Use of Predicted Suitable Habitats of Rare Species in an Environmental Review Tool

Joe Weber
Virginia Department of Conservation and Recreation
Division of Natural Heritage
Mission

To conserve Virginia's biodiversity through biological inventory, data management and analysis, protection, and stewardship.

Maintain a statewide database for:

- conservation planning
- environmental review
- land protection for the conservation of biodiversity
- the protection and ecological management of natural heritage resources
Sections

Information Management

Biodiversity data management

Conservation Lands Database

Conservation Planning Tools

Data Sharing and Dissemination

Inventory

Zoologists

Botanists

Ecologists

>35 years of data collection and analysis

Protection

Stewardship

Environmental Review

Zoologists

Botanists

Ecologists

NatureServe

BIOTICS5

Virginia Natural Landscape Assessment

Conservation Planning Tools

Data Sharing and Dissemination

Environmental Review
Conservation Site:
• is a non-regulatory boundary
• surrounds mapped elements
• includes habitat and buffer area

Natural Heritage Conservation Sites
EO, ConSites, and predicted suitable habitats are used in environmental review.
Previously, a project anywhere in these four counties would have triggered FWS consultation.

*Rhus michauxii* EOs
2 mile EO buffer
*R. michauxii* screening layer
*R. michauxii* Counties
Species Distribution Models = Habitat Suitability Model

Inputs:
- Known locations -> Presence points
- Background locations (pseudo-absence) -> Absence points
- Environmental Variables -> Predictor layers

Process:
- Inductive Method (specific to general)
- Random Forests in R statistical software
- 30m resolution

Output:
- Raster of probabilities (of similar conditions being present)
Present } Species Occurrence Data
Absent } Negative or Background Data

Environmental Variables (EV)

Extract Values

Build a Forest

Build thousands of trees, each from a different sample of training data.

Random Sample of Training Data

Species Occurrence Data

Negative or Background Data

Training Set

Grow a Tree

Training Data Sample

A different random selection of EV is used to find the best split at each node.

X for EV#3

X for EV#7

Best Split

X for EV#1

VOTING Probability

suitable habitat = # trees that label cell present / # trees

Predict

Run each unknown raster cell down each tree of the forest.

Class Label for 1 Tree

Example
(model uses all variables in selection)
88 Predictor Variables developed

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Derived EV</th>
<th>Source¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate – precipitation</td>
<td>11</td>
<td>PRISM</td>
</tr>
<tr>
<td>Climate – temperature</td>
<td>12</td>
<td>PRISM</td>
</tr>
<tr>
<td>Elevation and Derivatives</td>
<td>15</td>
<td>NED</td>
</tr>
<tr>
<td>Geology (distance to types)</td>
<td>13</td>
<td>SoilsGeo (TNC)</td>
</tr>
<tr>
<td>Hydrography</td>
<td>10</td>
<td>NHD, NHD+, NLCD, NED</td>
</tr>
<tr>
<td>Land cover – NLCD</td>
<td>24</td>
<td>NLCD</td>
</tr>
<tr>
<td>Land cover - NWI</td>
<td>3</td>
<td>NWI</td>
</tr>
</tbody>
</table>

- All at 30 m resolution
- Fully aligned with each other
- Covering full extent of study area

¹PRISM Climate Group; National Elevation Dataset; The Nature Conservancy; National Hydrography Dataset; National Land Cover Dataset; National Wetlands Inventory
Example of a Model Output and a Screening Coverage
Welcome to the Virginia Department of Conservation and Recreation’s

**Natural Heritage Data Explorer**

This site provides interactive access to various map data representing Natural Heritage resources and other conservation values in Virginia.

**ConserveVirginia**, Virginia’s statewide land conservation plan, is now available here.

The Virginia Natural Heritage Data Explorer was updated on May 20, 2019. To ensure the updates work correctly, we recommend refreshing your browser’s cache. Instructions can be found here: [https://www.refreshyourcache.com/en/home/](https://www.refreshyourcache.com/en/home/)

This site should be viewed in Firefox version 3.6 or higher. Google Chrome, or Safari version 3 or higher, or Internet Explorer 10 or higher.

**Open Access:** You do not need to register for use, nor log in, if you are interested in using the site for land use planning or conservation planning. Anyone can freely view and create maps of conservation status and conservation values, by clicking the “Map” tab above. Click the “Species/Communities Search” tab to search our database and create summaries of Natural Heritage Resources (i.e., rare species populations and natural communities) by conservation status ranks, counties, watersheds, and other descriptors.

**Subscription Access:** A subscription is required to access additional sensitive Natural Heritage Resources data, and/or to use the site for project review. If you represent a company, conservation organization or government agency looking for this service, please send an email with contact information and how your organization or company will utilize the website to [nhdrregister@dcr.virginia.gov](mailto:nhdrregister@dcr.virginia.gov). We will respond to your request within 5 business days.
Environmental Review

- Projects are screened for direct intersections with this version of the PSHS
Projects are screened for intersections with 100 ft. buffer

- New buffer—because of the PSHS!
- Also stopped using GLNHR
Fields marked with red asterisks are required fields.

Project Title *

Enter a descriptive and brief title for this project.

User Project Number(s)

Organization-specific project number(s) for user tracking purposes (optional)

Project Description *

Site Conditions *

Contact Name *

Joe Weber

Tax ID

Organization *

Virginia Natural Heritage Program
PROJECT INFORMATION

TITLE: Hellbender Highlands

DESCRIPTION: Wind farm--200-400 units.

EXISTING SITE CONDITIONS: Vacant land--nothing but trees.

QUADRANGLES: Williamsville

COUNTIES: Bath, Highland

Latitude/Longitude (DMS): 38° 13' 15.6907" N / 79° 34' 54.868" W

Acreage: 32 acres

Comments: This Tier I report is for a presentation.

REQUESTOR INFORMATION

Priority: N Tier Level: Tier I Tax ID:

Contact Name: Joe Weber

Company Name: Good Guys Consulting LLC
<table>
<thead>
<tr>
<th>Conservation Site</th>
<th>Site Type</th>
<th>Rank</th>
<th>Average</th>
<th>Listed Species</th>
<th>Presence</th>
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<tbody>
<tr>
<td>BURNVILLE COVE</td>
<td>Conservation Site</td>
<td>B2</td>
<td>5295</td>
<td></td>
<td>FL</td>
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<tr>
<td>SUMMERS MOUNTAIN TO BULLPASTURE GORGE</td>
<td>Conservation Site</td>
<td>B2</td>
<td>7020</td>
<td></td>
<td>FL</td>
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<tr>
<td>BULLPASTURE RIVER SCU</td>
<td>SCU</td>
<td>B2</td>
<td>31</td>
<td></td>
<td>FL</td>
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</tbody>
</table>

Natural Heritage Screening Features Intersecting Project Boundary

**Intersecting Predictive Models**
- Karst Bedrock
- Rusty-patched Bumble Bee
- Virginia Big-eared Bat
- A Freshwater Snail
- Little Brown Bat
- Northern long-eared Myotis
- Tricolored Bat
- Indiana Bat
- James Spinymuscle
- Northeastern Bulrush

**Predictive Model Results**
<table>
<thead>
<tr>
<th>Conservation Site</th>
<th>Site Type</th>
<th>Rank</th>
<th>Acres</th>
<th>Listed Species Presence</th>
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<tbody>
<tr>
<td>BURNVILLE COVE</td>
<td>Conservation Site</td>
<td>B2</td>
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<td>SUMMERS MOUNTAIN TO BULLPASTURE GORGE</td>
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<tr>
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<td>SCU</td>
<td>B2</td>
<td>31</td>
<td>FL</td>
</tr>
</tbody>
</table>

**Natural Heritage Screening Features Intersecting Project Boundary**

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Group Name</th>
<th>Common Name</th>
<th>Scientific Name</th>
<th>GRANK</th>
<th>SRANK</th>
<th>Fed Status</th>
<th>Species of Concern</th>
<th>State Status</th>
<th>EO Rank</th>
<th>Last Obs Date</th>
<th>Precision</th>
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</thead>
<tbody>
<tr>
<td>SUMMERS MOUNTAIN TO BULLPASTURE GORGE</td>
<td>Invertebrate Animal</td>
<td>Riverine Tiger Beetle</td>
<td>Cicindela anoccidentis</td>
<td>G3</td>
<td>S2</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>G1</td>
<td>1995-07-14</td>
<td>S</td>
</tr>
<tr>
<td>SUMMERS MOUNTAIN TO BULLPASTURE GORGE</td>
<td>Terrestrial Natural Central Appalachian Community</td>
<td>Pitch Pine Bog</td>
<td>Pinus rigida / Comandrastrum cinnamomeum - Carex stricta - Enophorum virgicinus / Sphagnum spp. / Wooded Herbaceous Vegetation</td>
<td>G1</td>
<td>S1</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>G1</td>
<td>2013-06-13</td>
<td>S</td>
</tr>
</tbody>
</table>

**Natural Heritage Resources Intersecting Project Boundary**

**Interesting Predictive Models**

- Karet Bedrock
- Rusty-patched Bumble Bee
- Virginia Big-eared Bat
- A Freshwater Snail
- Little Brown Bat
- Northern long-eared Myotis
- Tricolored Bat
- Indiana Bat
- James Spinymussel
- Northeastern Bulrush
Environmental Review Coordination

Challenges:
- VNHP using reduced intersection buffer (100 ft.) for documented occurrences plus direct intersection with PSHS
- VDGIF still using 2-mile buffer for documented observations; not using models for review
- USFWS still using county method for many species
  - Because many models have not yet been reviewed by USFWS experts
  - Because USFWS not comfortable with update frequency
- USFWS in some cases required to use alternate models

Solutions:
- Continue discussions
- USFWS has resumed model reviews
- Update compromise proposed
  - Update when new occurrences not covered by existing models
- VNHP developing composite models to be used by both entities
Richness of At Risk Species

Based on modeled habitat for G1 (critically imperiled), G2 (imperiled), and federally listed vascular plants, vertebrates, pollinating insects, and select aquatic invertebrates

Map of Biodiversity Importance

A collaborative effort to identify the places most important for conserving at-risk species

- Over 2,600 detailed species habitat maps
- Support better management of individual at-risk species
- Reduce regulatory conflict

Network Modeling Programs
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Conserving Virginia's biodiversity through inventory, information management, protection, and stewardship