Investigating the Potential for Green Infrastructure Improvements in the Columbia Slough

Ashley Baker | Ellen Palmquist | Megan Stanford

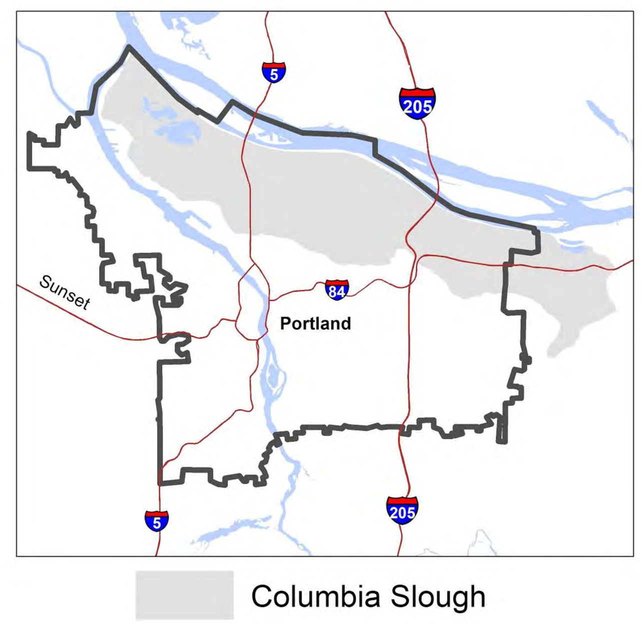
INTRODUCTION

Research Question: What are the most suitable sites for green infrastructure improvements in the Columbia Slough Watershed?

The Columbia Slough is a diverse, highly modified watershed located south of the Columbia River in North Portland. Historically, the area was a large wetland, but levee installation and decades of development in the 1900s transformed the slough into channeled streams (Fish & Jordan, 2016). The slough is home to over 150,000 people, the Portland International Airport, and is a thriving industrial center (Adams & Marriott, 2007). In 2016, BES released a monitoring report detailing the slough's high stream temperatures and high susceptibility to eutrophication (Fish & Jordan, 2016). Implementing green infrastructure projects within the slough may provide a cost-effective way of addressing poor watershed health. Green streets are a highly visible type of green infrastructure and offer many benefits including flood mitigation, water treatment, and habitat provision (US EPA, 2017). In 2008, City of Portland launched the Grey to Green initiative and started constructing green infrastructure projects throughout the city (BES, 2018). A multi criteria evaluation considering the impact of slope, impervious surfaces, roads, critical habitat, and storm drains was used to determine green infrastructure potential in the Columbia Slough Watershed.

METHODS

A literature review of existing green infrastructure models informed variable choice and variable weight (Tetra Tech, 2015). For the purpose of this multi criteria evaluation, each variable was assigned an independent prioritization of values, and then compiled in a weighted raster overlay. The resulting values determined best-suited sites for potential green street locations. To achieve this, each of the 5 variables were processed for analysis according to the desired attributes and relationship with the site analysis, as listed below:

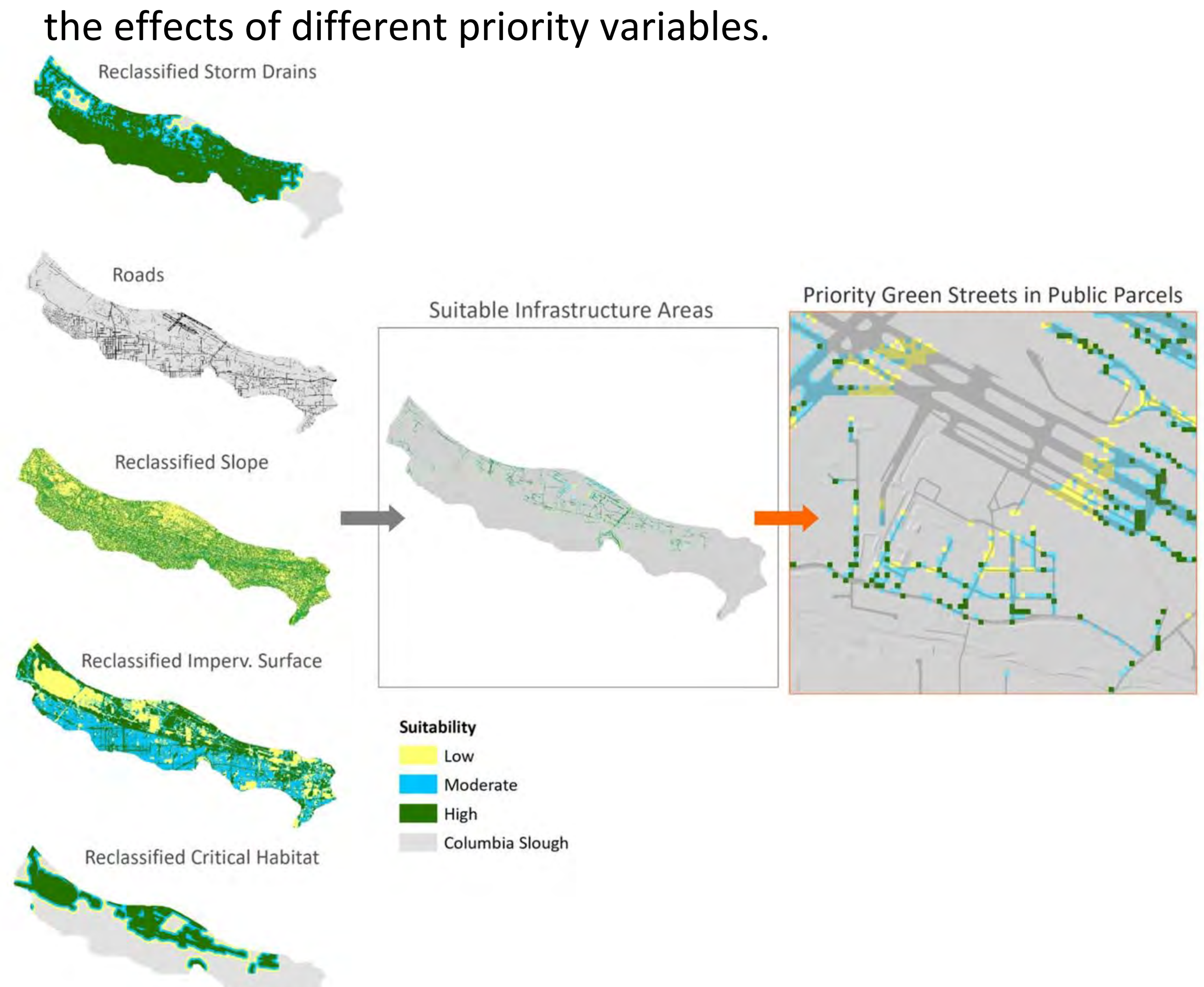


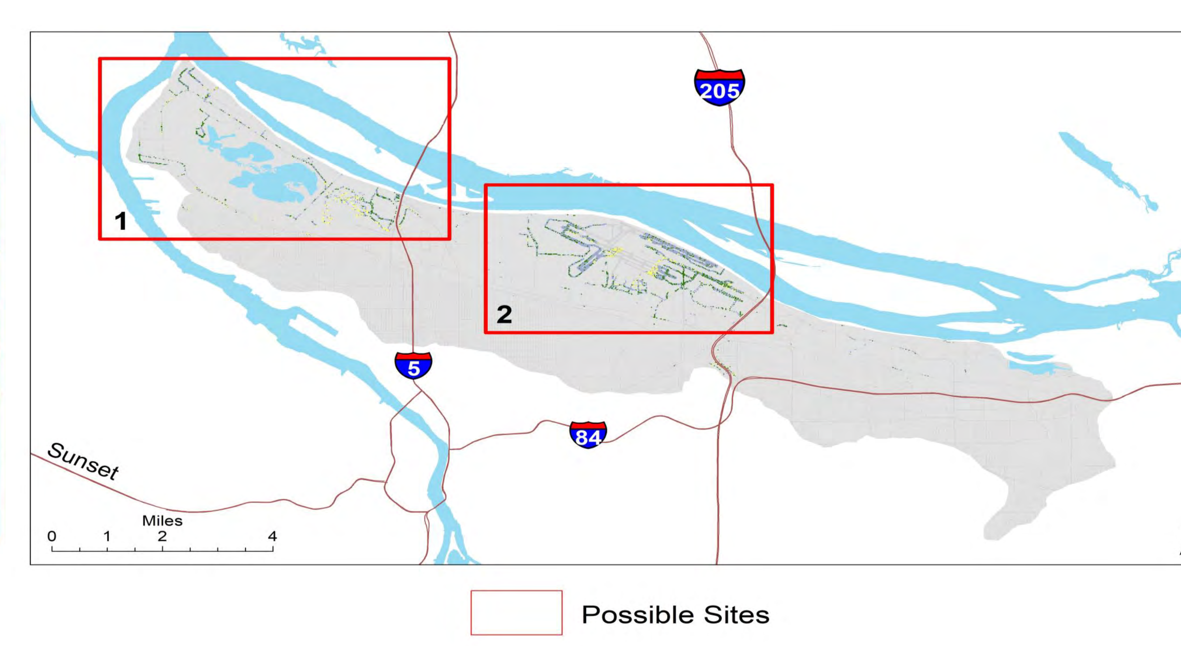
Variables (10m x 10m)	Weighted Overlay Model: Base	2 (IS)	3 (Habitat)	Highest Priority Value	Classification Range	Source
Impervious Surface	20%	20%	10%	66%-100%	0%-100%	NLCD
Roads	20%	40%	40%	1	0,1	BES
Slope	20%	20%	20%	2%-4%	0%-6%	USGS
Critical Habitat	20%	10%	20%	<100 m	0 m- < 300 m	City of Portland
Storm Drain Points	20%	10%	10%	<100 m	0 m- >300 m	City of Portland

Table 1: Exhibits the range and classification of values for each dataset and each variable's relative weight within the 3 models.

- Impervious surfaces: Cell values were reclassified by cell into 3 equal intervals
- Roads: The Nibble tool was applied to include raster cells adjacent to roads, locations which would be able to accommodate a green street. The Focal Statistics tool set to majority was then applied. Cells containing the resulting 'road' were then assigned an integer of 1, and cells without roads a 0.
- Slope: The Slope tool was used to determine a slope value for each raster cell. Areas with low slope are preferred for green streets (City of Portland, 2016), so the cells were reclassified with priority values of 1-3 if they had a value of 0-6, otherwise they were assigned a 0.
- Critical Habitat: The Euclidean distance tool was used with critical habitat locations as the input. Distance values were then reclassified, with nearest being highest priority.
- Storm drain points: The Euclidean distance tool was used with the storm drain point locations as the input. Distance values were then reclassified, with nearest being highest priority.

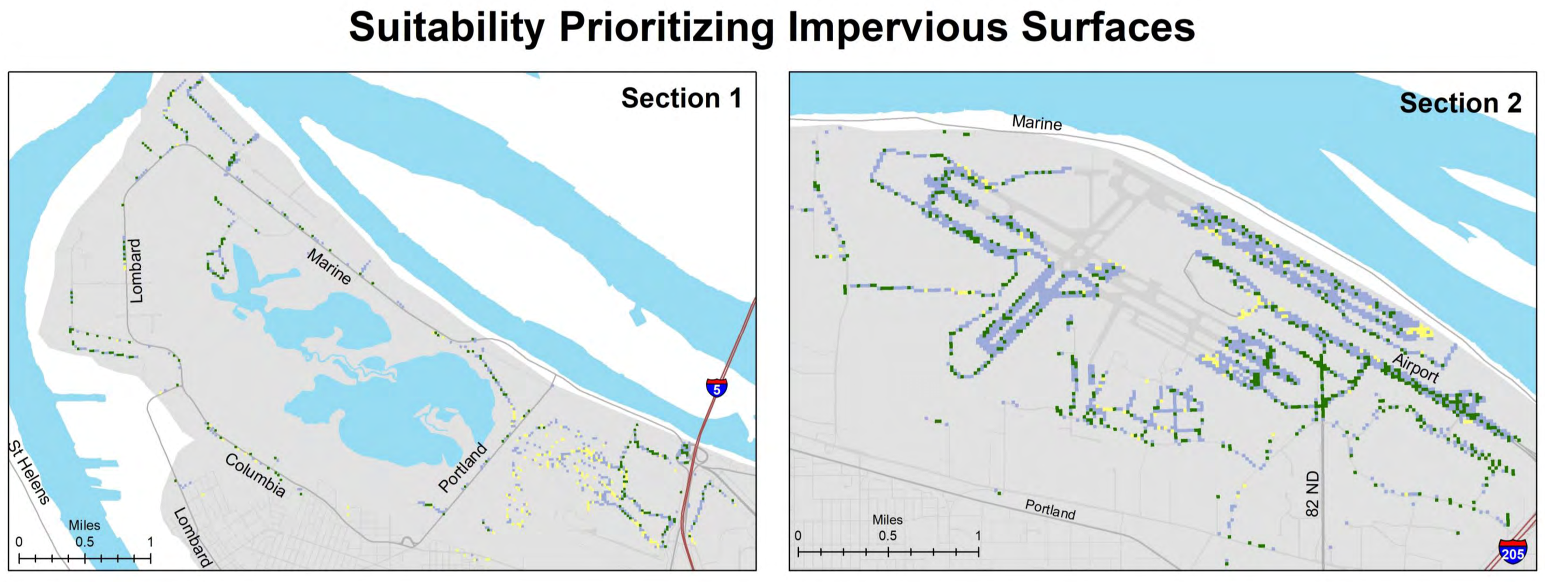
After the five variables were reclassified and normalized, the Weighted Sum tool was used to determine potential high priority sites, identified by their high output values. The final determinant of status as a potential site was dependent on public land ownership, so the Weighted Sum output was clipped to public parcels. The Weighted Sum tool was used twice more to assess the effects of different priority variables.



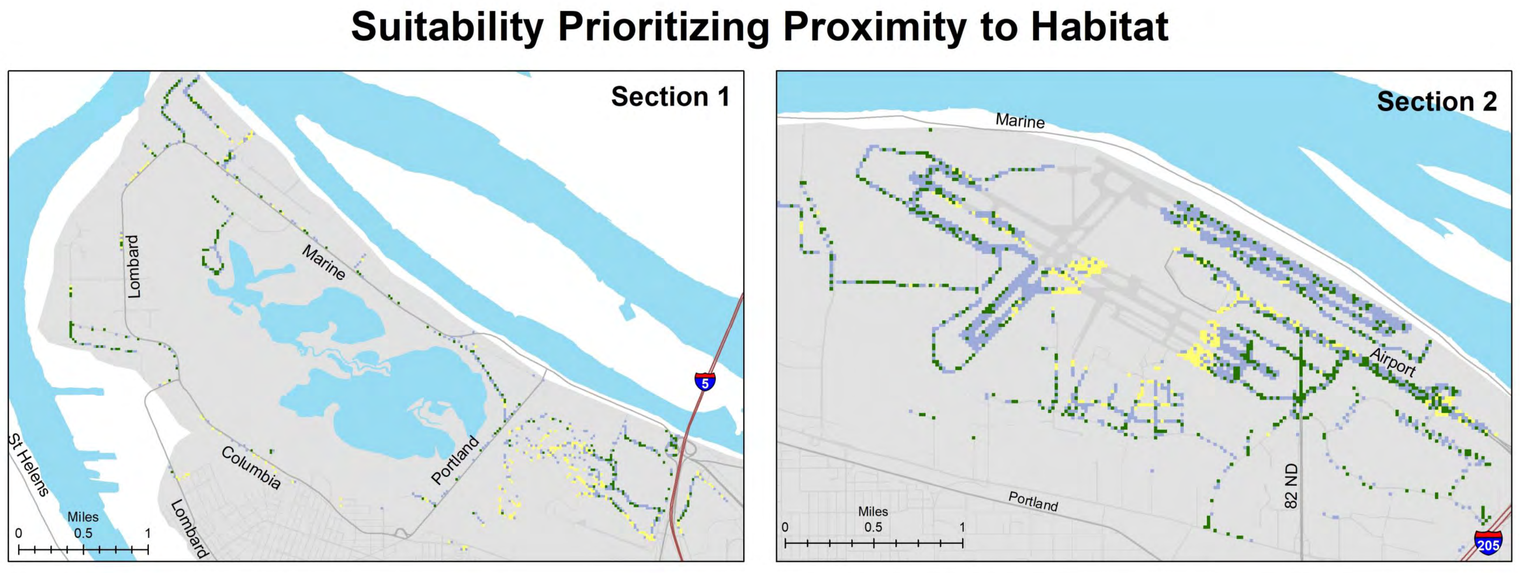


RESULTS & CONCLUSIONS

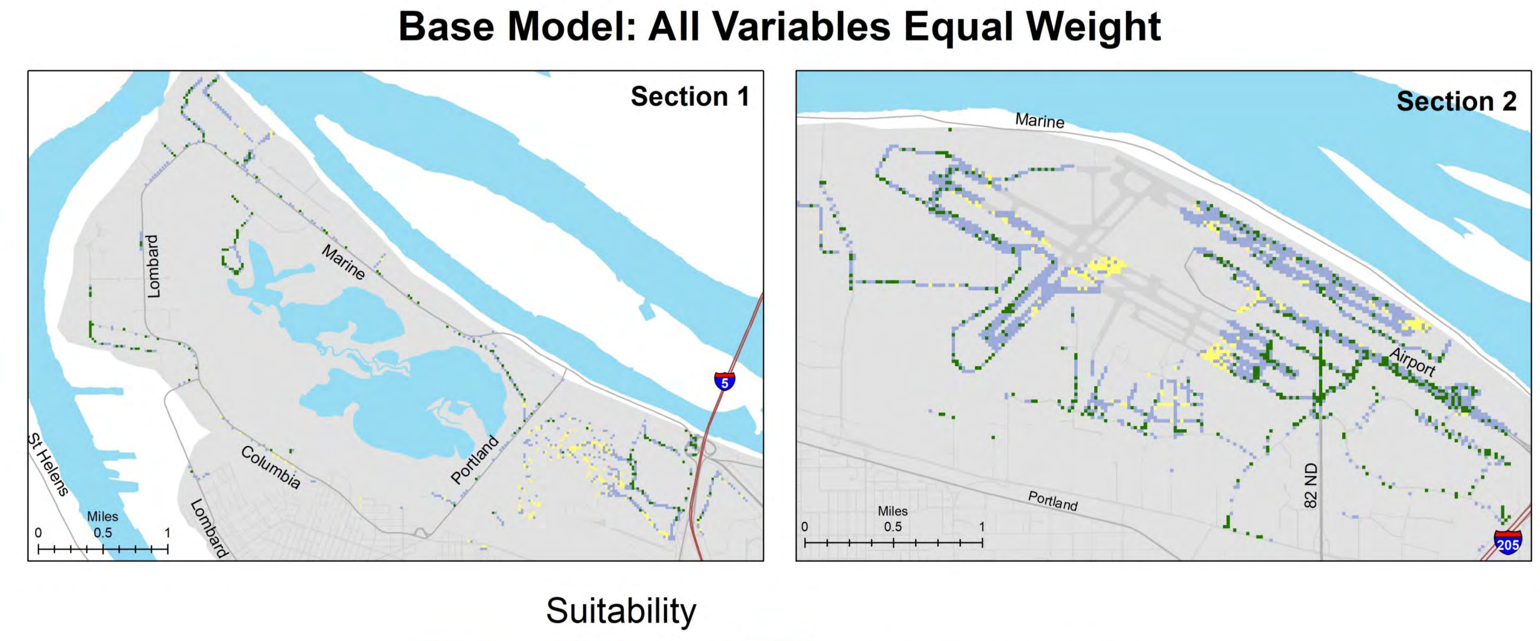
Suitability Prioritizing Impervious Surfaces



Suitability Prioritizing Proximity to Habitat



Base Model: All Variables Equal Weight



Results from the multi criteria evaluation show two main areas of suitable parcels for green street installation. All suitable locations have been limited to streets so there is little variation in total suitable public parcels. Suitability ranking of the parcels changed based on how the variables were prioritized. The most noticeable difference in suitability is between weight for habitat (habitat would be more valuable for connecting existing green spaces) and weight for impervious surface (impervious surfaces have potential for increased rates of runoff). The model used in our analysis considered all types of green infrastructure. The results give us a good starting point for locating suitable parcels for green street installation. Our next step would be to eliminate the parcels that show low suitability and run the analysis again at a 1 meter scale focusing on areas of the slough that show the most clustering of suitable parcels. At the smaller scale we could add additional variables specific to green streets such as proximity to storm drains.

*See attachment for project sources

Portland State University
GEOG 592 | Winter 2018
Professor Duh