Impacts of built environments on ecosystems

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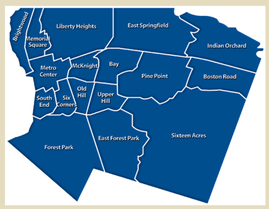
Introduction

Built environments serve growing populations in urban areas, but can have impacts on ecosystems. These impacts include loss of habitat, increased fragmentation, storm water flooding, lowering groundwater, and poor quality of living. Impervious surfaces in built areas limit infiltration of rain water and increases runoff on land surface leading to flooding in urban areas.

Built environments in urban areas can vary by neighborhood and this have impacts on ecosystem services at a local scale. There is a need to study this variable impacts of built environment. This study focuses on the neighborhoods in the City of Springfield to evaluate impervious cover and its implications on canopy cover and air quality.

Downtown Springfield with dense impervious cover



Springfield's population is projected to grow from an estimated 155,922 today to 169,991 in the year 2035, an increase of 8.9 percent.

Study Area:

The City of Springfield in Western Massachusetts and has a total area of 33.1 square miles.
Springfield's industries include Trade and Transportation, Education and Health Services, Manufacturing, Tourism and Hospitality, and Government.

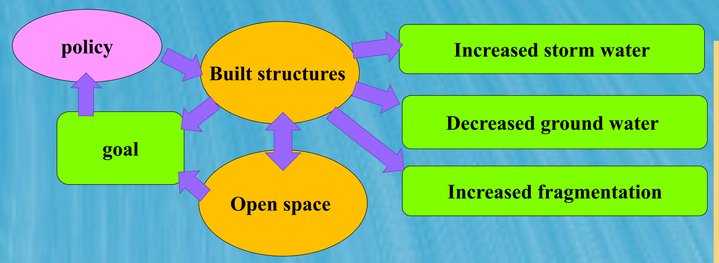
Objectives

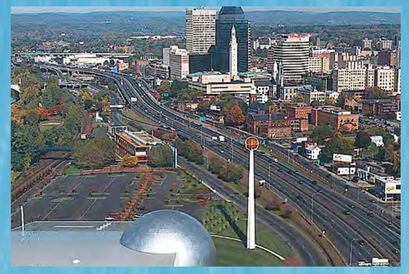
The general objective: to study the impacts of built environments on ecosystems.
Specific objectives:
•To assess the extent of built environments
•To evaluate impacts of impervious surfaces on landscape processes
•To identify ways to mitigate the impacts of built environments.
Hypothesis: Impact of built environments can be mitigated by increasing tree canopy

Methods

1) Data Analysis: Calculate percent of tree canopy by neighborhood
2) Estimate correlation between the trees, the rain water and the sequestration of air pollutants.
3) To develop strategies to improve built environments in selected neighborhoods.

Conceptual Model





Methods:

Data	Source
Tree Canopy	I-Tree Canopy
Impervious Cover	MassGIS

Results

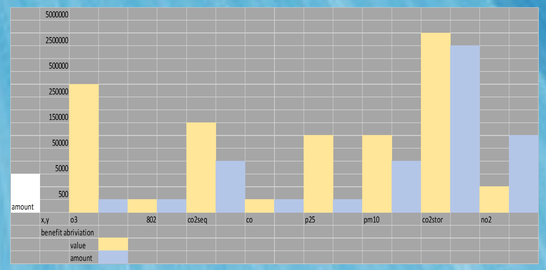
Distribution of impervious cover in the City of Springfield

Tree canopy cover by neighborhood

Neighborhood	Percent Canopy Cover	Area Cover (Sq.Mi.)
Sixteen Acres	50 (CI = 4.08)	4.04 (CI = 0.33)
Boston Road	44 (CI = 4.05)	1.02 (CI = 0.09)
Forest Park	41.3 (CI = 4.02)	1.45 (CI = 0.14)
East Forest Park	30.7 (CI = 3.76)	0.86 (CI = 0.11)
Indian Orchard	30.2 (CI = 3.76)	0.77 (CI = 0.1)
Pine Point	29.3 (CI = 3.72)	0.71 (CI = 0.71)
Liberty Heights	28 (CI = 3.61)	0.77 (CI = 0.1)
Bay	26.7 (CI = 3.61)	.29 (CI = 0.04)
Brightwood	20 (CI = 3.27)	0.13 (CI = 0.02)
East Springfield	17.3 (CI = 3.09)	0.54 (CI = 0.1)

CI denotes Confidence Interval

Air quality improvement by tree canopy



Impervious: Large concentrations of impervious cover occur in specific areas of the city. There are increased urban density along: Main street, upper saint James avenue and Belmont avenue. The impervious surface and its annual growth can have higher flood hazard in the downtown and other areas of neighborhoods the city.
Canopy Cover: East Springfield and Bright wood are low in canopy cover, while Sixteen acres and Boston road are high in tree canopy.
Tree benefits: Vegetation helps to improve air quality and reduce flooding in built neighborhoods.

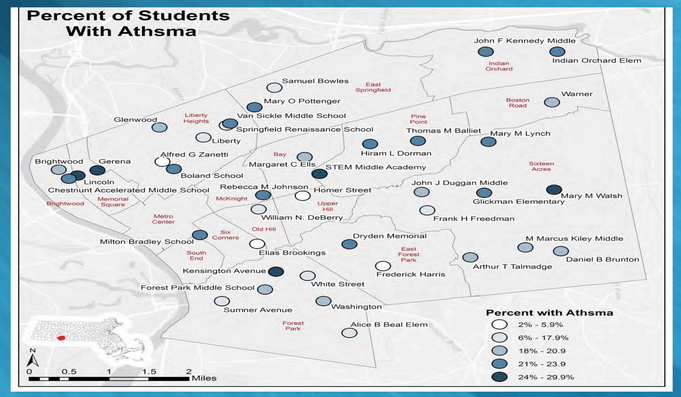
Further Research:
Evaluate future impacts of continued decrease in vegetation and increasing impervious cover.

Conclusions

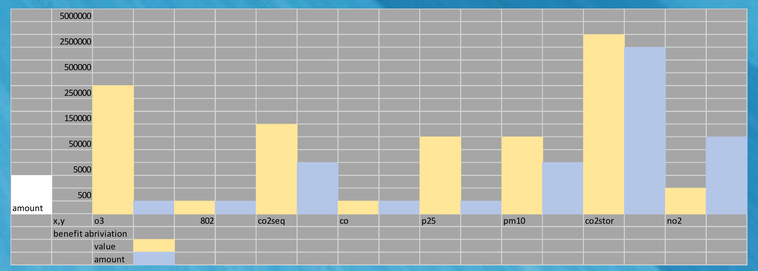
- Springfield has an urbanization rate of 18%, which is expected to increase built structures every year. There is a need to counteract the growth of these impervious structures and impacts through urban trees.
- Tree cover can reduce flooding in urbanizing areas.
- Trees and shrubs improve air quality in built areas. This is critical to improve quality of living.

Acknowledgement

I would like to thank Dave Bloniarz, USFS, and above all, my professor, professor Timothy Randhir.


Percent of Students
With Athsma
John F Kennedy Middle
Indian Orchard
Indian Orchard Elem
Samuel Bowles
East Springfield
Warner
Boston Road
Mary O Pottenger
Glenwood
Liberty Heights
Van Sickle Middle School
Springfield Renaissance School
Pine Point
Thomas M Balliet
Mary M Lynch
Liberty
Hiram L Dorman
Alfred G Zanetti
Bay
Margaret C Ells
STEM Middle Academy
Sixteen Acres
Brightwood
Gerena
Lincoln
Boland School
Chestnut Accelerated Middle School
John J Duggan Middle
Rebecca M Johnson
Homer Street
Mary M Walsh
Glickman Elementary
Brightwood
Memorial Square
McKnight
Upper Hill
William N. DeBerry
Frank H Freedman
Metro Center
Six Corners
Old Hill
Dryden Memorial
M Marcus Kiley Middle
Milton Bradley School
South End
Elias Brookings
East Forest Park
Daniel B Brunton
Kensington Avenue
Frederick Harris
Arthur T Talmadge
White Street
Forest Park Middle School
Sumner Avenue
Washington
Forest Park
Alice B Beal Elem
Percent with Athsma
2% - 5.9%
6% - 17.9%
18% - 20.9
21% - 23.9
24% - 29.9%
N
0 0.5 1 1.5 2
Miles


How does a rain garden work?
Native Plants
Native plants are adapted to local conditions and are easy to maintain once established. Plus, they attract birds, butterflies and other pollinators.
Gutters & Down Spouts
Assist with directing rain water from your roof to your rain garden.
Deep Roots
Plants with a deep root system encourage infiltration and help absorb nutrients.
Berm
A berm holds water in the garden during heavy rains.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