GIS and Green Infrastructure: Case Study in the Alley Creek Watershed and Sewershed, Queens, New York

Hixon Center for Urban Ecology

Yale School of Forestry & Environmental Studies

NYC Parks

By: Uma Bhandaram

Date: Jan. 30, 2015

Northern Research Station
New York City Urban Field Station

Outline

- Introduction
- Methodology
- Results
- Discussion
  - Limitations & Opportunities
- Next Steps
- Conclusion

Introduction

- Consent Order to reduce Combined Sewer Overflows (CSOs)
  - 2005
  - 2011: Green infrastructure (GI)
- NYCDPR interested in rain gardens on public lands → Alley Creek watershed and sewershed (Study Area)

Introduction

- Research question: How can spatial analytics be used:
  1. to identify optimal rain garden sites on public lands?
  2. to automate the process for the Study Area?
  3. to automate the process to the rest of NYC?
- Geographic Information Systems (GIS)

Methodology

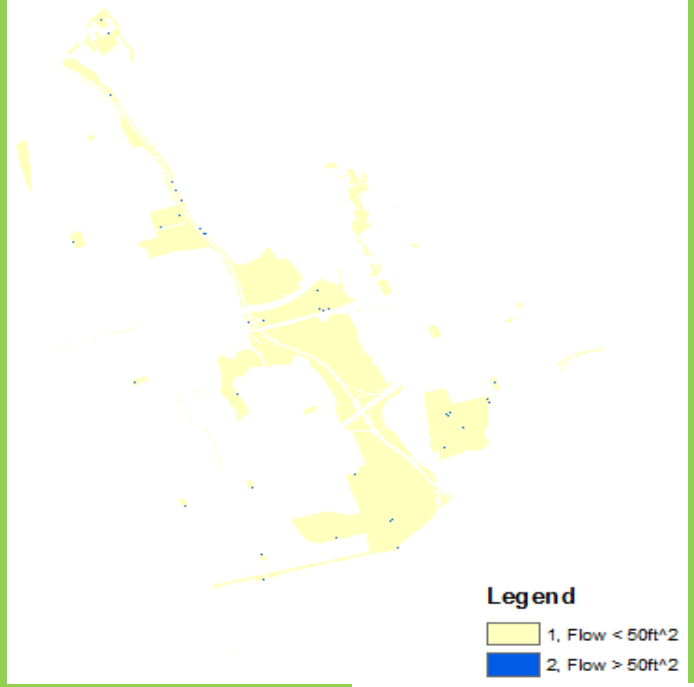
- NYCDPR existing protocol to identify rain garden sites
  - Requires manual steps/input
- Two part protocol
  - Part one → *biophysical variables*: site selection criteria based on physical suitability
  - Part two → *prioritization variables*: NYCDPR programmatic objectives

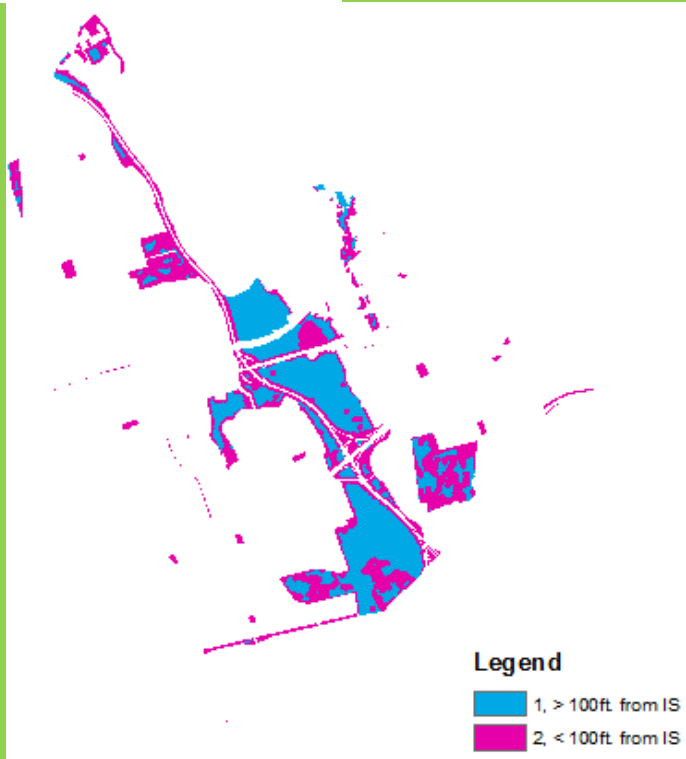
Methodology

- Biophysical variables:
  1. Surface type
     - ‘Non-build’: lands with conflicting uses (ex. Basketball courts, buildings, marsh, etc.)
     - ‘Build’: available lands
  2. Flow from impervious surfaces
     - ‘Non-build’: receive no flow
     - ‘Build’: receive flow

Methodology

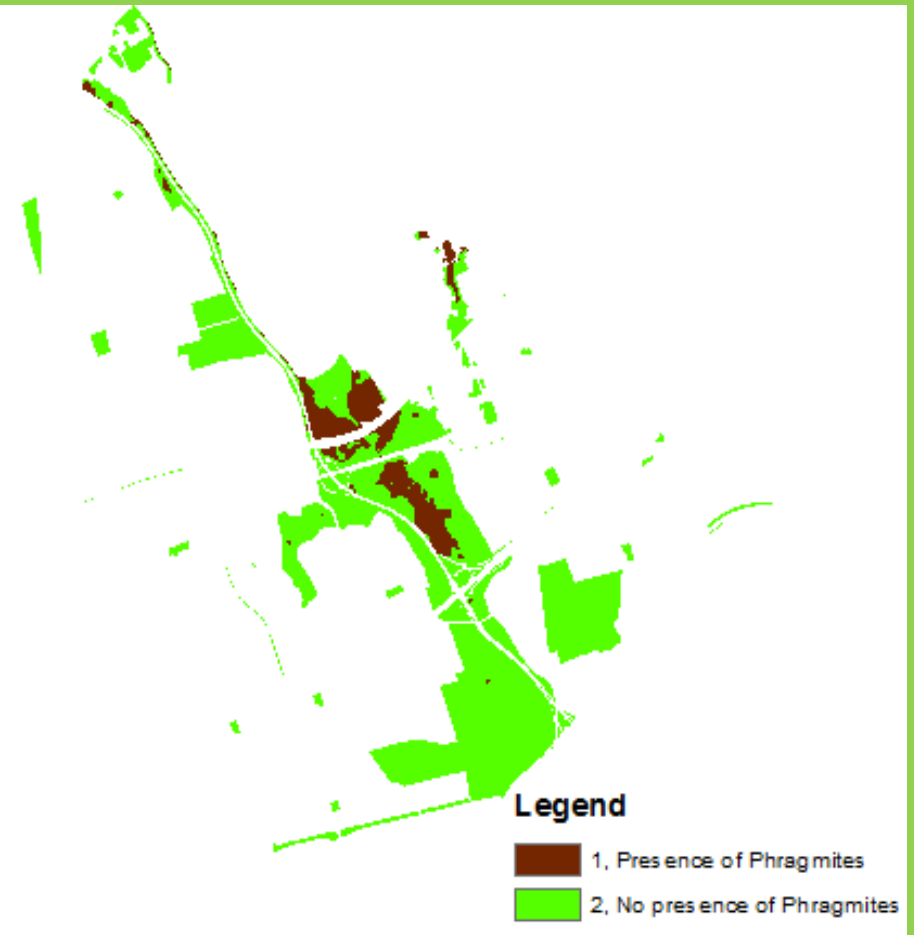
- Prioritization variables
  1. Amount of flow from impervious surfaces
     - High priority: flow over 50 square feet
  2. Proximity to impervious surfaces
     - High priority: parkland within 100 feet

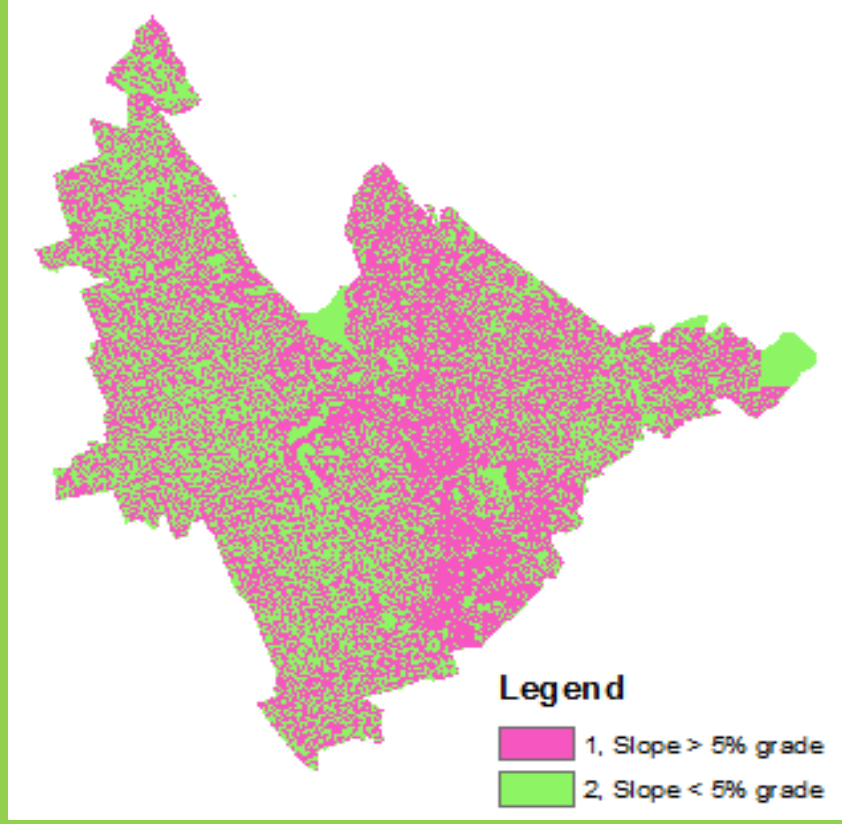




Methodology

3. Slope
   - High priority: 5% grade or less

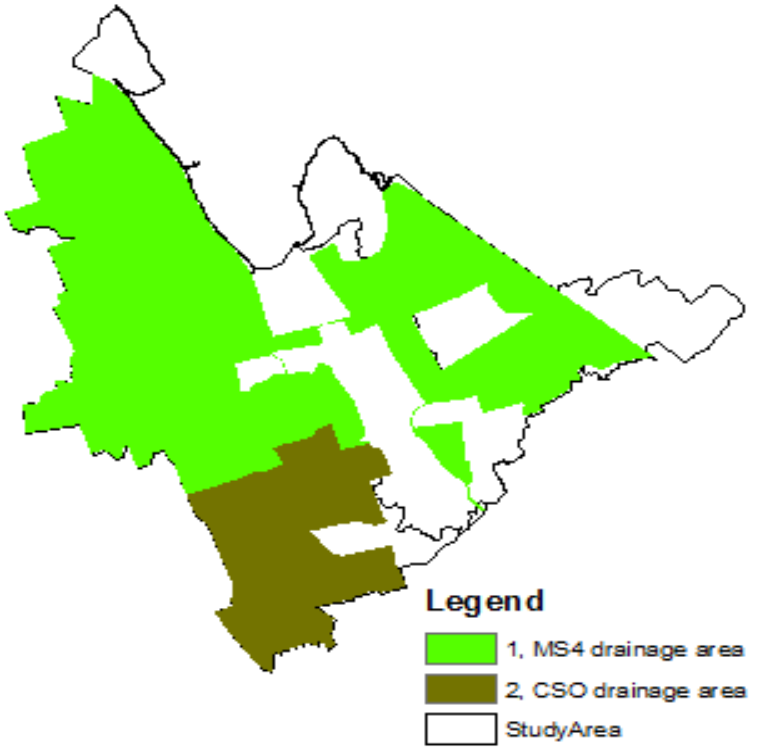


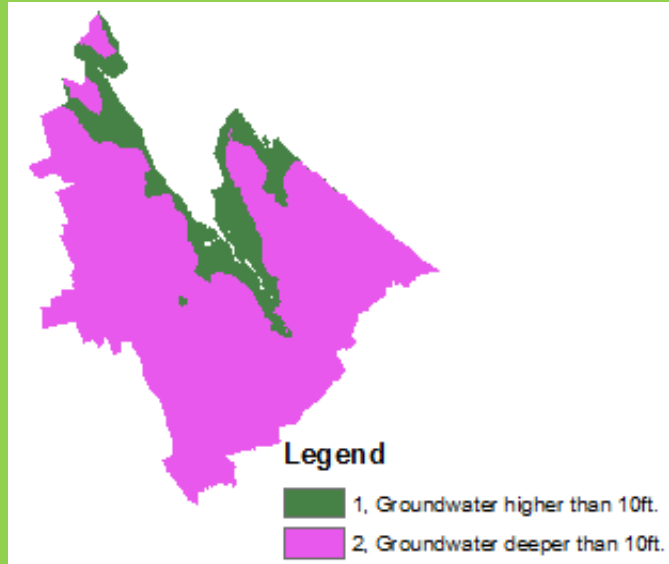


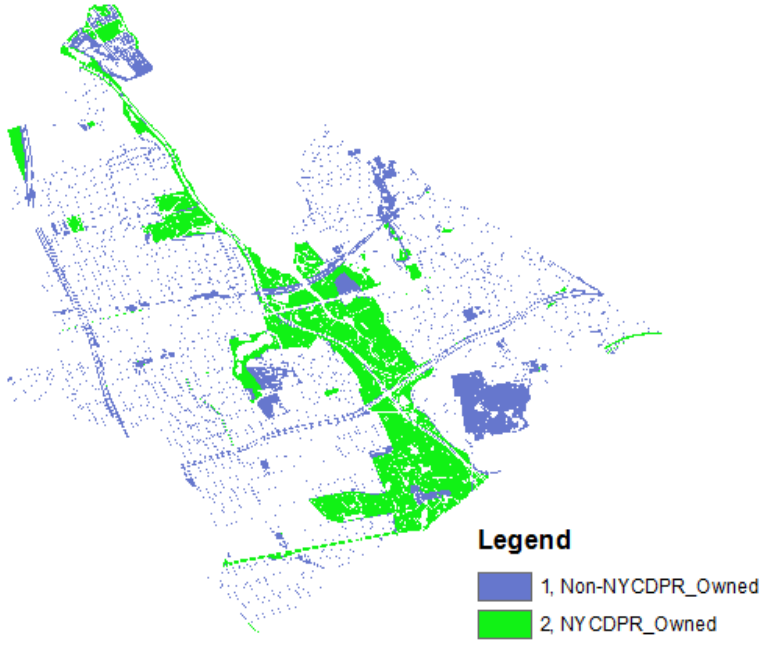
4. Presence of phragmites
   - High priority: no phragmites

Methodology

5. Drainage type
   - High priority: CSO areas
6. Land ownership
   - High priority: NYCDPR-owned lands
7. Groundwater depth
   - High priority: deeper than 10 feet

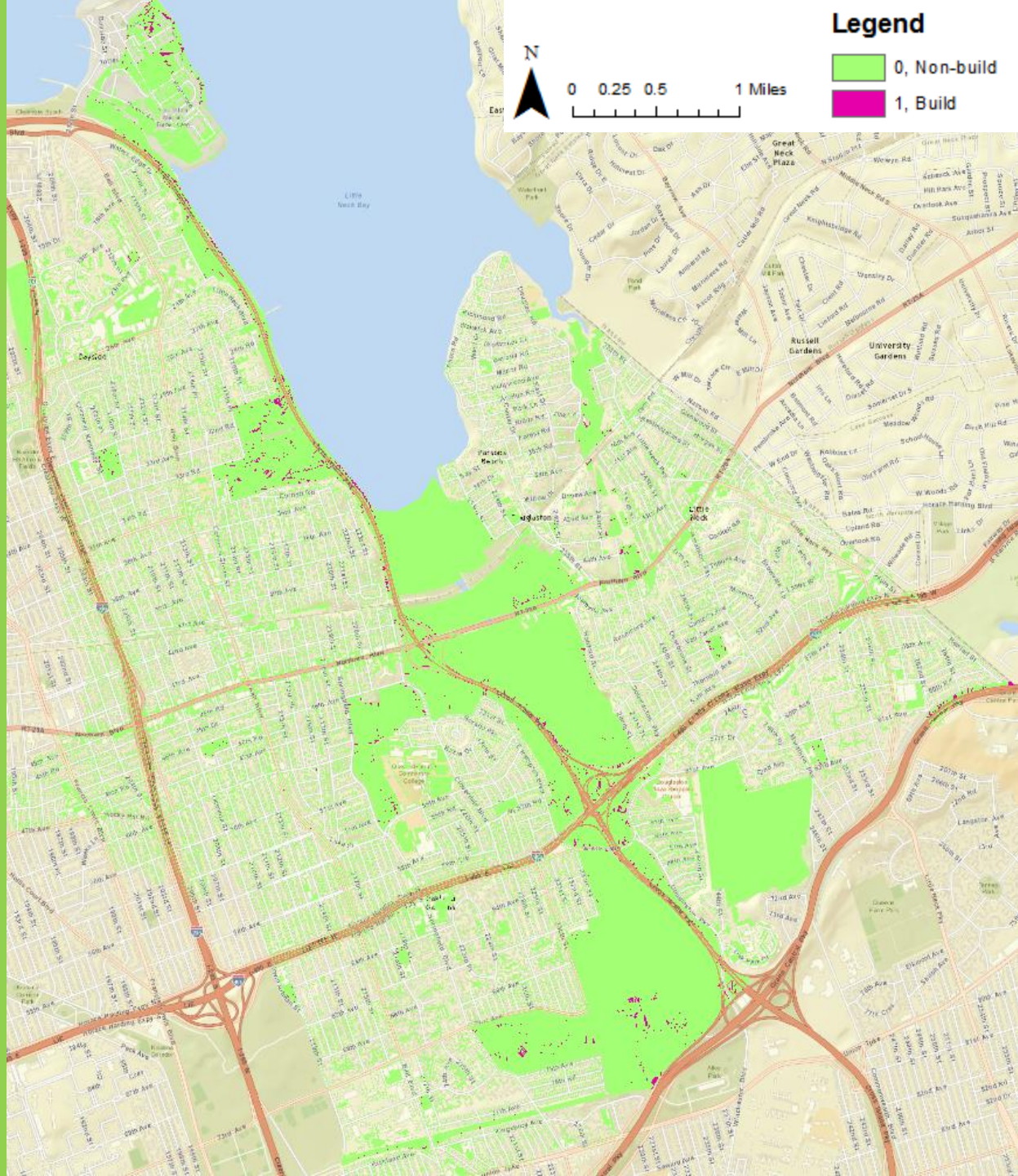






Results

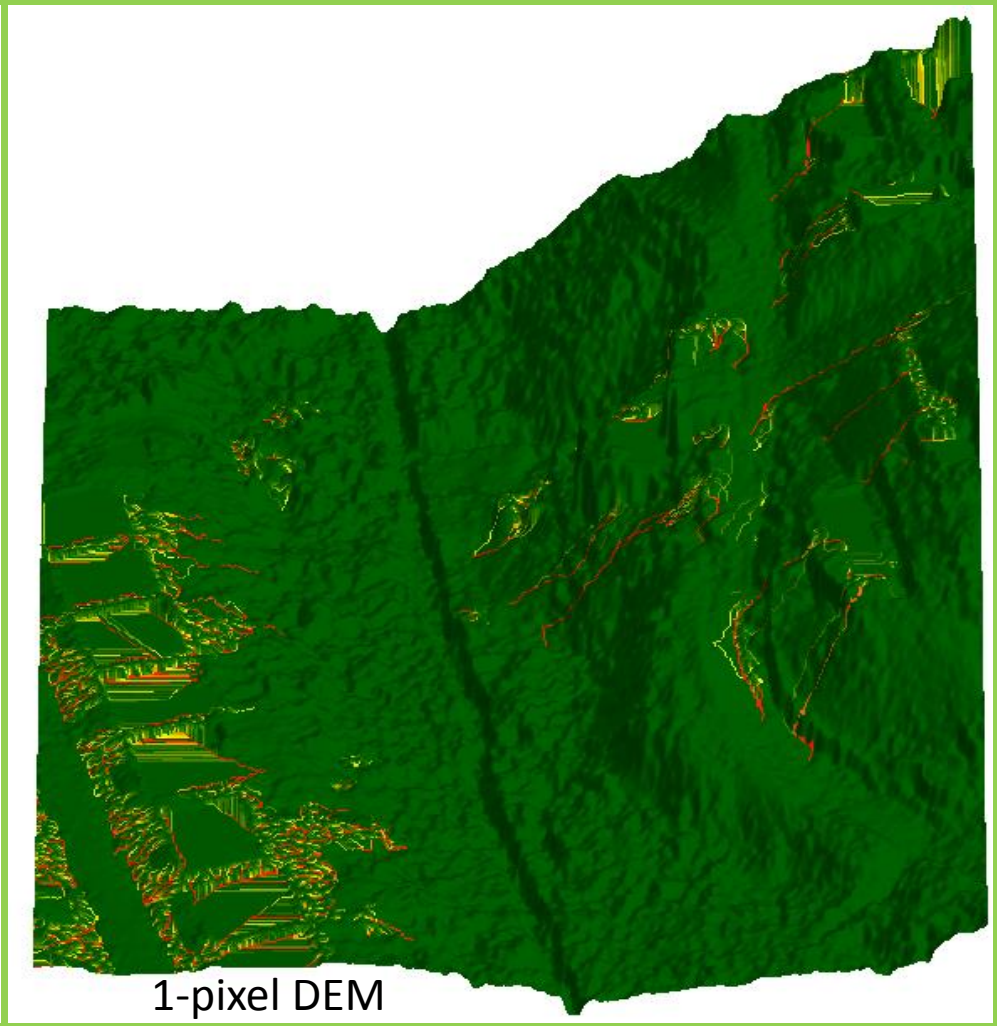
- Part 1



Discussion

- 1ft. Digital elevation model (DEM) vs. a smoothed-out version

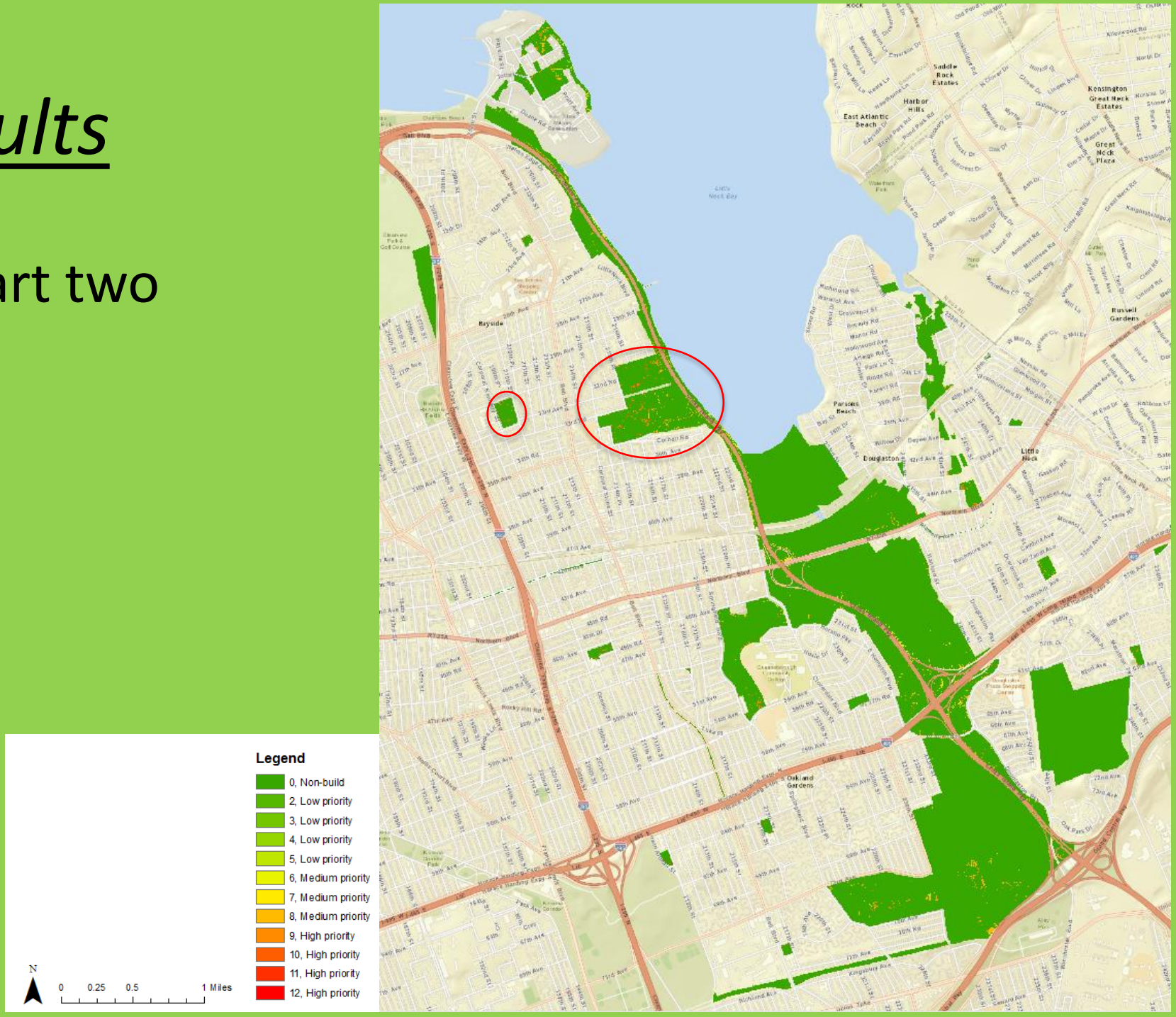
10-pixel average DEM



1-pixel DEM

Results

- Part two



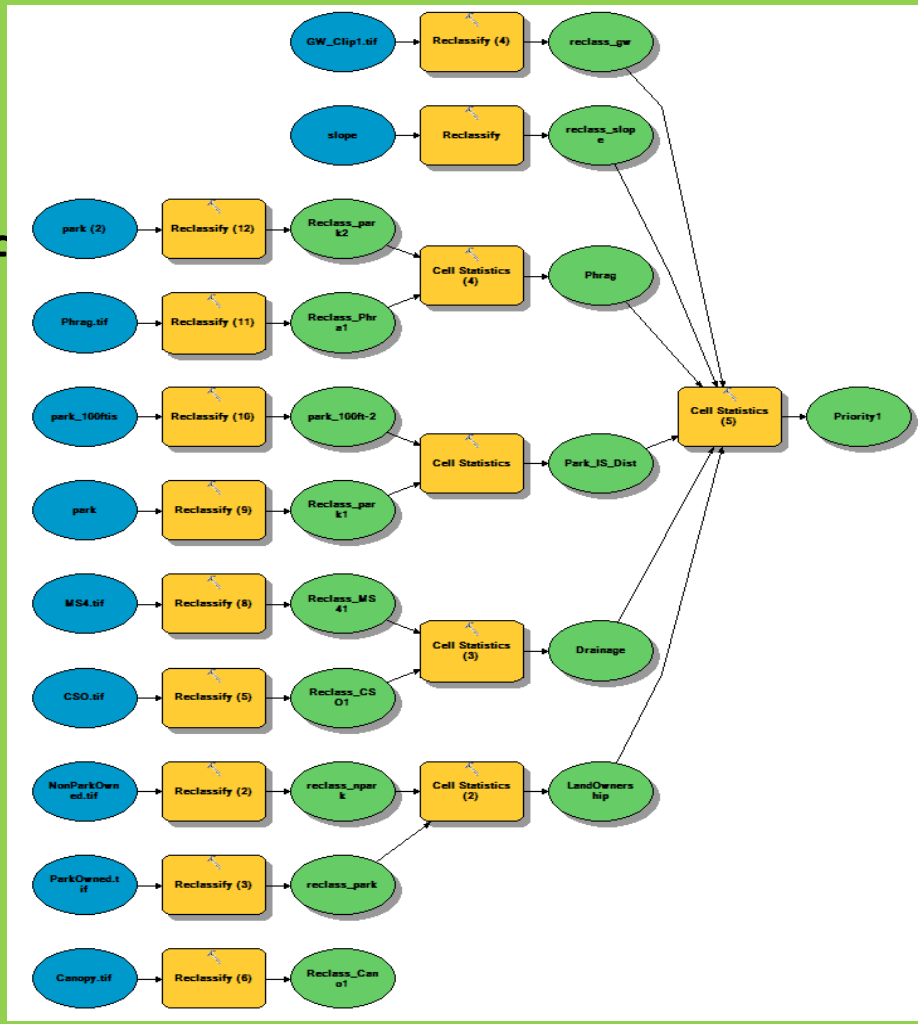
Results


Kennedy Playground


John Golden Park
Cross Island Parkway
Crocheron Park

Discussion

- How can GIS be used to:
  1. To automate the process f the Study Area?
- Protocol automation
  - ModelBuilder
  - User input: upload desired files
  - For Study Area: automated



Discussion

- How can GIS be used to:
  1. To automate the process for the rest of NYC?
- Still requires some manual work
  - Different biophysical variables
  - Different priorities in programmatic objectives
- Model advantages & disadvantages
  - *CAN* include/delete variables based on applicability with ease
  - *CANNOT* distinguish which criteria were met/not met

Limitations & Opportunities

- Biophysical variable: surface type
  - Automatically discards lands with conflicting uses
- Soil
  - Not considered because of insufficient data
- Phragmites
  - Assumption made about water treatment provided

Limitations & Opportunities

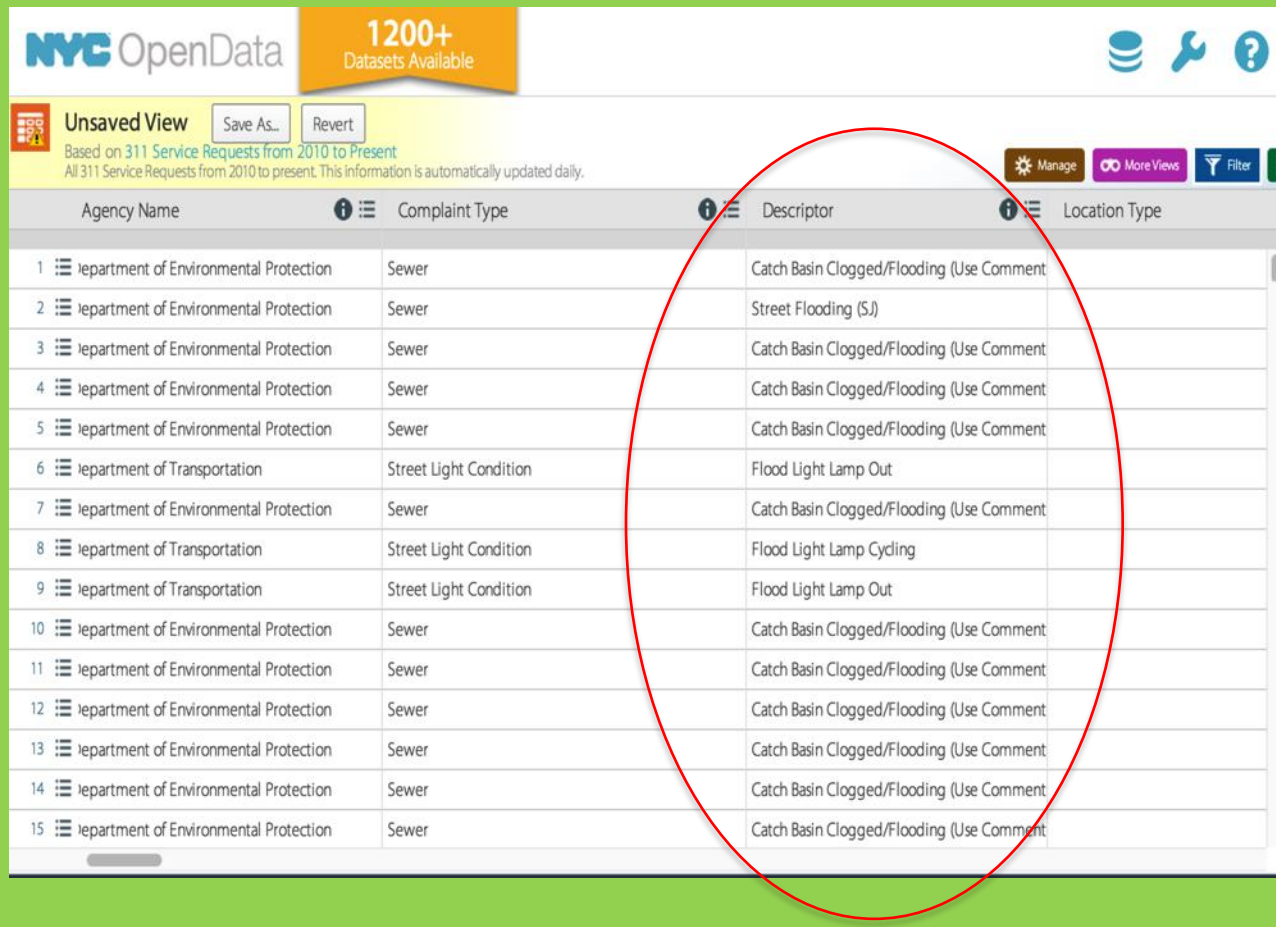
- Impervious surface layer
  - Not all roads are captured
  - Flow analysis is skewed

Limitations & Opportunities

- Social variables not considered
  - Community willingness (ex. Older gentleman that had planted a flower garden; memorial to a soldier)
- Model data is not real-time
  - Importance of fieldwork

Next Steps

- Different maps based on changing priorities
  1. Stormwater management
  2. Environmental co-benefits
  3. Environmental justice
  4. Additional city data (ex. 311 calls)



	Agency Name	Complaint Type	Descriptor	Location Type
1	epartment of Environmental Protection	Sewer	Catch Basin Clogged/Flooding (Use Comment	
2	epartment of Environmental Protection	Sewer	Street Flooding (SJ)	
3	epartment of Environmental Protection	Sewer	Catch Basin Clogged/Flooding (Use Comment	
4	epartment of Environmental Protection	Sewer	Catch Basin Clogged/Flooding (Use Comment	
5	epartment of Environmental Protection	Sewer	Catch Basin Clogged/Flooding (Use Comment	
6	epartment of Transportation	Street Light Condition	Flood Light Lamp Out	
7	epartment of Environmental Protection	Sewer	Catch Basin Clogged/Flooding (Use Comment	
8	epartment of Transportation	Street Light Condition	Flood Light Lamp Cycling	
9	epartment of Transportation	Street Light Condition	Flood Light Lamp Out	
10	epartment of Environmental Protection	Sewer	Catch Basin Clogged/Flooding (Use Comment	
11	epartment of Environmental Protection	Sewer	Catch Basin Clogged/Flooding (Use Comment	
12	epartment of Environmental Protection	Sewer	Catch Basin Clogged/Flooding (Use Comment	
13	epartment of Environmental Protection	Sewer	Catch Basin Clogged/Flooding (Use Comment	
14	epartment of Environmental Protection	Sewer	Catch Basin Clogged/Flooding (Use Comment	
15	epartment of Environmental Protection	Sewer	Catch Basin Clogged/Flooding (Use Comment	

Next Steps

- Increase intra-government agency communication
  - Field visit to potential site where DOT was constructing a sidewalk
  - Integrate with efforts from Office of Green Infrastructure

Conclusion

- GIS protocol automation in the Study Area
- Some limitations to automation outside the Study Area
- GIS is a great tool
  - Significantly reduces effort
  - Fieldwork is still necessary

Acknowledgments

The *USDA Forest Service* and the *Urban Resources Initiative* provided funding for this research. The *New York City Urban Field Station* provided guidance and supervision.

Special thanks to Lindsay Campbell, Marit Larson, Vjeko Matic, Erika Svendsen, Ross Bernet, and Dana Tomlin for all their feedback and help.