R-BASED GIS MODELING OF INVASIVE PLANTS ALONG THE APPALACHIAN TRAIL

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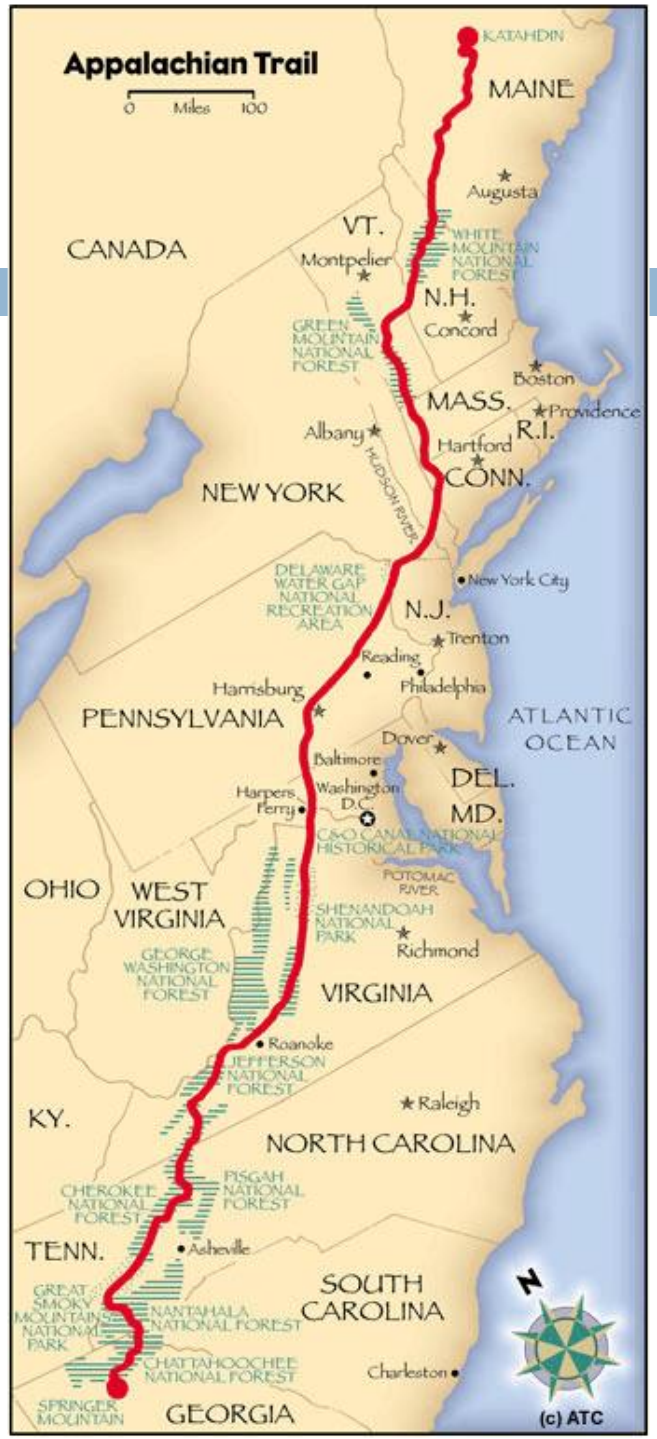
Purpose of Project

- (1) Extent of total area and concentration of these species along the trail
- (2) Determine the impacts of environmental and human impact variables on the location of the species
- (3) Identify hot spots along the trail to further investigate dispersion (e.g., transmission lines, trail entry points)
- (4) Identify hot spot areas for management approaches



Exotic Species 1: Tree of Heaven

- *Ailanthus altissima*
- Tree of Heaven, Chinese origin

Exotic Species 2: Purple Loosestrife

- *Lythrum salicaria*
- Native of Europe, Asia

Exotic Species 3: Japanese Stilt Grass

- *Microstegium vimineum*
- Native of South Asia, East Asia
- Introduced in TN through packaging of Chinese porcelain

Model Variables

Environmental Variables

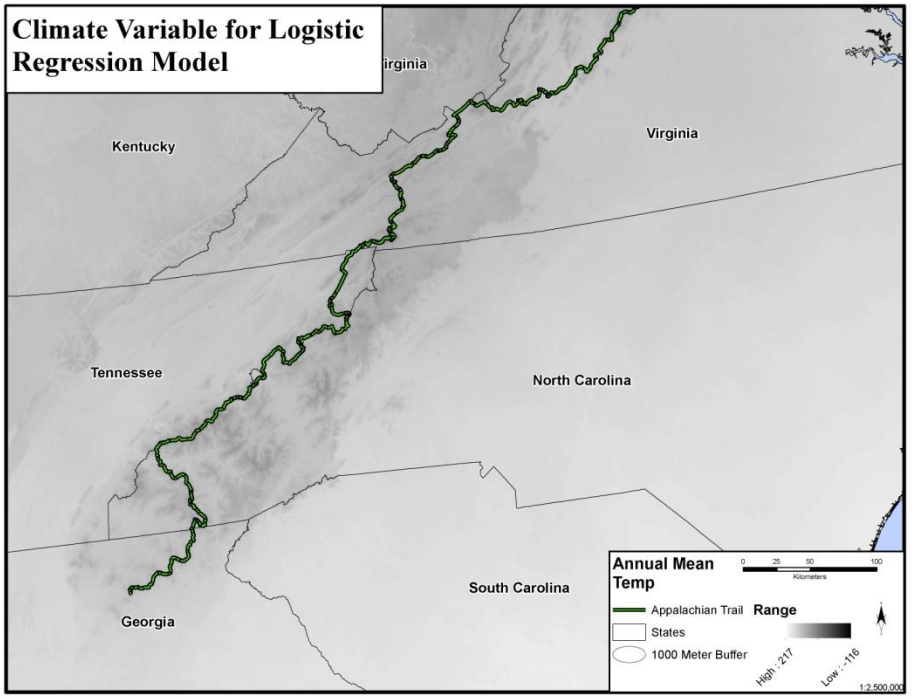
- Digital Elevation Model
- Slope
- Aspect
- Southwestness
- Impervious Surface (3x3 and 7x7 windows)
- Distance to Major Roads
- Distance to Secondary Roads
- Distance to Streams
- Distance to Transmission Lines

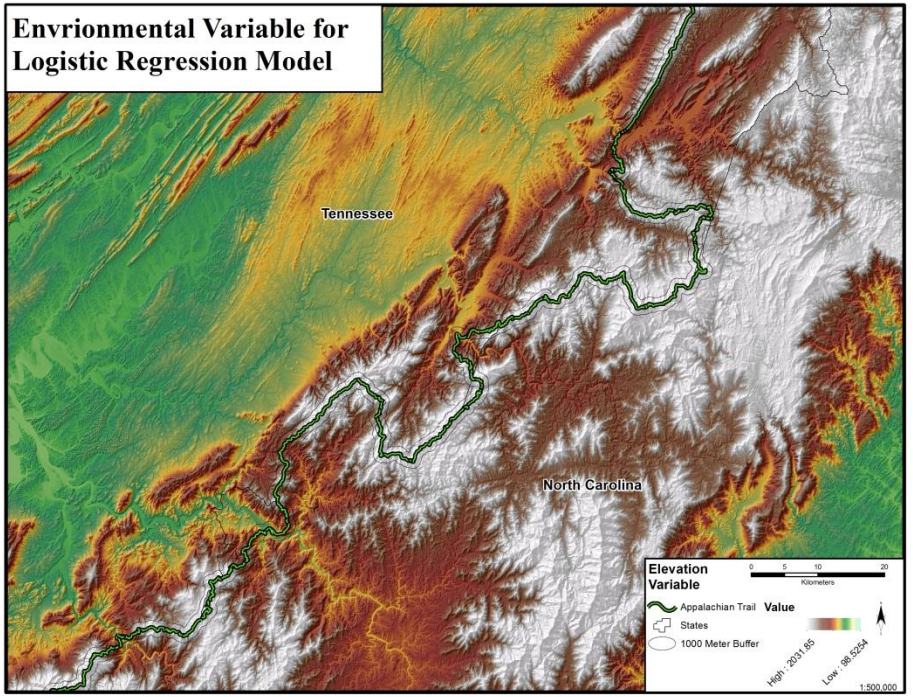
Climate Variables

- Annual Mean Temperature
- Temperature Annual Range
- Mean Temperature of Coldest Quarter
- Annual Precipitation
- Precipitation Seasonality

Left out of Final Model

- 7x7 Impervious Layer
- Distance to Transmission Layer
- Aspect





Model Development

Geodatabase

- Incorporated all of the data into a new geodatabase projected in Albers Equal Area
- Allowed for quicker geoprocessing (From ESRI online support)
- Provided an organizational advantage

Presence/Absence Data

- Presence data was obtained from EDDmapS and GBIF websites for the 3 species
- http://www.eddmaps.org
- http://www.gbif.org
- Absence data was generated randomly inside of a GIS

Model Development

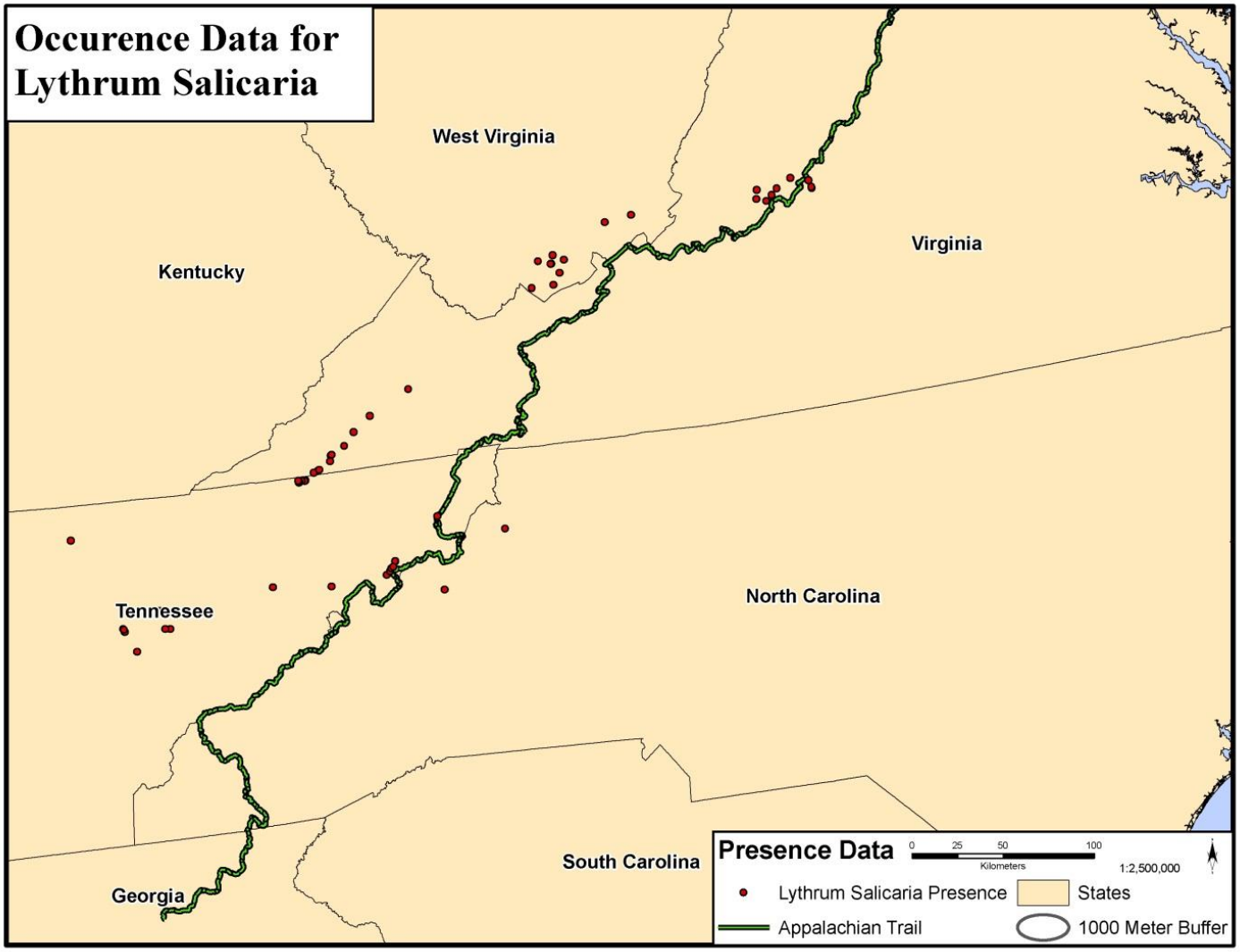
Variable Extraction

- Presence/Absence tables were developed inside of ArcGIS.
- The data points were used to extract the cell values for each variable at that location.
- These tables were then combined in “R” and ran inside the Logistic Regression model

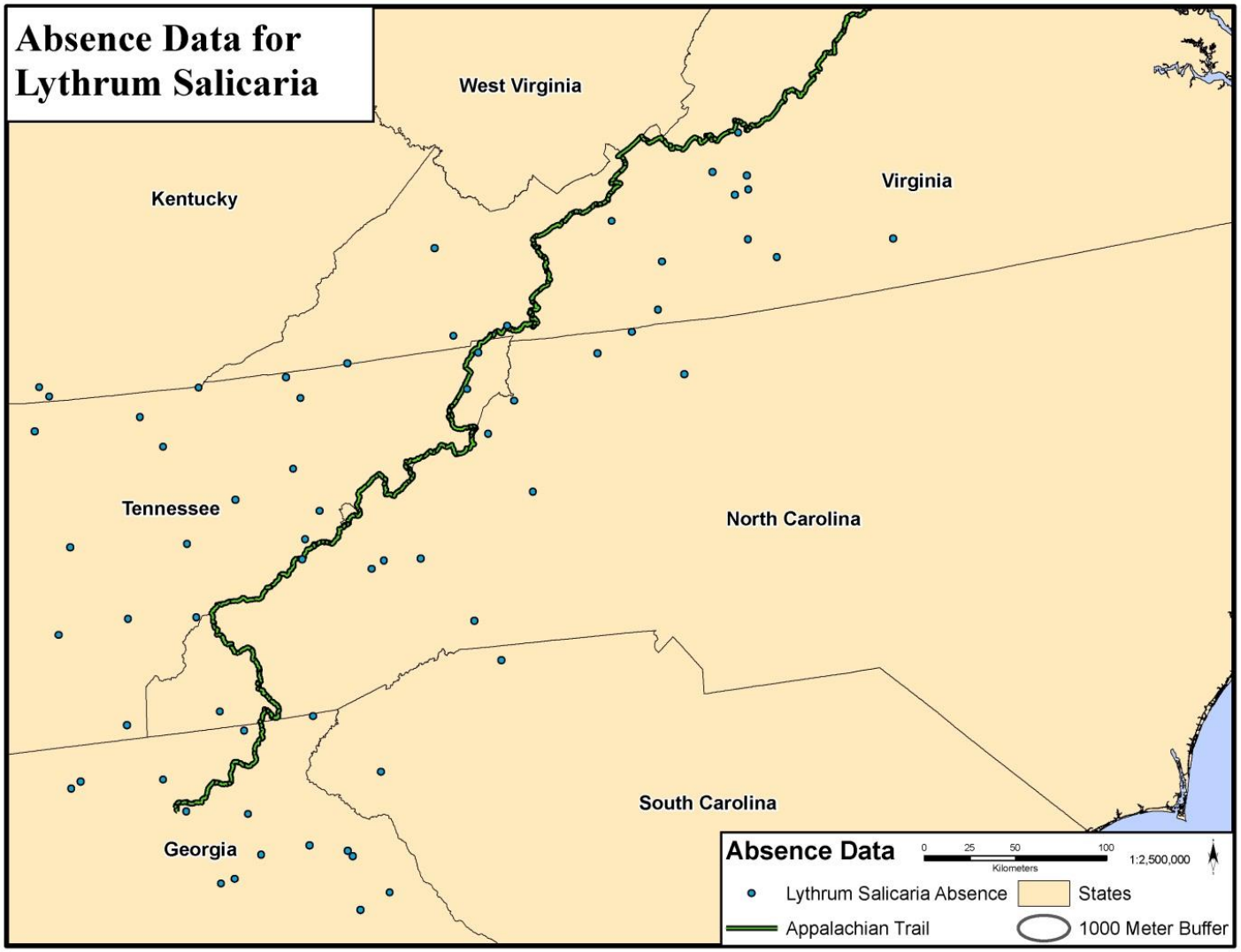
Raster Calculator

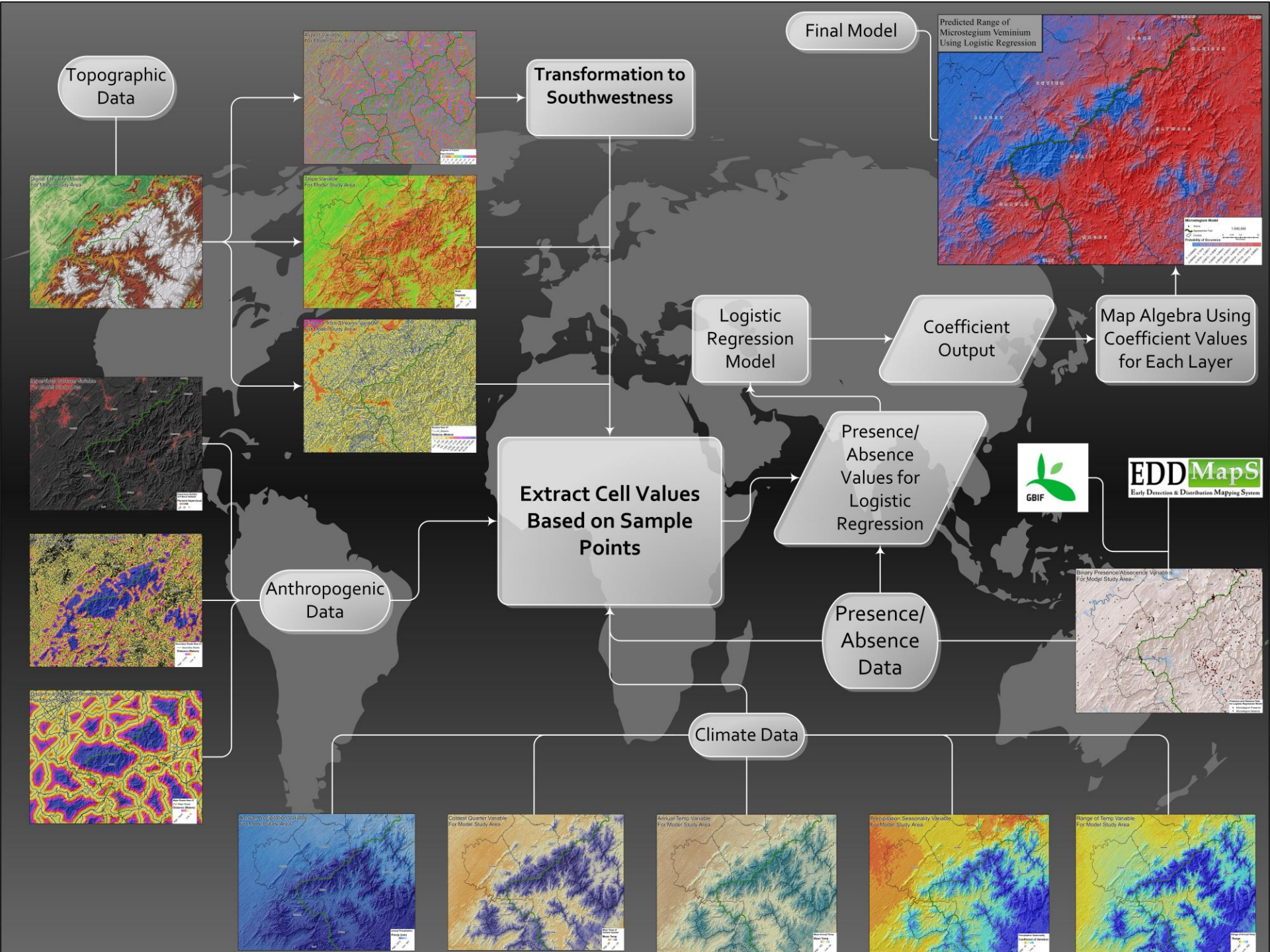
- After obtaining the coefficients in “R” they were used in Raster Calculator to weight each of the variable layers.
- From that a range prediction graphic can be obtained.

Presence – Absence Data



Presence – Absence Data

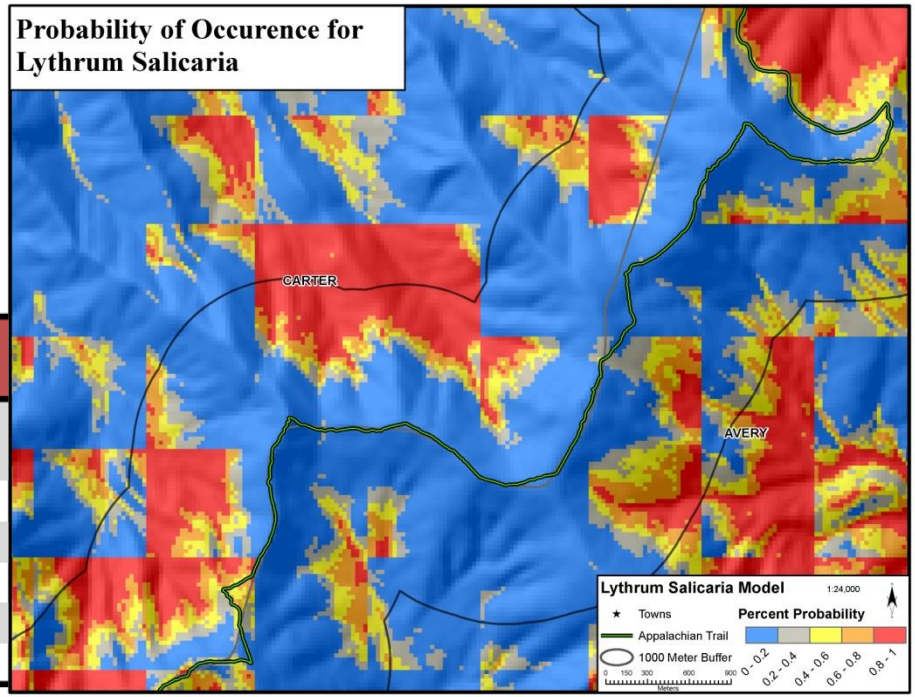


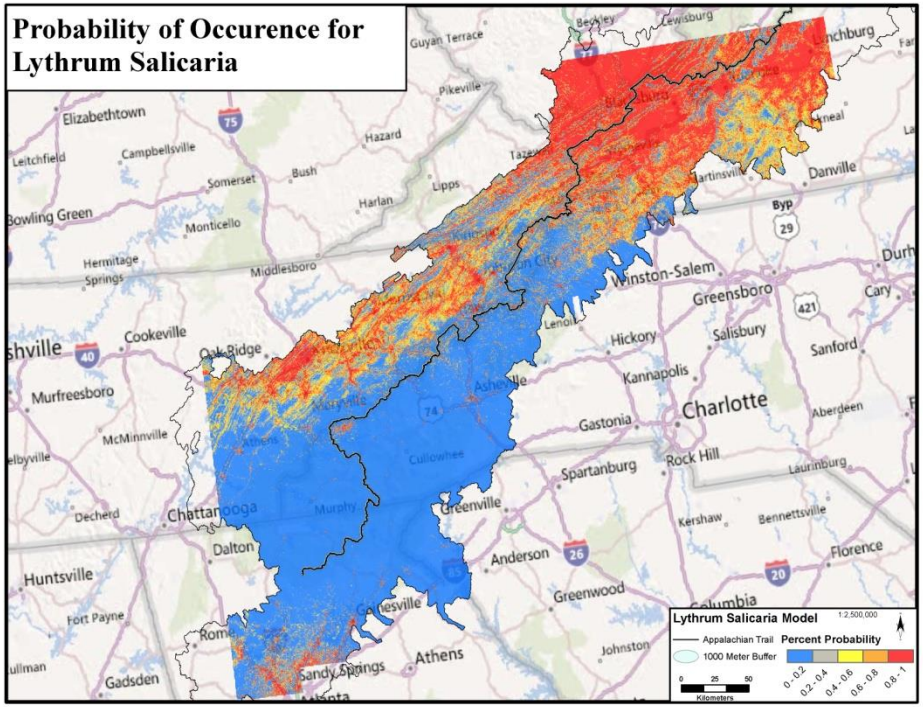

Topographic Data
Transformation to Southwestness
Final Model
Predicted Range of Microstegium Veminium Using Logistic Regression
Logistic Regression Model
Coefficient Output
Map Algebra Using Coefficient Values for Each Layer
Extract Cell Values Based on Sample Points
Presence/ Absence Values for Logistic Regression
Anthropogenic Data
Presence/ Absence Data
Climate Data
GBIF
EDDMapS
Early Detection & Distribution Mapping System

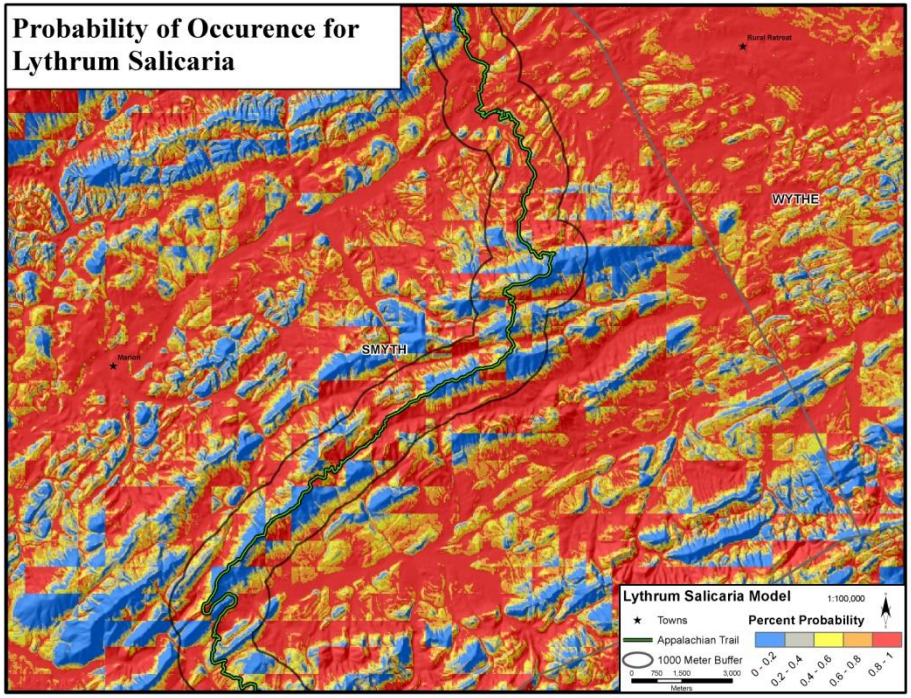
Model Outputs

Percentage of Area at Risk within 1000 Meter Buffer

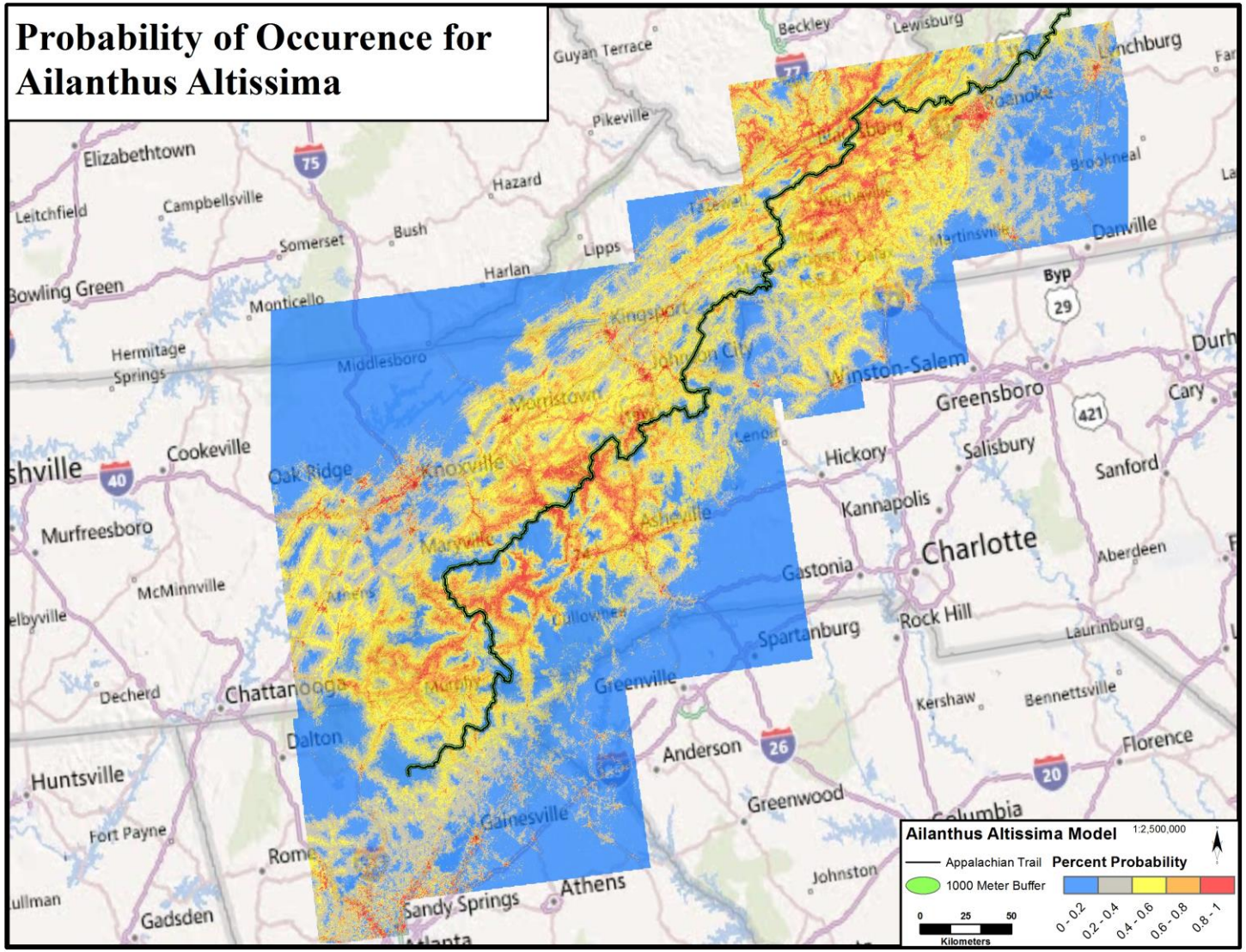
	Ailanthus Altissima	Lythrum Salicaria	Microstegium Veminium
Likelihood of Occurrence(%)			
0 - 20	30.20409	59.129825	21.961204
21 - 40	27.366497	6.272678	17.639627
41 - 60	24.377029	5.278301	20.306289
61 - 80	13.775029	6.556611	23.239231
80 - 100	4.277353	22.762582	16.853647



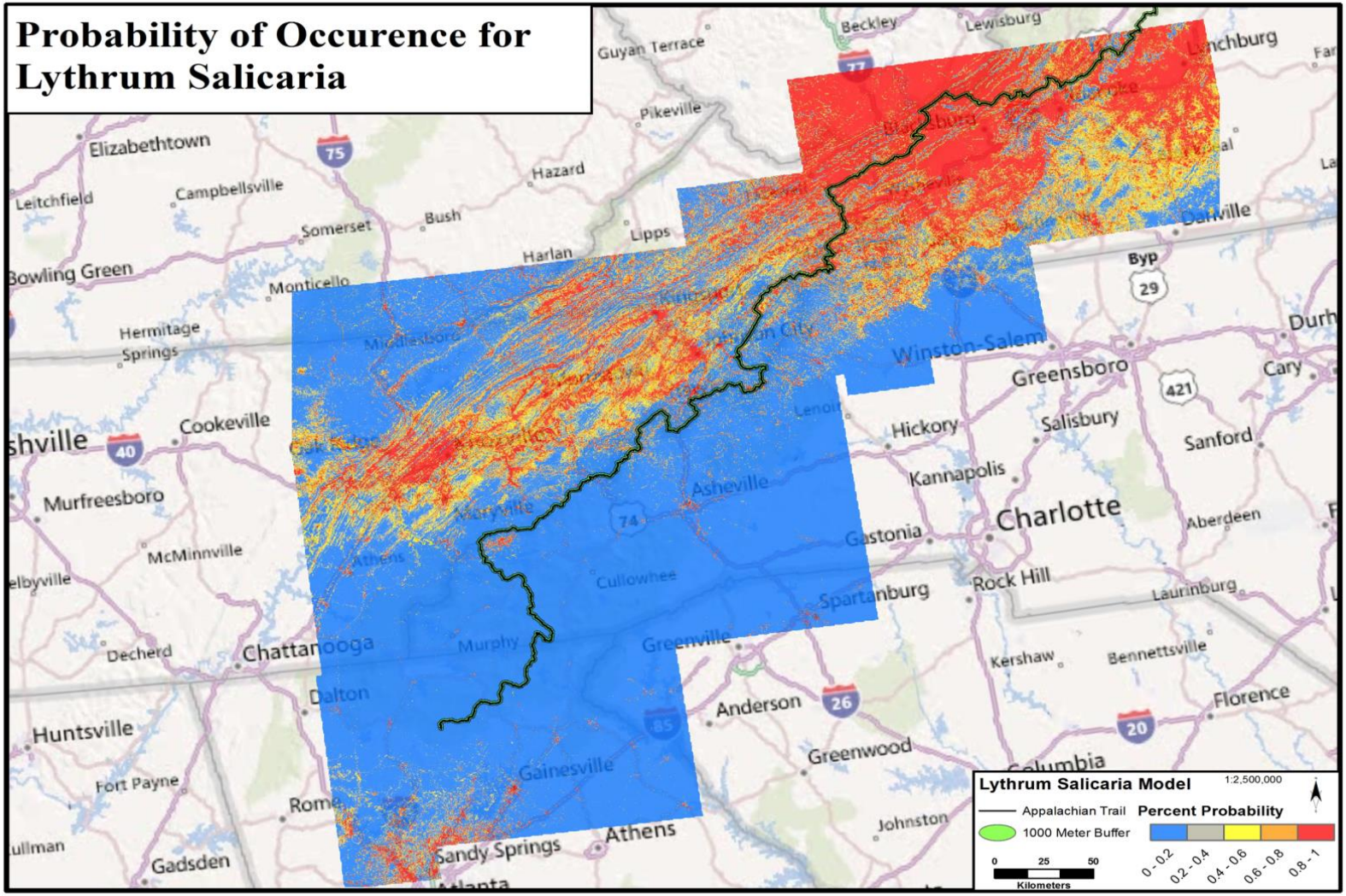




Results Species 1: Tree of Heaven



Results Species 2: Purple Loosestrife



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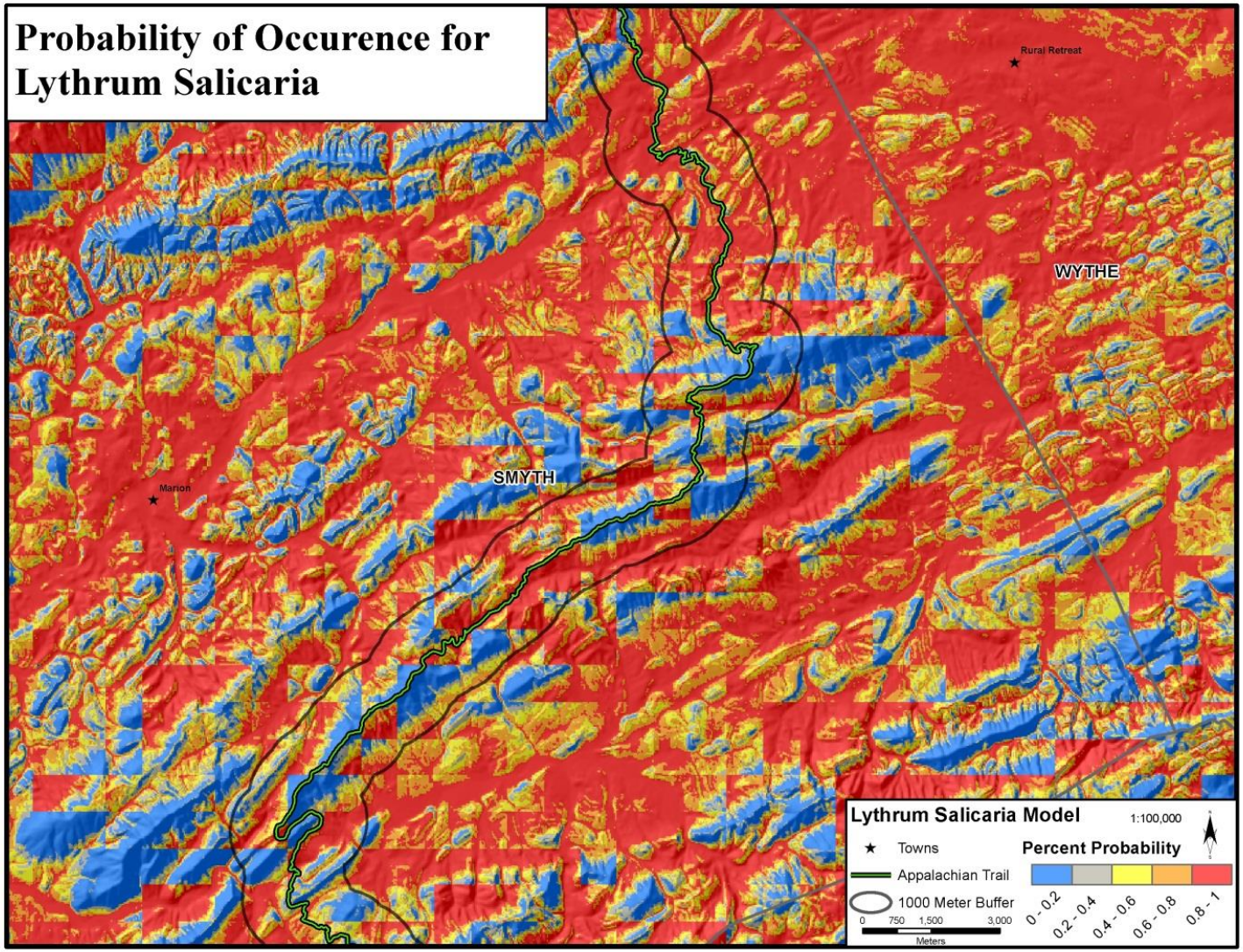

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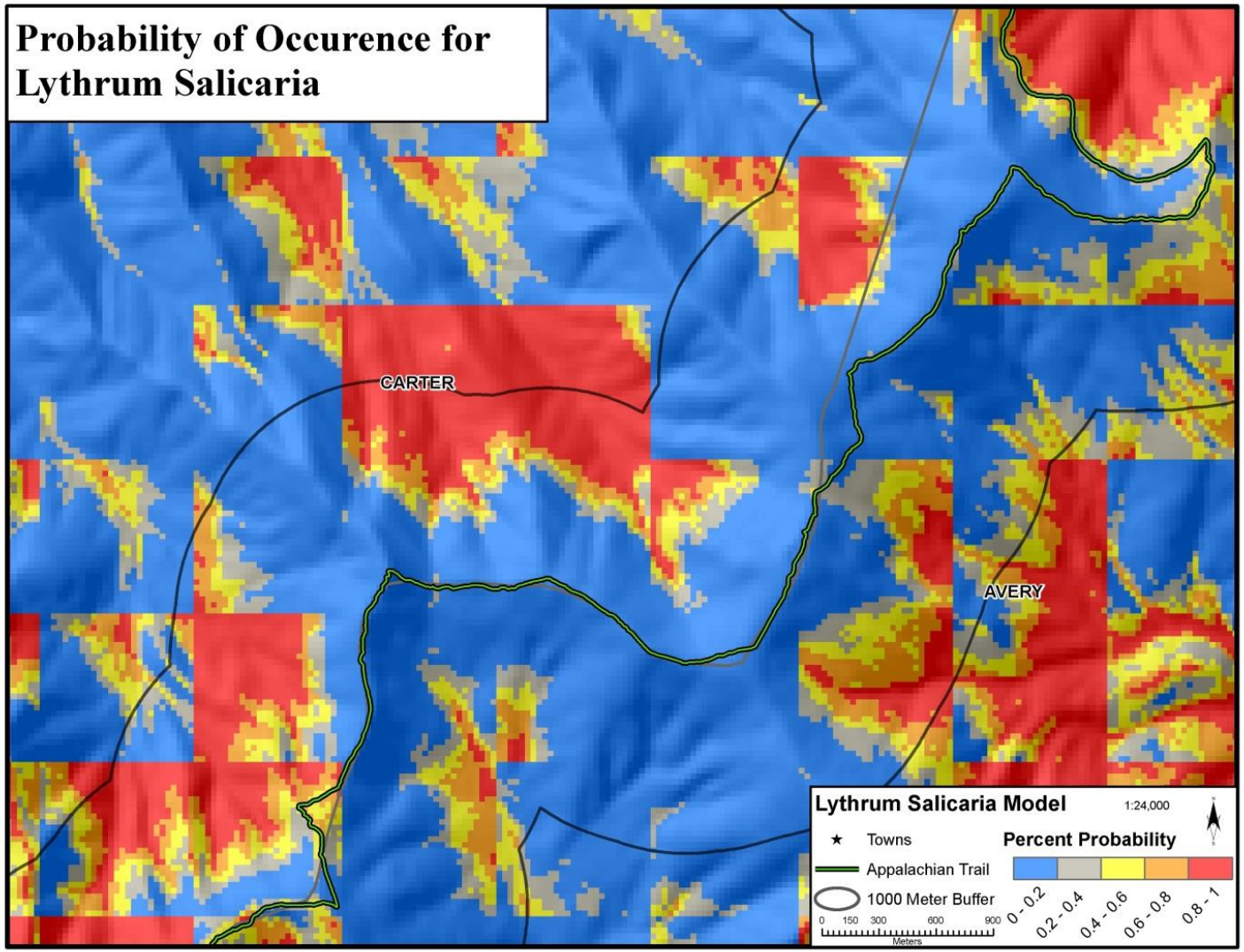
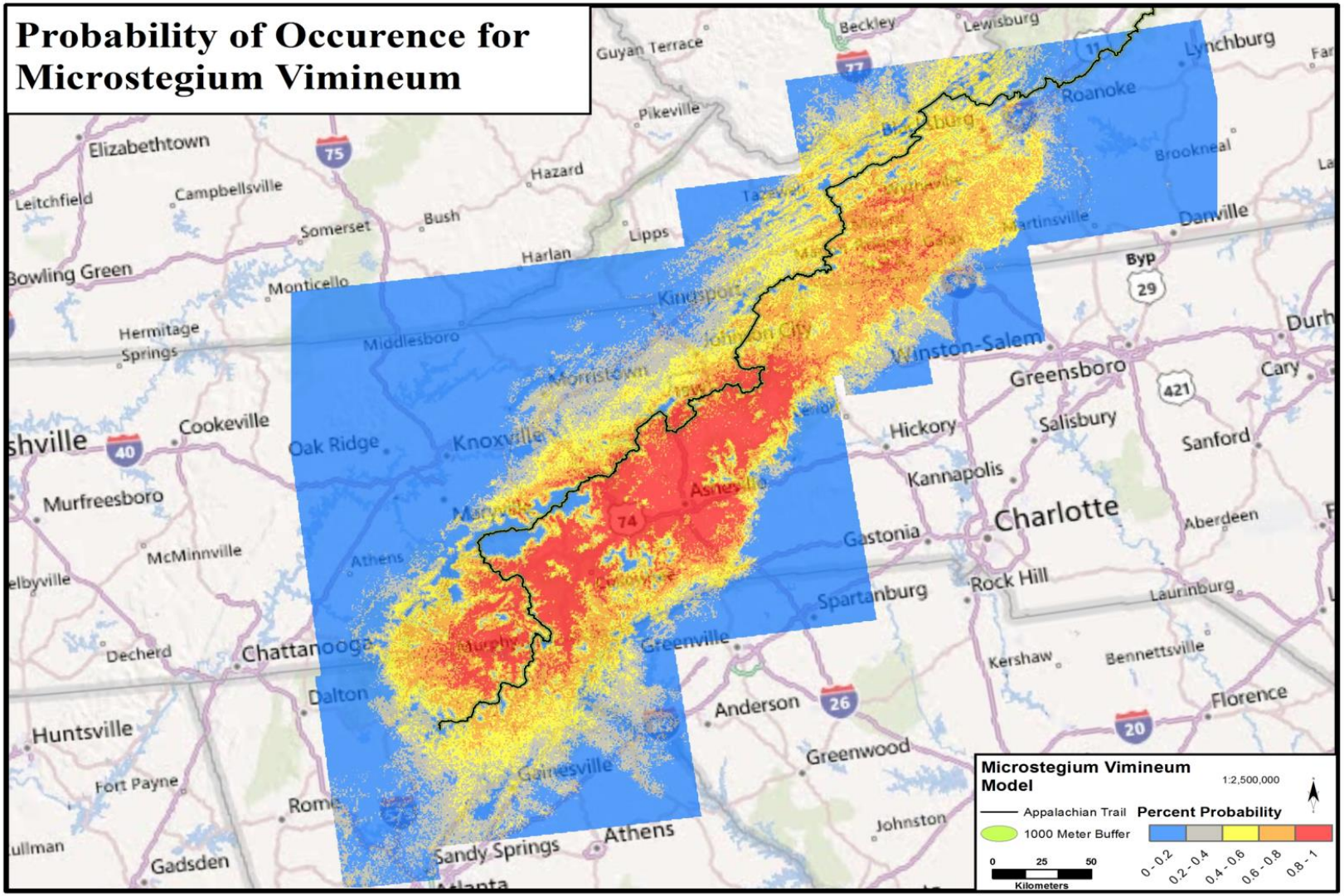


Results Species 3: Japanese Stilt Grass



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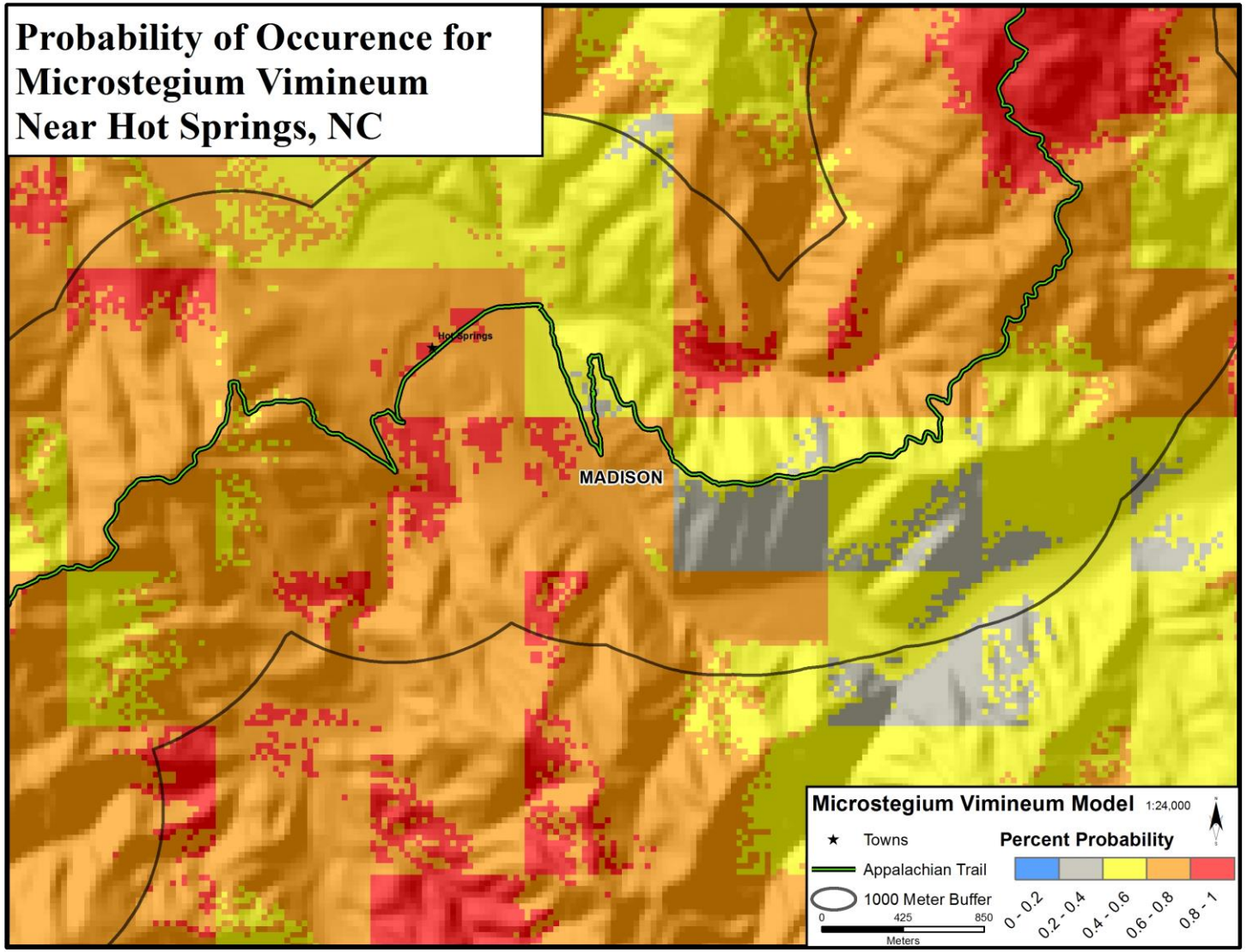

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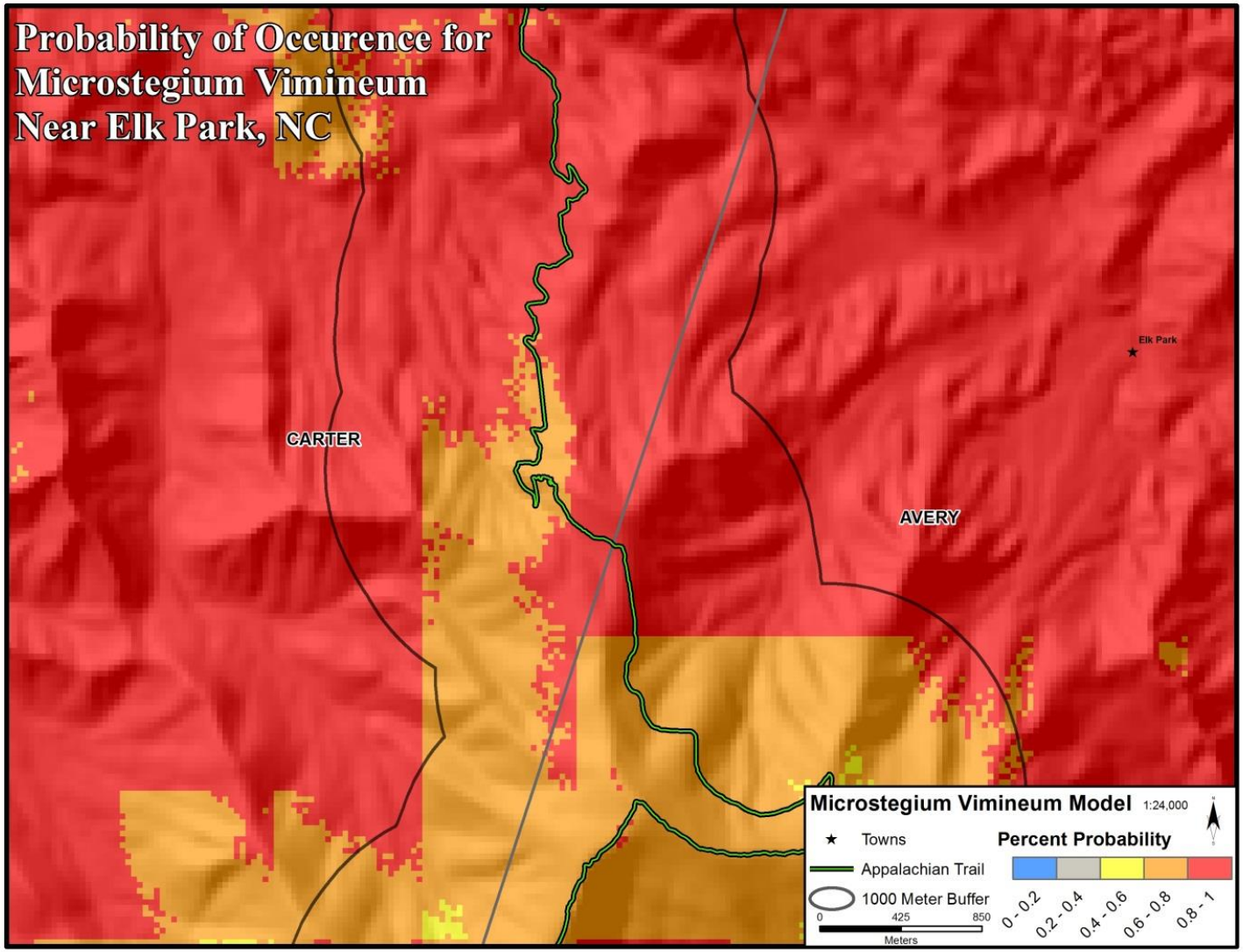

Summary of Findings

- The model results provide reasonable probabilities for the three species.
  - Human disturbance variables displayed varying importance.
    - impervious surface was only significant for *Ailanthus*, while distance to major roads was significant for the *Ailanthus* and *Microstegium* models.
  - Elevation was negatively related to *Lythrum* occurrence and was not significant for the two other species.
  - Slope was found to be positively related to *Ailanthus* occurrence and negatively related to the occurrence of *Lythrum*. Slope was not a significant variable in the *Microstegium* model.

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