural environments. Re-vegetation of land connected by green infrastructure will allow for public space and reclamation typologies specific to Cairo.

**Reclaimed Structure Pavilion**
Unused buildings may be stripped of finishes to offer impromptu nature pavilions creating pockets of public space in historically dense environments.

**Re-vegetated Boundary Nature Trail**
Paths leading to the re-vegetated periphery may provide learning opportunities and encourage ecological engagement.
Adapted Civic Structure
Buildings of historic importance may be repurposed to serve public functions and impromptu meeting places.

Flexible Public Space
Spaces throughout the city such as public squares may be designed in such a way that during high river waters, they may function as retention ponds.

Landscaped Levee Wall
The concrete levee on the Ohio River side of Cairo is a protective yet divisive element that may accommodate landscaping that reconnects people with the river.

Figure 4.8 / Proposed Public Space Typologies
Chapter 4 / Design Proposal

Proposed Building Typologies

Considerations
The proposed building typologies were developed as a response to the programmatic needs of Southern Illinois University - College of Science at Cairo. Academic, administration, residential, and recreation facilities each necessitate specific forms and configurations in pursuit of sustainable design solutions and good urban practice.

Form
Floor-plate width should fall within a range that prioritizes daylight accessibility by limiting the furthest potential distance from the building envelope. The length of building floor plates corresponds to the accommodated program. The number of floors for each typology prioritizes co-visibility and framing of streets. In all non-residential typologies, the first floor is programmed to accommodate public functions allowing for community access.

Configuration
The configuration of multiple typologies has the potential to respond to and provide for certain conditions. Linear bar typologies are used when a well-defined street edge is desired. When the corner of a block is reached, the linear bar may accommodate a turn to continue street edge definition while also creating open space within the block. If continued to the adjacent block corner now consisting of two turns, a semi-private courtyard condition is created. Block formations may occur when considering apartment typologies as this allows for an embraced inner courtyard creating a sense of community.

Variety
When considering residential typologies, it is critical to provide several living conditions that respond to varying levels of income. For example, not everyone may be able to afford or desire to live in a single-family detached unit. Row houses provide a great alternative to detached units as they provide a sense of independence while being part of a community. Existing infrastructure may be adapted to accommodate smaller unit living conditions such as dormitories while apartment conditions provide a sense of community and activity at a low cost.
Chapter 4 / Design Proposal

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Southern Illinois University at Carbondale
College of Environmental Science
Campus Program Requirements

Academic
Adaptive Reuse (AR) ≈ 173.9k sf
New Construction (NC) ≈ 194.9k sf
- Small Lecture
- Large Lecture
- Assembly
- Research Lab
- Maker-Space
- Library / Media
- Dining
- Faculty Office
- Student Center
- Bookstore
- Cafe
- Athletic Center
- Facilities

Administration
Adaptive Reuse (AR) ≈ 43.2k sf
New Construction (NC) ≈ 31.8k sf
- Office
- Conference
- Reception
- Facilities

Residential
Adaptive Reuse (AR) ≈ 95.5k sf
New Construction (NC) ≈ 174.7k sf
- Dormitories - Campus Operated
- Apartments - Campus Operated
- Apartments - Privately Operated
- Rowhouses
- Single-Family Detached
- Garage Apartment - Shared Lot

Recreation
Reuse or New = 261k sf
- Commons
- Football
- Baseball
- Track
- Riverboat Port
- Revegetated Land

General Academic
AR/NC
Ground Floor
- Dining
- Cafe
Above
- Small Lecture
- Faculty Office

Academic Research - Bar
AR/NC
Ground Floor
- Small Lecture
- Large Lecture
- Assembly
- Research Lab
- Dining
- Cafe
Above
- Small Lecture
- Faculty Office
- Library / Media
- Dining
- Maker-Space
- Student Center
- Bookstore
- Cafe

Academic Research - Corner
AR/NC
Ground Floor
- Small Lecture
- Large Lecture
- Assembly
- Research Lab
- Dining
- Cafe
Above
- Small Lecture
- Faculty Office
- Library / Media
- Dining
- Maker-Space
- Student Center
- Bookstore
- Cafe

Academic Center - Block End
NC
Ground Floor
- Assembly
- Large Lecture
- Library / Media
- Dining
- Maker-Space
Above
- Small Lecture
- Faculty Office
- Library / Media
- Dining
- Student Center
- Maker-Space
- Bookstore
- Cafe

Athletic Center
AR/NC
Ground Floor
- Lobby
- Staff Office
- Equipment
- Pool
- Basketball

Academic Center - Block End
AR/NC
Ground Floor
- Assembly
- Large Lecture
- Library / Media
- Dining
- Maker-Space
- Student Center
- Bookstore
- Cafe

Administration - Block
AR/NC
Ground Floor
- Reception
- Office
Above
- Office
- Facilities

Administration - Bar
AR/NC
Ground Floor
- Reception
- Office
Above
- Office
- Facilities

Administration - Shared
AR/NC
Shared Ground Floor
- Reception
- Office
Above
- Office
- Conference
- Facilities

Single Family Detached
AR/NC

Rowhouses
NC

Dormitories - Campus Owned
AR/NC

Apartments - Campus / Privately Owned
AR/NC

Figure 4.9 / Proposed Building Typologies
District Configuration Proposal

Synthesis
The proposed building and public space typologies are designed as a flexible guide for urban design with the ultimate goal of responding to the needs of the present Cairo community. Here they come together resulting in a dense urban core that encourages movement with well framed streets and interwoven public space. The periphery of the urban boundary is defined by opportunities for education and exploration by way of a re-vegetated nature trail and landscaped levee park as destinations.

1 Re-purposed Structure Pavilion
2 Re-vegetated Boundary Nature Trail
3 Adapted Civic Structure
4 Flexible Amphitheater
5 Landscaped Levee Wall

Figure 4.10 / Proposed District Configuration
Figure 4.11 (Opposite) / Re-purposed Structure Pavilion
Southern Illinois University - College of Science at Cairo
Proposed Development Master Plan

Figure 4.12 / Proposed Development Key Plan
Chapter 4 / Design Proposal

8th Street
Section Perspective (A)

Figure 4.13 / 8th Street Section Perspective
Chapter 4 / Design Proposal

Washington Avenue Greenway
Section Perspective (B)

Figure 4.14 / Washington Avenue Greenway
Section Perspective
Ohio Levee Park
Section Perspective (C)
Armborst, T., D'Oca, D., & Theodore, G. Blots and new suburbanism. *Interboro partners*

1.7


2.10


2.15


2.12


2.1, 2.4


2.13


2.8


1.8


2.6


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CONCEPT #1 FLOOD CAIRAO

With a large area of Cairo's land empty, preparation for development could occur to provide alternative shelter to those citizens. A new Mississippi River basin building typology could be developed that functions to meet the needs of ongoing issues (biodiversity) and emergent situations (500-year flood event).
Appendix A / Concept Sketches

CONCEPT # 2. WATER + SEDIMENT AS PUBLIC RESOURCE

THE (MISSISSIPPI) IS A SEDIMENT RICH RESOURCE AS CAN BE SEEN BY THE CONFLUENT DIVISION OF MISS. + OHIO RIVERS FOR 1 MI. DOWNSTREAM. THE OHIO RIVER IS NOXIOUS FOR ITS CURRENT POINT SOURCE POLLUTION HARMING BIODIVERSITY FURTHER DOWNSTREAM. THE CONFLUENT PROVIDES THE IDEAL SOLUTION FOR A HARVESTING OF SEDIMENT AND ADDRESSING POLLUTION BEFORE THE ISSUES ARISE.

- RIVER POLLUTION TREATMENT PLANT
- RIVER BASIN WATER TREATMENT HEADQUARTERS
- SEDIMENT CATCH BASIN
- TAKE ADVANTAGE OF UNTAPPED RESOURCES
- POLLUTED WATER
- SEDIMENT RICH WATER
**Concept #3: Sandboil Advantage**

Even the protected portions of Cairo are susceptible to flooding when river waters are high. This flooding is a result of a phenomenon known as sandboils, which refers to less dense portions of land surrounded by large bodies of water in which water rises up through the land bypassing underlying levee walls. By implementing an underground network of drainage infrastructure that allows for controlled flooding of the sandboil occurrence, the farming of the shovel nose sandbar in controlled environments could provide a much-needed economic function.
Appendix A

Concept Sketches

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois
CONCEPT #5: ACTIVE ECOLOGICAL COMMUNITIES

With the knowledge that the Mississippi River is rich in valuable nutrients and sediment, and the Ohio plagued by point source pollution, natural solutions to counter the bath of these resources may be pursued along with living communities which celebrate these new initiatives. The living communities may offer new learning experiences for children, while the new industries provide a source of jobs such as teaching and engineering for adults.
Appendix B / Presentation Boards

Review 1 Presentation Boards

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

Appendix B / Presentation Boards

**Design Theorem**

Ecological Urban Design Intervention: Shrinking Cities as a Global Phenomenon

- **Cause of Shrinkage**
  - Economic
  - Environmental
  - Social

- **Case Study**
  - Detroit, Michigan

**Design Hypothesis**

Shrinking Cities as a Global Phenomenon

**Literature Review**

Shrinking Cities in the Rust Belt

**Nature of Proposal**

Shrinking Cities in the Rust Belt

**Point of Interest**

- **Site Analysis**
  - Urban Design
  - Historical Analysis

- **Site Analysis**
  - Ecological Urban Design

**Design Analysis**

Site Analysis

- **Site Analysis**
  - Urban Design
  - Historical Analysis

- **Site Analysis**
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Review 1 Presentation Boards

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois
Appendix B / Presentation Boards

Design Process

Site Context

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois
Review 2 Presentation Boards

Points of Interest
- Major shifts such as economic downturns, social tensions, or climate-related changes. Detroit, Michigan, is a common example within the United States as the city has experienced steady population loss since the move of automobile manufacturing jobs out of the city. Riverine cities like Cairo, Illinois, and St. Louis have experienced population loss following powerful racial conflicts and the shifting of transportation methods from river to rail and automobile. Coastal cities like New Orleans, Louisiana, have lost their very existence threatened by an increase in the frequency and impact of storm systems that are only expected to worsen as global climate change progresses. While many people leave these cities in search of work, others are forced to leave due to a lack of resiliency in the event of devastating natural events. However, whether due to financial instability, accessibility concerns, or a sense of responsibility and belonging to one’s community, not everyone chooses to leave when times get tough. Those that remain in the places that they call home are often met with unsustainable conditions as they struggle to function in a city designed for many times the remaining population. By assessing the current conditions and quality of life within shrinking cities in the Midwest Rust Belt, this thesis aims to suggest measures that may meet the needs of the remaining smaller populations.

Why the Rust Belt?
Shrinking cities typically can be described as having experienced one or more types of change:
- Economic Change: Deindustrialization, relocation of industry and service employment
- Structural Change: Suburbanization, outflow of people (Dennis)
- Political Change: Collapse of socialist organizations in Eastern Europe

The Rust Belt region contains the majority of the United States shrinking cities thinking on the ideal candidate for investigation

Scales of Impact

Street
- Characterized by decreased building density resulting in fewer attractors to encourage pedestrian movement

Block
- Weather due to large industrial buildings that once consumed entire city blocks or critical levels of depopulation, empty blocks are a common occurrence in many shrinking cities

Building
- Individual structures that once served a function, but have now been abandoned. In some cases, buildings are no longer inhabitable and are a threat to even demolition

Design Principles
- Social (Community Development): The design of cities must be reformed to serve people and enhance the lives of all members of the local ecosystem. Regional accessibility of cities must view ecological connections as a necessity in future restructuring.
- Economic (Local Resources): Every city has a unique regional context and geographic positioning that may inform various design responses to the needs of communities. Viewing this context in terms of accessibility and connectivity may result in design opportunities specific to the city in question.
- Climate (Regional Ecology): The tension between man-made and nature must be eased in order to enhance the design and function of cities. This means working with natural processes in cities and seeking to constantly learn from and engage with our surroundings.
Appendix B / Presentation Boards

Shrinking Cities: Ecological Urban Design Interventions

Town Branch Commons Lexington, KY
Town Branch Commons aims to reverse years of urban infrastructure that keeps naturally occurring streams hidden underground. By daylighting waterways and stream channels in the form of regional anomalies known as karst geology, ecologically inclusive environments can replace costly hidden infrastructure. The new hybrid landscape provides paths for human movement throughout the city while accommodating numerous indigenous and migratory species.

Blotting Detroit, MI
Blotting is a term coined by the design firm, Interboro. It is used to describe the process of meeting the needs of remaining populations in shrinking cities by allowing them to purchase abandoned housing lots surrounding their own to form larger plots of land. This provides an inexpensive way for abandoned parcels to be purposefully re-purposed.

Civic Commons Philadelphia, PA
Studio Gang’s framework for re-imagining existing infrastructure in Philadelphia calls for the re-branding of public service buildings. This provides community members with accessibility and engaging spaces within their city at a relatively low cost. The following program objectives are seen as critical starting points for enhancing the lives of already present community members.

Site for Investigation Cairo, IL
Upon investigation of shrinking cities throughout the U.S. Rust Belt, Cairo, Illinois revealed itself to be an idea candidate for testing design interventions. Cairo has experienced both rapid growth and decline due to economic, social, and environmental factors.

Street Scale
- Discover regional design opportunities
- Streets are primarily public space
- Identity strategic points of intervention
- Design with natural processes
- Create self-sustaining interventions
- Propose flexible systems

Block Scale
- Understand the needs of communities
- Shift from growth-oriented practices to those that promote right-sizing
- Planning regulations may be adjusted to meet current realities rather than planned

Building Scale
- Public buildings may host shared community functions
- Civic buildings may form a network of destinations giving order to a city
- Sustainable building technology does not necessitate high cost or specialization if natural processes are prioritized

Economic

Social

Environmental

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

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Shrinking Cities: Ecological Urban Design Interventions

Cairo, Illinois Site Context

The figure (LEFT) shows land use along commercial avenue during the late 19th century. During the Civil War, the northern general Ulysses S. Grant was stationed at Fort Defiance at the confluence of the rivers. This positioning provided Northern states strategic access to many Southern states along the Mississippi river. Cairo’s increase in population at this time was largely due to the docking of troops in the area which encouraged economic growth and development along Commercial Avenue. Social inequality caused growing tensions in Cairo into the mid to late-20th century with boycotts of white business owners resulting in many store closures and further decline. Today, there is very little development along Commercial Avenue with what is present serving primarily industrial functions. The docking station present just outside the Ohio Levee presents the primary interface between maritime traffic and the city of Cairo.

Much of the land surrounding this entrance to the city remains either completely open or contains buildings being slowly reclaimed by nature. This reclamations reveals a city that once required space to accommodate a population of over 16,000 struggling to function with a much smaller population. This raises the question of how this no longer required and could be reutilized to accommodate regionally indigenous and seasonally migratory species in an effort to promote ecological collaboration ultimately enhancing the lives of the current community in Cairo.

Cairo Historical Population Distribution

Cairo Regional Characteristics

Significant Mississippi River Cities

Appendix B / Presentation Boards

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois
Appendix B / Presentation Boards

Shrinking Cities: Ecological Urban Design Interventions

Cairo, Illinois Site Conditions

Property Condition Density
- Inhabitable Residential
- Inhabitable Non-Residential
- Non-Inhabitable

Property Condition Map
- Inhabitable Residential
- Inhabitable Non-Residential
- Non-Inhabitable

Site Elevation

Site Conditions and Analysis

The junior and high schools were recently combined into one facility located near the perimeter of the city.

The remaining historical landmarks within the city occur primarily along a secondary artery that connects many of the residents to the rest of the city.

Detached single family housing is located throughout the city with the highest percentage of the city’s population residing in underfunded multi-family housing developments that are planned to be shut down as of 2017.

The city of Cairo has two primary arterials bisecting the city. This movement throughout the city is primarily vehicular with few destinations within walking distance.

The entire city is protected from fluctuating river heights by a levee system combining use of earthen dikes and concrete levee walls.

The primary economic driver within the city is the Bunge soybean processing plant on the shores of the Ohio River giving easy access to the markets.

A large portion of the waterfront is undeveloped and is separated from engaging directly with the Ohio river.

What little development is present along the waterfront is no longer commercial as it has seen historically, but now serves primarily industrial functions.

Inhabitability

Accessibility
Shrinking Cities: Ecological Urban Design Interventions

Cairo, Illinois Site Analysis

Space syntax analysis is a collection of techniques developed by Bill Hillier and Julienne Hanson as a way of quantifying existing conditions and the impact of new interventions within a given urban configuration or network. The axial analysis used for this project shows all possible uninterrupted paths of movement as single line segments that can then be weighted based on their integration value. Integration is weighted based on the number of turns it takes to reach other segments within a network from the segment being analyzed.

Through analyzing the existing network of movement within Cairo, primary paths which are easily accessible to the entire community are revealed. This would suggest that new civic or institutional development should occur along these paths. By adding proposed paths of movement to the existing network, the impact of new interventions can be quantified in the form of overall intelligibility of the system to confirm their contribution.

Appendix B / Presentation Boards

Site Analysis

Secondary Road Extension
By extending a secondary road to complete a connector previously severed by a park, a new highly integrated core emerges informing new development.

Primary Road Extension
By extending the most integrated road to make more connections, the intelligibility is increased further.

Periphery Road Removal
By eliminating low roads along the periphery, the intelligibility of the system significantly improves.

Levee Wall Road Removal
While levee roads are a potential path of movement, they are primarily used for maintenance and not common travel.
Appendix B / Presentation Boards

Shrinking Cities: Ecological Urban Design Interventions

Southern Illinois University at Carbondale
College of Environmental Science Campus Typologies

Academic
Adaptive Reuse (AR) = 173.9k sf
New Construction (NC) = 194.9k sf
- Small Lecture
- Large Lecture
- Assembly
- Research Lab
- Maker Space
- Library / Media
- Entry
- Faculty Office
- Student Center
- Residence
- Atlantic Center
- Facilities

General Academic AR/NC

Academic Research - Bai AR/NC

Academic Research - Corner NC

Academic Center - Block Enc. NC

Athletic Center AR/NC

Administration
Adaptive Reuse (AR) = 42.2k sf
New Construction (NC) = 31.8k sf
- Office
- Conference
- Reception
- Facilities

Administration - Block AR/NC

Administration - Bar AR/NC

Administration - Shared AR

Residential
Adaptive Reuse (AR) = 96.5k sf
New Construction (NC) = 174.7k sf
- Dormitories - Campus Operated
- Apartments - Campus Operated
- Apartments - Privately Operated
- Single Family Detached
- Garage Apartment - Shared Lo

Single Family Detached AR/NC

Single Family Detached w/ Garage Apartment AR/NC

Rowhouses NC

Dormitories - Campus Owned AR/NC

Apartments - Campus / Privately Owned AR/NC

Recreation
Reuse or New = 261k sf
- Commons
- Football
- Basketball
- Track
- Riverboat Port
- Revegetated Land

Commons

Football

Baseball

Track

Riverboat Port

Revegetated Land

Given Cairo’s significant access to the Ohio and Mississippi Rivers and nearby wildlife reserves, the city offers great opportunity for hosting environmental science and ecology research. With Southern Illinois University at Carbondale about 50 miles North, Cairo would serve as the College of Science satellite campus providing unique research opportunity and small town college life. The primary goal of this campus is to provide learning opportunities for students and job opportunities for Cairo residents. Below are images and program requirements based on the current size of the College of Science at Carbondale.
Shrinking Cities: Ecological Urban Design Interventions

Cairo, Illinois Public Space Typologies

Connections
New development in Cairo should support the goal of improving connections between man-made and natural environments. Re-vegetation of land within Cairo connected by green infrastructure will allow for public space and recreation typologies that are specific to shrinking cities.

Uninhabited Building Reclamation
Unused buildings may be stripped of finishes to offer impromptu nature pavilions creating pockets of public space in historically dense environments.

Re-vegetated Path
Paths leading to the re-vegetated periphery may extend into the space providinglearning and ecological engagement opportunities.

Civic Reclamation
Buildings of historic importance may be re-purposed to serve public functions and impromptu meeting places.

Flood Preparation
Spaces throughout the city such as public squares may be designed in such a way that during high river waters, they may function as retention ponds.

Levee Wall
The concrete levee on the Ohio River side of Cairo is a protective yet distinctive element that may accommodate landscaping that reconnects people with the river.

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Shrinking Cities: Ecological Urban Design Interventions

Master Plan Phasing

Given the context that Cairo is a shrinking city, it is not practical to propose interventions that would be immediately implemented. The aim is to design for flexibility and development over time.

Existing Development 2016

The existing development in Cairo is approximately 40% unoccupied. A significant portion of land within the urban boundary is undeveloped. Rather than new development occurring on vacant land, existing buildings should be valued for their ability to be adapted for reuse. Vacant land should then be valued for re-vegetation potential creating connected pockets of ecological engagement.

Anchor Program Development 2030

Three districts have been identified as ideal candidates for future development due to their close to the highly integrated core and the opportunity for walking distance of 0.25 miles. These districts will accommodate initial program anchors for Southern Illinois University College of Science at Cairo and subsequent retail development. During this period, major re-vegetation may occur establishing the new urban-growth boundary.

College of Science Campus Integration 2040

The previously designated districts now accommodate Academic, Administration, Residential, and Recreation space required to host the the College of Science departments. The districts are developed in such a way that encourages constant use of the streets and high movement along highly integrated streets. The development in these districts encourages lateral movement which connects re-vegetated land to the newly landscaped Ohio Levee Wall.

Shrinking Cities in the Rust Belt: An Ecological Urban Design Intervention in Cairo, Illinois

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Thesis Competition Presentation Boards

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