

Habitat Suitability Model for a Rare Native Plant

Introduction

Polemonium vanbruntiae, commonly known as Easter Jacob's Ladder, is a native wildflower that is endemic to wetland habitats. It has been assigned a global rank of G3 (rare or uncommon globally) and is listed as threatened in the state of Vermont, where it is known to occur primarily in Addison County. Little work has been done regarding the conservation of this species, largely due to a lack of available information. One of the biggest practical obstacles facing the protection of Jacob's Ladder is simply that very few populations have been found, as they tend to occur in relatively remote areas. However, there appears to be a trend in the habitat characteristics of known populations. Of 9 studied populations, Jacob's Ladder occurs between the elevation range of 1000 and 2000 feet, typically in semi-open forested wetlands with glacial till.

Objective

The objective of this project is to develop a predictive model for potential habitats or reintroduction sites for *Polemonium vanbruntiae*. Based off of the known habitat parameters, potential sites where Jacob's Ladder may be able to survive can be identified through a systematic analysis with ArcGIS. The final results will allow conservation managers to search for unknown and unprotected populations in a more effective and efficient manner.

Data Layers

Source Data

Source	Layer Name	Scale	Raster/Vector
USGS	ElevationDEM_DEM24	1:24,000	Raster
VT ANR	WaterWetlands_VSWI	1:24,000	Vector
VT Geologic Survey	GeologicSurficial_Surficial62K	1:62,500	Vector
UVM Spatial Analysis Lab	CadastralPublands_CONSPUB	1:24,000	Vector
VT Center for Geographic Info	BoundaryCounty_CNTYBND	1:24,000	Vector

ElevationDEM_DEM24 contains data that VCGI extracted from NED and reprojected with the Vermont's SPCS NAD83. WaterWetlands_NWI contains quads from NWI that were reprojected to the NAD83 coordinate system. It gives the location and classifications of wetlands in Vermont. GeologicSurficial_Surficial62K shows surficial geology features for the state of Vermont. CadastralPublands_CONSPUB displays all of the conserved land in Vermont. BoundaryCounty_CNTYBNDS shows the boundaries of all counties in Vermont.

Created Data

Name	Description
Addison_County	Addison County selected from 'BoundaryCounty_CNTYBNDS', created layer from selection.
Optimal_Elevation_Clip	'ElevationDEM_DEM24' converted to vector, clipped to 'Addison_County',
Till_Clip	'GeologicSurficial_Surficial62K' clipped, selected for glacial till
Wetlands_Clip	'WaterWetlands_VSWI' clipped
Intersect_WC_TC_OEC	Intersection of 'Wetlands_Clip', 'Till_Clip', 'Optimal_Elevation_Clip'
10_meter_buffer	Buffer of 'Intersect_WC_TC_OEC'
Intersect_Sites_GMNF	'CadastralPublands_CONSPUB' clipped, selected for Green Mountain National Forest, intersected with '10_meter_buffer'
Sites_Outside_Bounds	Erased 'Intersect_Sites_GMNF' from '10_meter_buffer'
Priority1, Priority2, Priority3	Selected by attribute for area and created layers from highest 3

GIS Analyses

To begin, Addison County was selected from the 'BoundaryCounty_CNTYBNDS' layer. I created a layer from this selection and named it 'Addison_County'. This was used throughout the analysis to clip data to the study area of Addison County. I began the analysis with elevation. Optimal elevation for Jacob's Ladder is between 1000 and 2000 feet, so I utilized the raster calculator to select and create a layer from these values. I then converted these data to vector data and clipped the layer using 'Addison_County'. This created a layer that I named 'Optimal_Elevation_Clip'.

I clipped the layer 'GeologicSurficial_Surficial62K' to 'Addison_County' and Selected by Attribute for till, because Jacob's Ladder grows exclusively in sites with glacial till. This created the layer 'Till_Clip'. The layer 'WaterWetlands_VSWI' was also clipped to 'Addison-County' and was renamed 'Wetlands_Clip'. After this was accomplished, an Intersect command was used to intersect

'Optimal_Elevation_Clip', 'Till_Clip', and 'Wetlands_Clip'. This created a layer ('Intersect_WC_TC_OEC') that displayed areas of Addison County where all of these features occur concurrently. Because Jacob's Ladder often occurs at the edges of wetlands, I created a 10 meter buffer around the intersect layer and named it '10_meter_buffer'.

I wanted to examine the distribution of these potential habitat sites in relation to the Green Mountain National Forest, so I imported the layer 'CadastralPublands_CONSPUB' and clipped it to 'Addison_County'. I used the 'Select by Attribute' function to identify the areas of Green Mountain National Forest and created a layer ('GMNFBounds') from this. I then intersected this layer with '10_meter_buffer' to display the areas where potential habitat sites fall within the national forest ('Intersect_Sites_GMNF'). Because these areas are already protected, the most important habitat areas to conserve are those that lie outside the forest boundaries. To focus on these areas, I used an erase function where the '10_meter_buffer' was the input and 'Intersect_Sites_GMNF' was erased. This created a layer ('Sites_Outside_Bounds') that showed the potential habitat areas outside of Green Mountain National Forest. I then designated conservation priorities for these areas based on the area or size of potential sites by Selecting by Attribute (area) and created new layers for the sites with the 3 largest areas ('Priority1', 'Priority2', and 'Priority3').

Results

The results from this study revealed three key areas that should be evaluated for potential conservation sites. The largest priority area was 497.6 km², while priorities 1 and 2 were 231.8 km² and 171.9 km², respectively. These areas should be field tested to ensure that the predictability of the model was accurate, and conservation actions should be assigned as needed to preserve current or future habitat sites for this rare species.