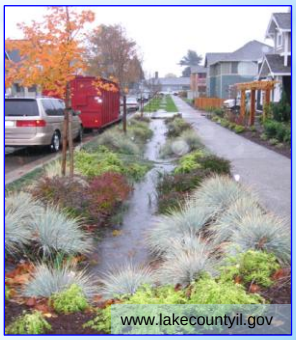
Determining Optimal Sites for Bioswales in the Richmond Neighborhood, Portland, Oregon

Amy Goodwin and Dolores Weisbaum
GEOG 493/593 - Fall 2012



Impervious Surfaces

- Comprise large percent of urban surface areas
- Increase stormwater runoff
- Increase peak discharge
- Increase pollutant loading and transportation of sediments
- Increase temperature of outflow

Bioswales

- Landscape features designed to collect and partially treat stormwater runoff
- Bioretention of pollutants and sediment from stormwater by substrate and plants
- Mitigates pollutant loading
- Recharges groundwater

Project Overview

Drainage Analysis

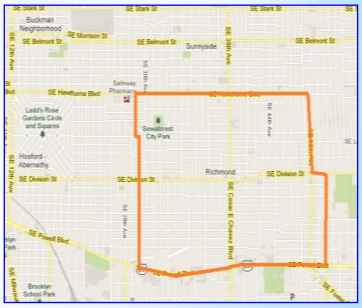
- Neighborhood selected at random
- Richmond (southeast Portland)

Criteria for Site Selection

- Slope < 2 degrees
- Land cover consists of shrubs or dirt
- Areas with multiple drainage points

Model Validation

- Use existing bioswales



Methods

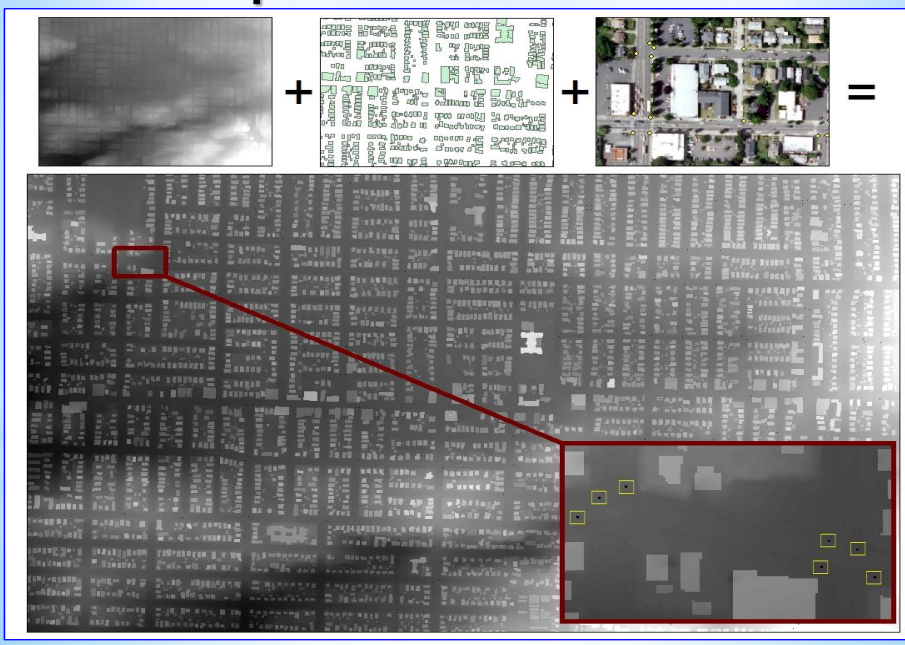
- ESRI ArcGIS 10.1
- Raster cell size: 3 x 3 ft
- Projection: NAD 1983 HARN StatePlane Oregon North FIPS 3601 Feet Intl

Data Layer	Source
Land Cover	Metro
Digital Elevation Model (DEM) Grid	Center for Spatial Analysis and Research
Buildings, Neighborhood, Taxlot, Orthophotos	RLIS

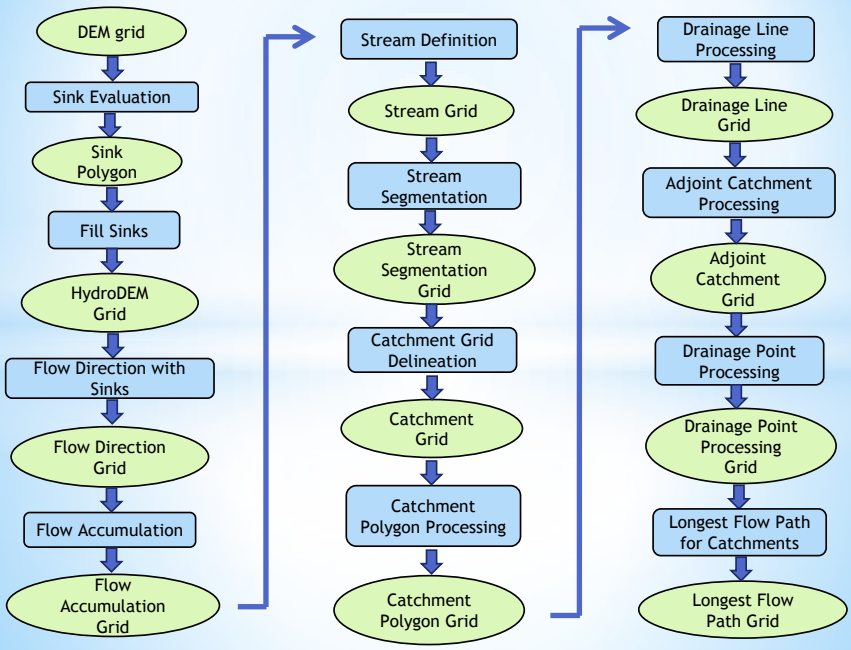
Methods

- Manipulate DEM using the Con Tool and Raster Calculator
  - Added average building heights to DEM
  - Digitized sewer inlets using Portland Maps and orthophotos
    - Inlet = -100
- Drainage Line, Drainage Points, and Catchments
  - ArcHydro 10.1 Beta
- Site Selection
  - Weighted Overlay and Kernel Density

DEM Manipulation

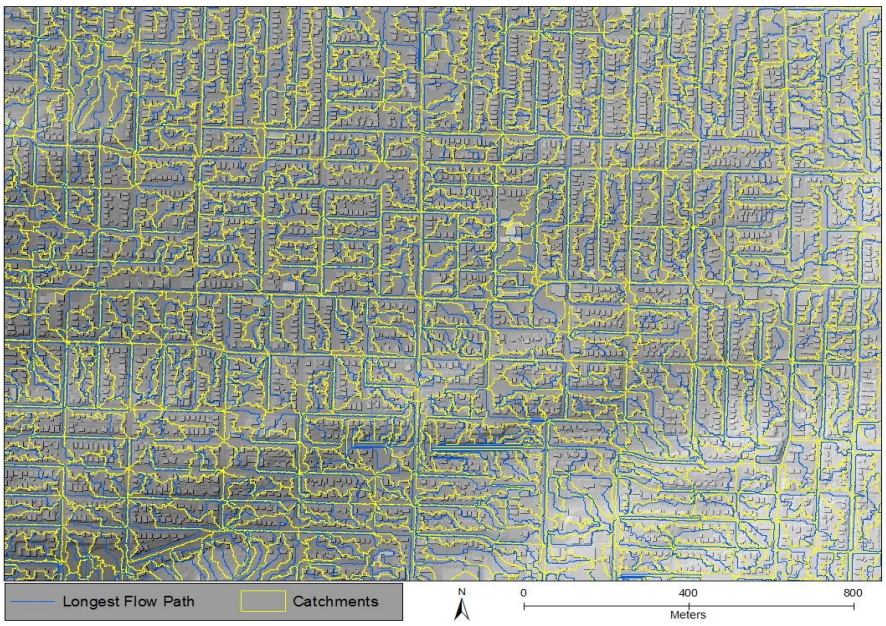


Basic Deranged Terrain Processing Workflow

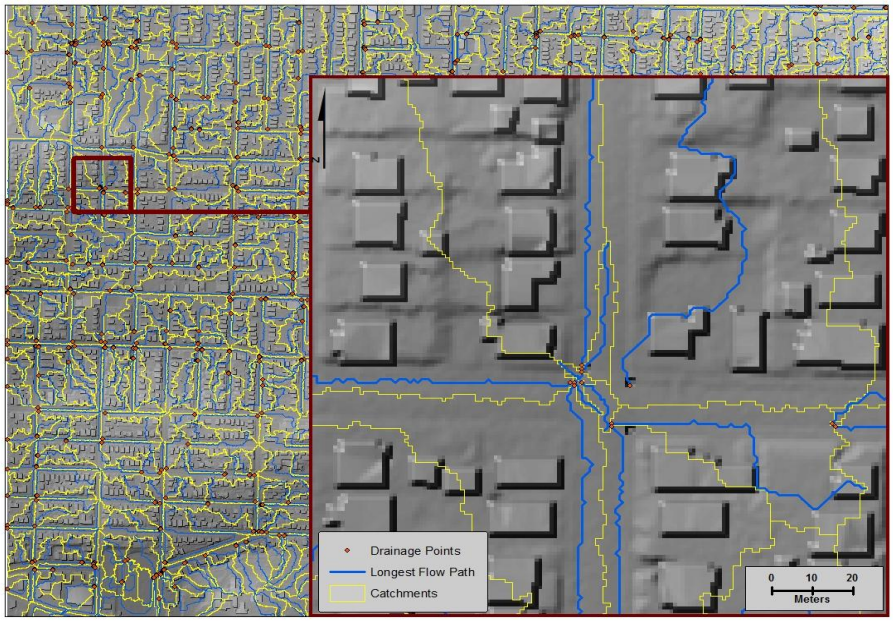


Drainage Lines

Catchments and Longest Flow Path



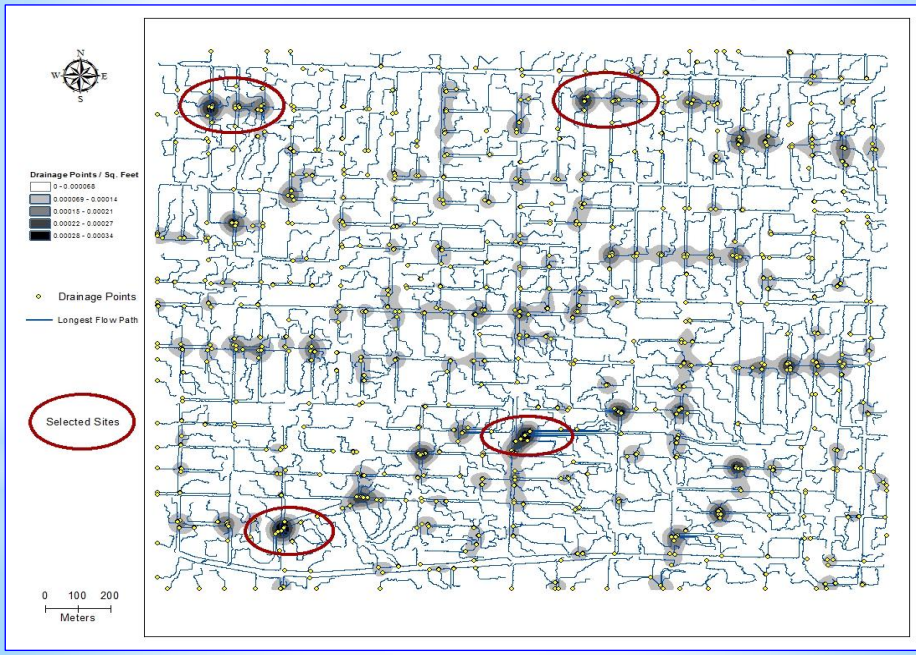
Drainage Points



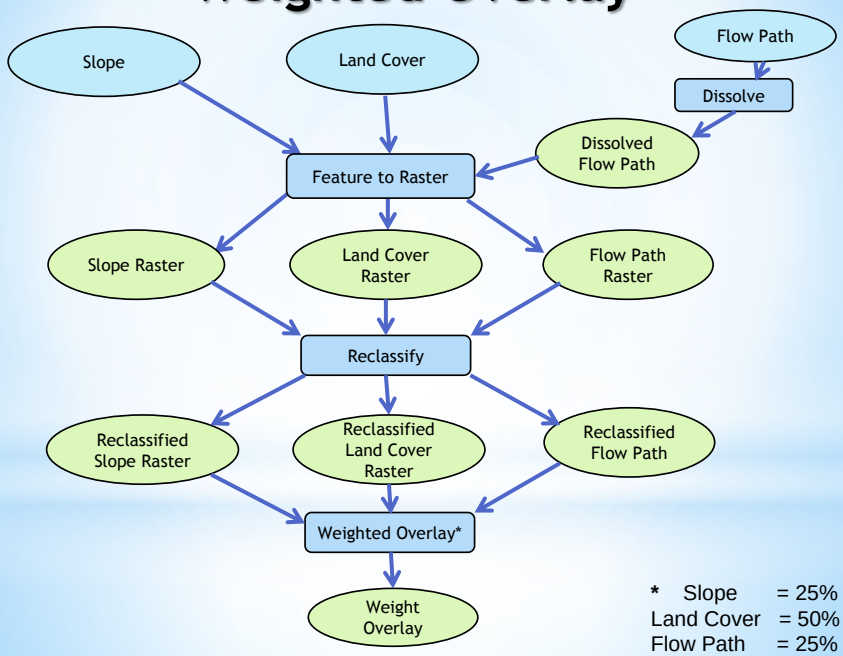
Site Selection

- Kernel Density
  - Density of drainage points
- Weighted Overlay
  - Slope, landcover, and longest flow path
    - Removed taxlots from above layers

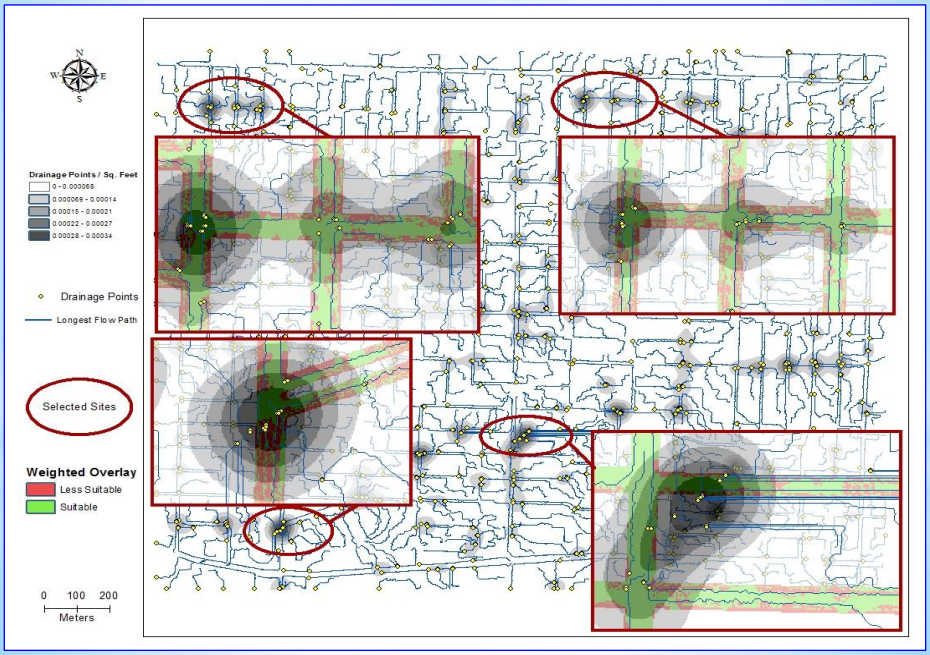
Site Selection - Kernel Density



Weighted Overlay



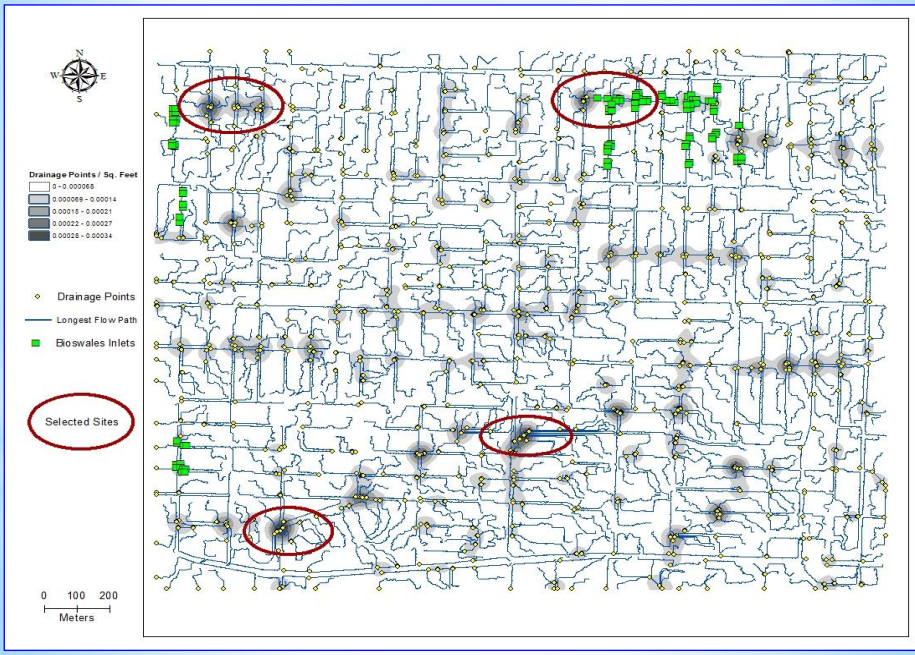
Site Selection - Weighted Overlay



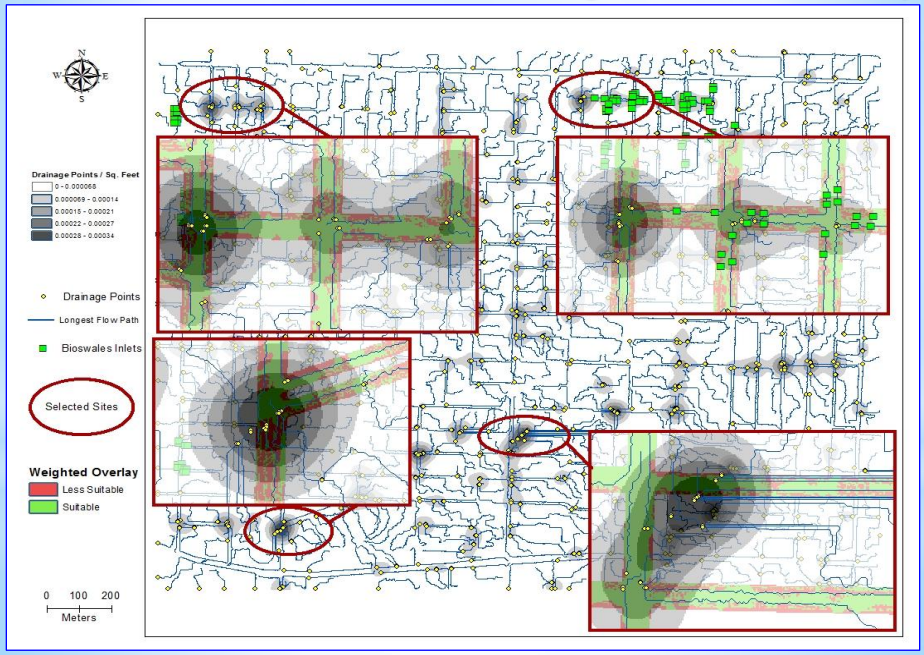
Model Validation

- Digitized bioswale inlet points and area
- Bioswale inlet points and polygons fell along longest flow path
- Bioswales located near areas with a high density of drainage points

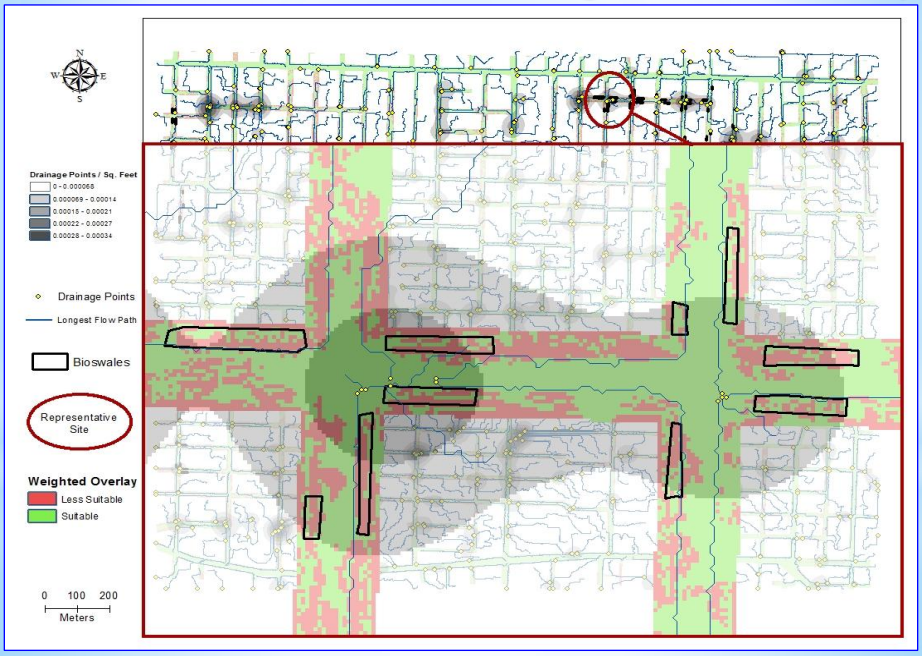
Model Evaluation - Kernel Density



Model Evaluation - Weighted Overlay



Model Evaluation - Weighted Overlay



Conclusions

- Model is fairly accurate in locating sites
  - Only 4 out of 50 bioswales did not fall along a flow path
  - Kernel density is a good way to identify sites
  - Weighted overlay was a weak indicator for a bioswale placement
- Areas for improvement
  - Watershed scale instead of neighborhood
  - Inlet layer from City of Portland
  - On-site validation

Acknowledgements

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