

Predicting the Spread of European Buckthorn in Waterloo Region

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Introduction

- European buckthorn (*Rhamnus cathartica*) is an invasive species, noxious weed and host for soy bean aphids and oat crown rust. It can take over the understory of forests and alters soil chemistry
- Purpose: to create a spatially explicit model for predicting the spread of European buckthorn across regional landscapes

Methods

Completed

- 15 sampling areas with 224 25m x 25m grid cells each, randomly chosen within Waterloo Region, excluding agricultural fields and urban areas that are more than 400m from the nearest forested area
- Presence or absence of buckthorn determined and a core taken from the largest buckthorn within each cell
- Used Generalised Linear Mixed Model (GLMM) to relate habitat characteristics to the presence or absence of buckthorn and account for the clustered sampling structure.
- Age of the largest buckthorn in each grid cell determined from cores, used to represent the historical spread of buckthorn

In Progress

- Another GLMM will be used to determine how the habitat suitability and the distance to older buckthorns influences the likelihood of a cell transitioning from buckthorn absence to presence.

Preliminary Results

- Of 3324 cells sampled, 818 contained buckthorn
- The oldest tree sampled was 56 years old and the average age of buckthorns sampled was 19 years old.
- The habitat characteristics included in the maximal model were: surficial material, permeability, distance to forest patch edge, distance to nearest property line, compound topographic index, and land cover type.
- The minimum acceptable model was created by backward selection and included the permeability, distance to forest patch edge and land cover type (Figure 1).
- The probability of buckthorn presence decreases with increasing distance to the patch edge and is highest for medium-low permeability and forest land cover types (Figure 2)
- There is habitat highly suitable for buckthorn scattered throughout Waterloo Region (Figure 3)
- The Area Under the Receiver Operating Curve (a measure of discrimination) was determined to be 0.634 by leave one out cross-validation

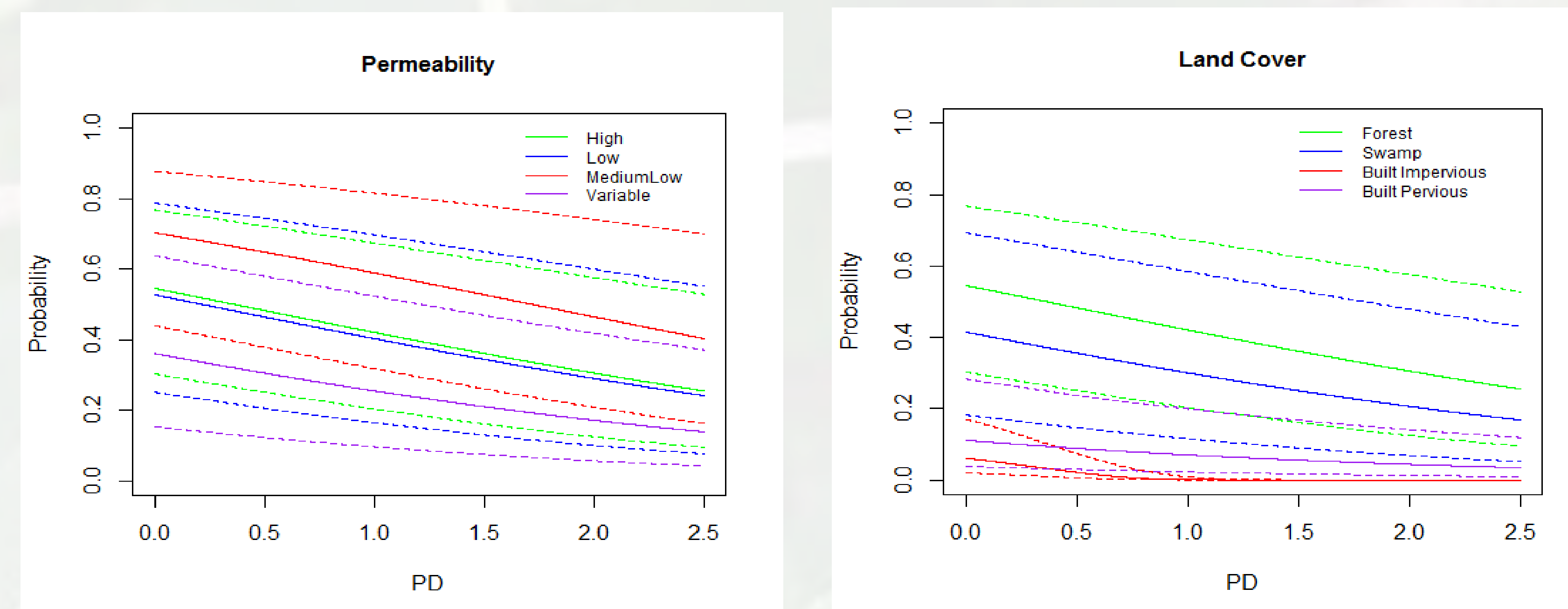


Figure 2: PD = $\log_{10}(\text{PatchDist} + 1)$. Dashed lines represent confidence intervals. A) Probability of a cell containing buckthorn for 4 levels of permeability when land cover type is forest. B) Probability of a cell containing buckthorn for 4 levels of land cover type when permeability is high.

European Buckthorn Habitat Suitability in Waterloo Region

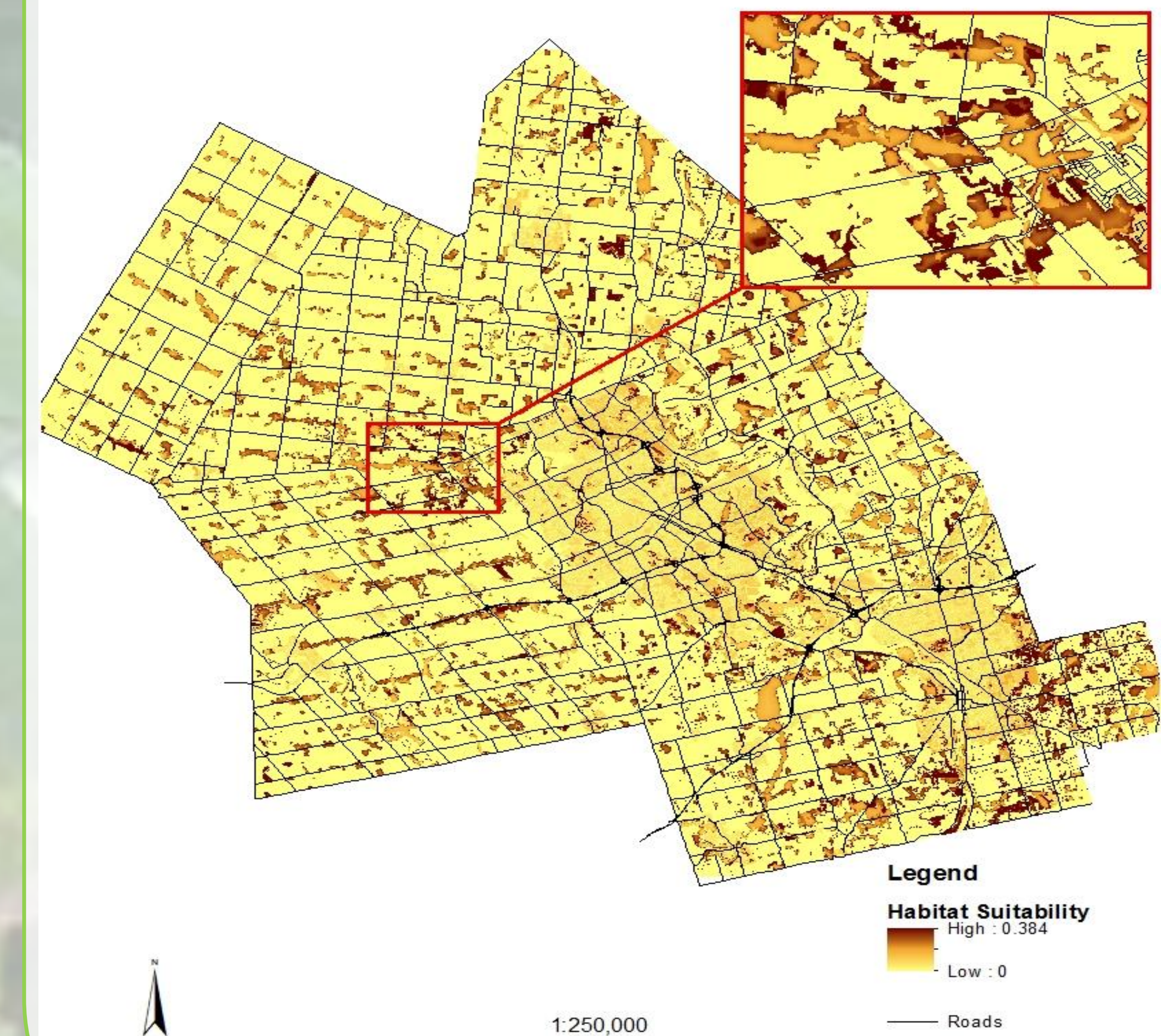


Figure 3: Habitat suitability for European buckthorn in Waterloo Region

Conclusion

- European buckthorn is most likely to be found near forest edges, but is also present in 23% of built up pervious areas
- The AUROC of 0.634 means model has higher probability of correctly predicting the presence of buckthorn than random chance (AUROC 0.5)
- Next Steps: Including the influence of dispersal by analyzing the historical spread pattern should improve the model.

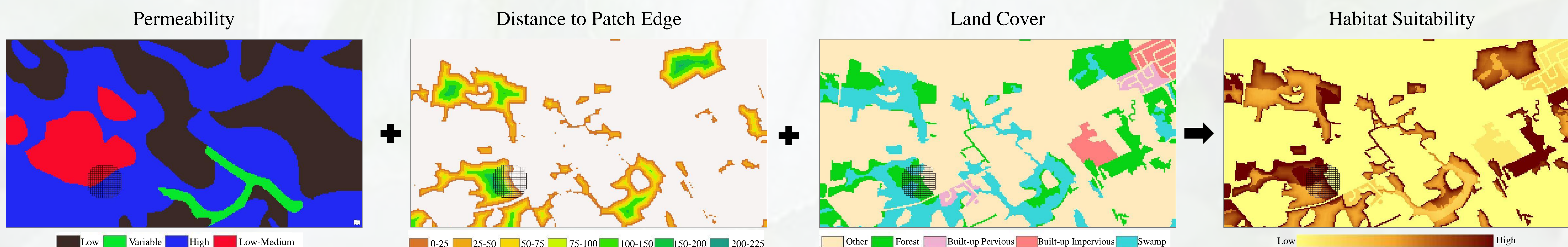


Figure 1: Layers used to make habitat suitability map.

References

- 1 Knight, K. S., Kurylo, J. S., Endress, A. G., Stewart, J. R., & Reich, P. B. (2007). Ecology and ecosystem impacts of common buckthorn (*Rhamnus cathartica*): A review. *Biological Invasions*, 9(8), 925-937.

Follow Up

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