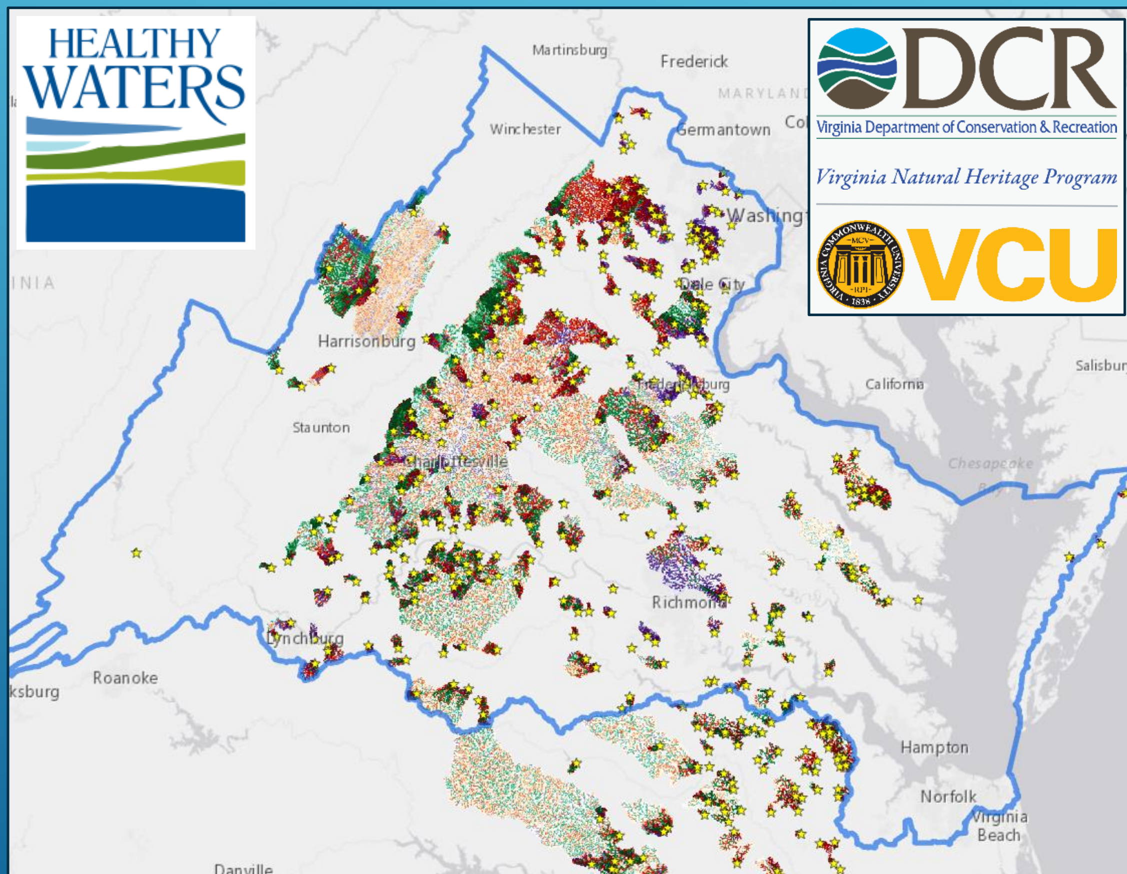
A prioritization model for maintaining Healthy Waters in Virginia

Maintain Healthy Watersheds GIT Meeting, February 8, 2021

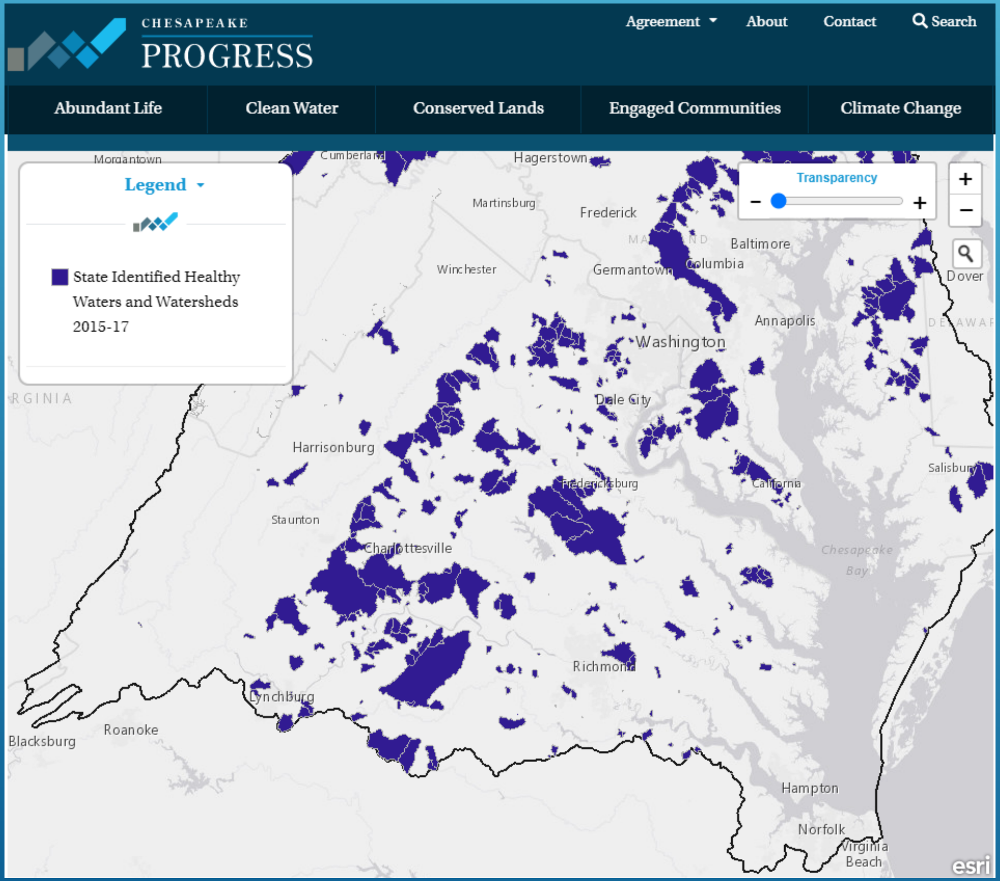


Presenter: Dr. Kirsten Hazler (kirsten.hazler@dcr.virginia.gov)

Goals

CBP desired outcome:

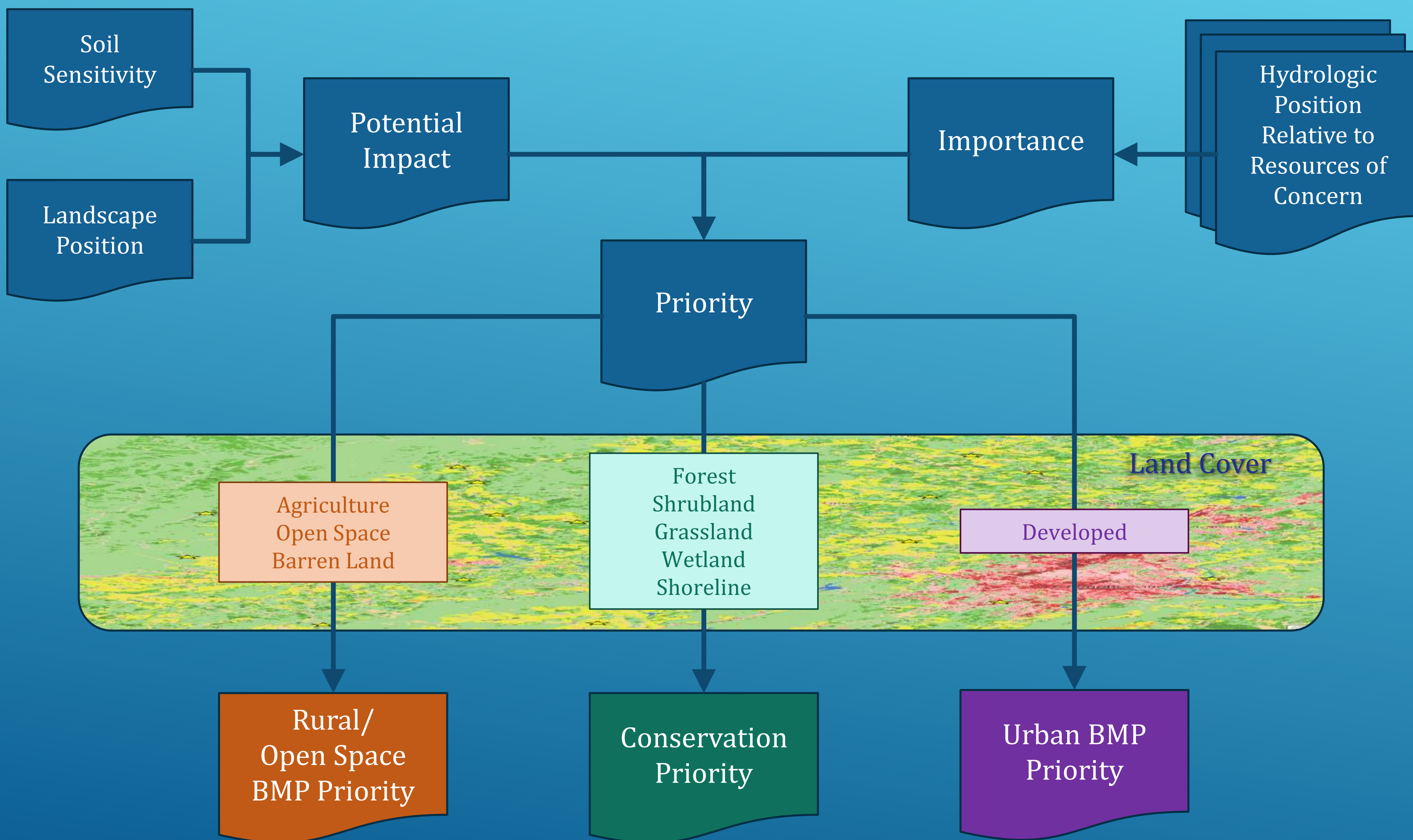
100% of state-identified currently healthy waters and watersheds remain healthy



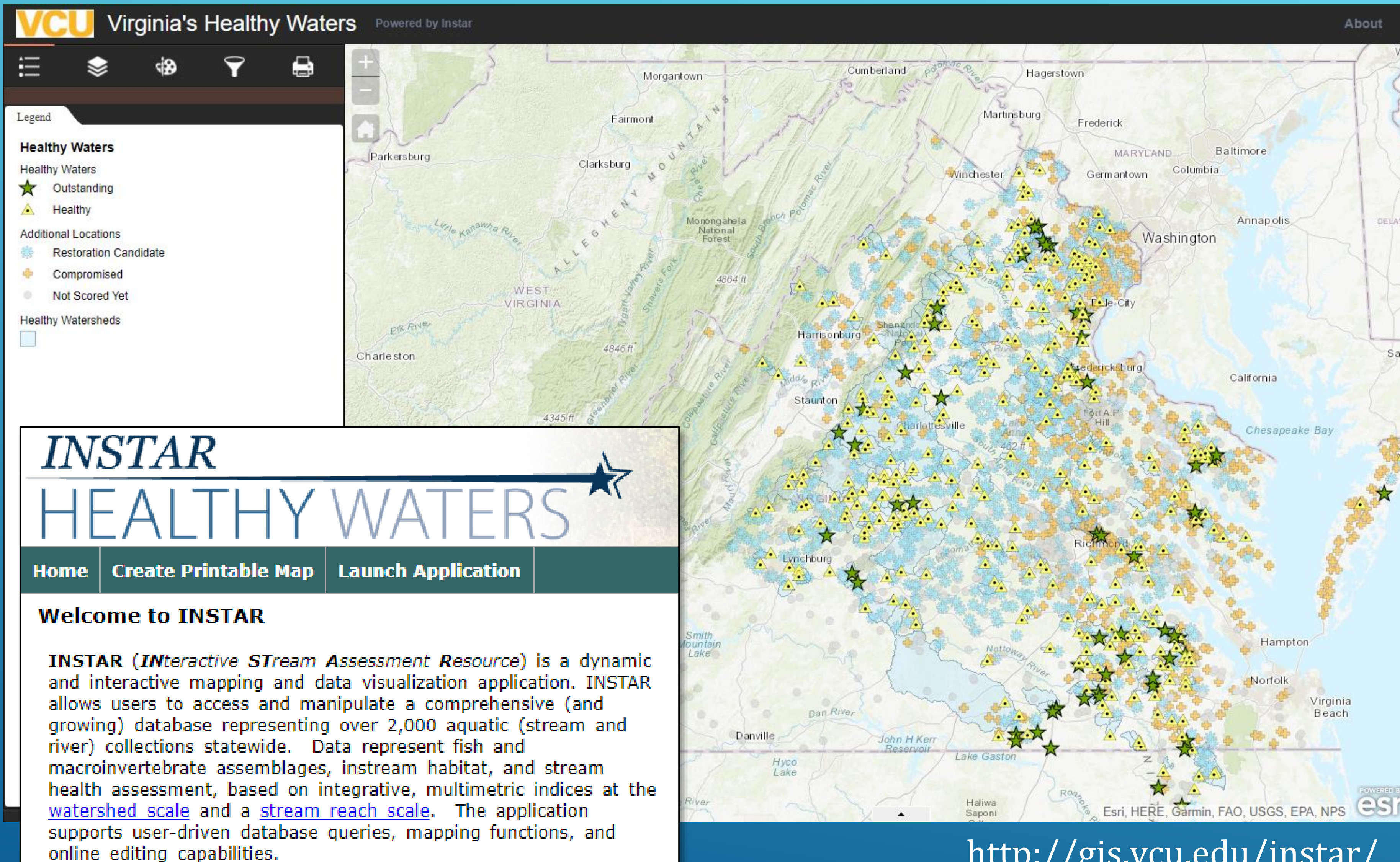
Prioritization model goals:

- Identify lands most important for protecting Virginia’s Healthy Waters
- Prioritize areas on the land where activities are likely to have the greatest impact on aquatic resources
- Help target lands for conservation and BMPs at landscape scales

ConservationVision Watershed Protection Model 2021 Update (Draft)



Identifying Resources of Concern



http://gis.vcu.edu/instar/

Relative Importance

For each Healthy Waters site, we delineated drainages at multiple scales:

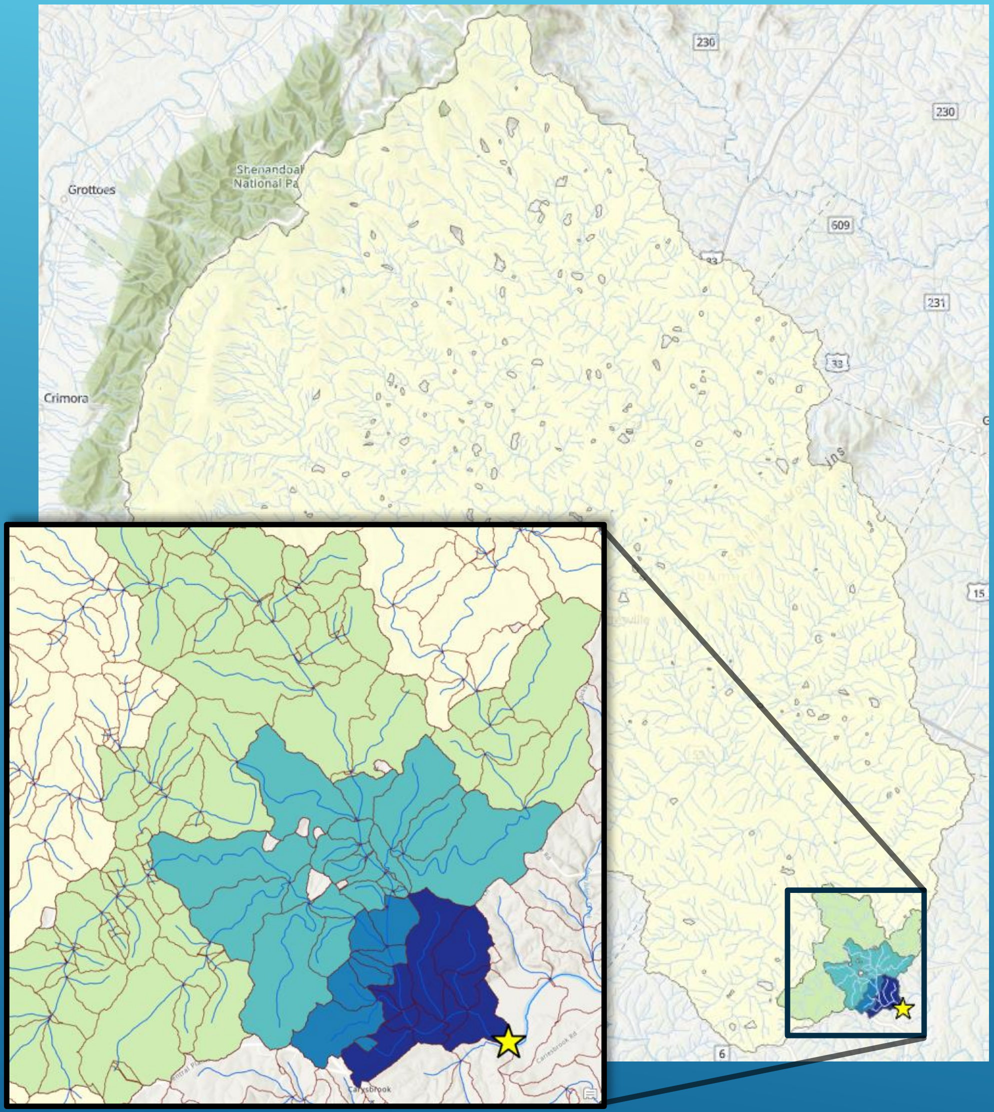
- **Entire drainage**
- **10-km upstream**
- **5-km upstream**
- **3-km upstream**
- **2-km upstream**

Importance

Assumption:

- Areas hydrologically closer to a HW site are more important than those farther away

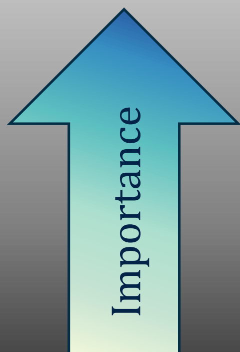
NHDPlus-HR flowlines and catchments used for drainage delineation



Relative Importance

We counted drainage overlaps from all HW sites, and rescaled sums to importance scores.

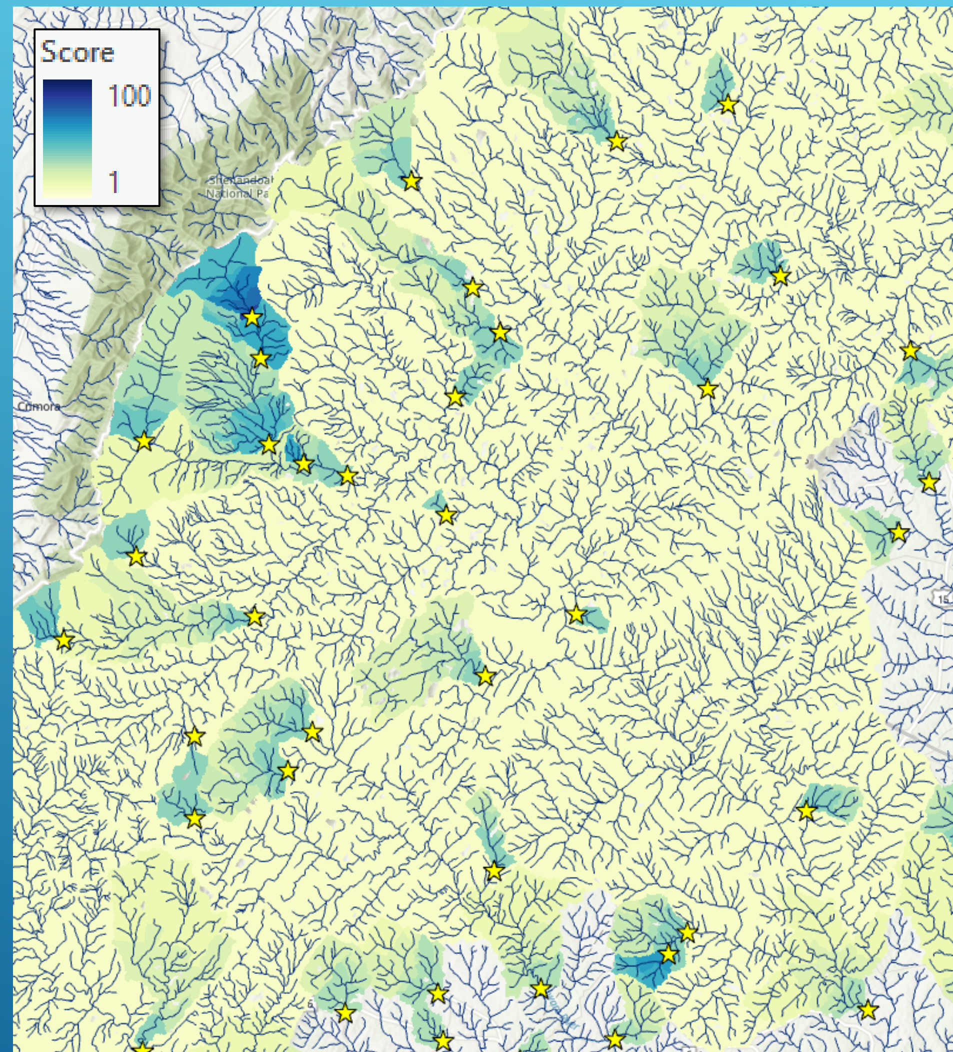
- **Multiple scales, many sites**



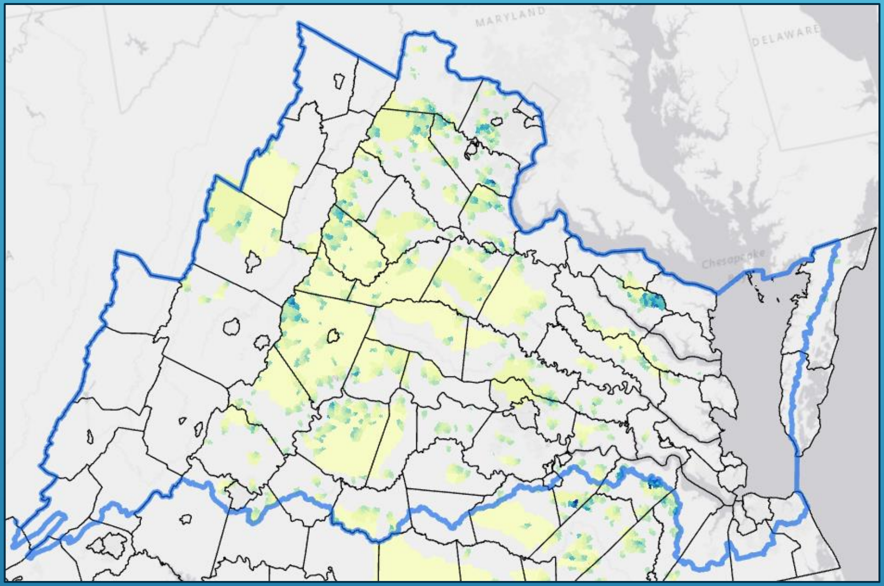
- **Single scale, single site**

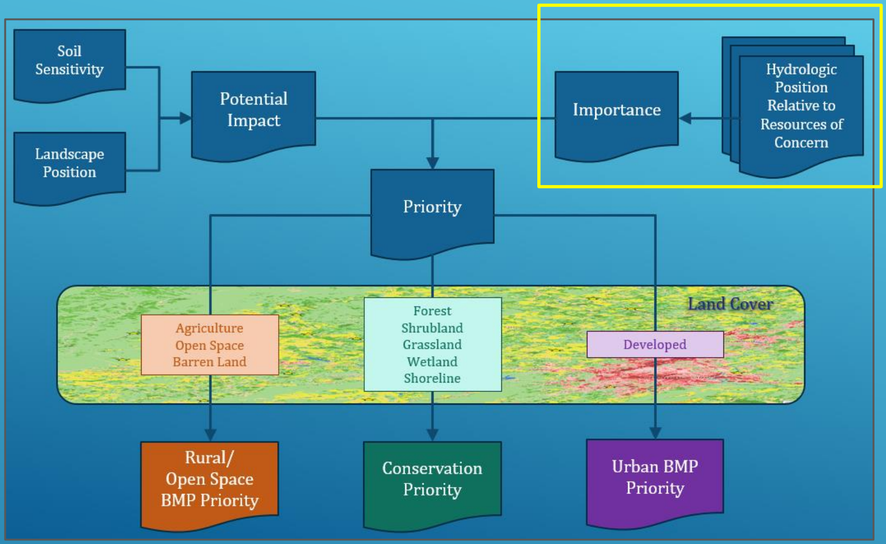
Assumption:

- Catchments contributing to multiple HW sites at multiple scales are more important than those contributing to a single site at a single scale



Relative Importance

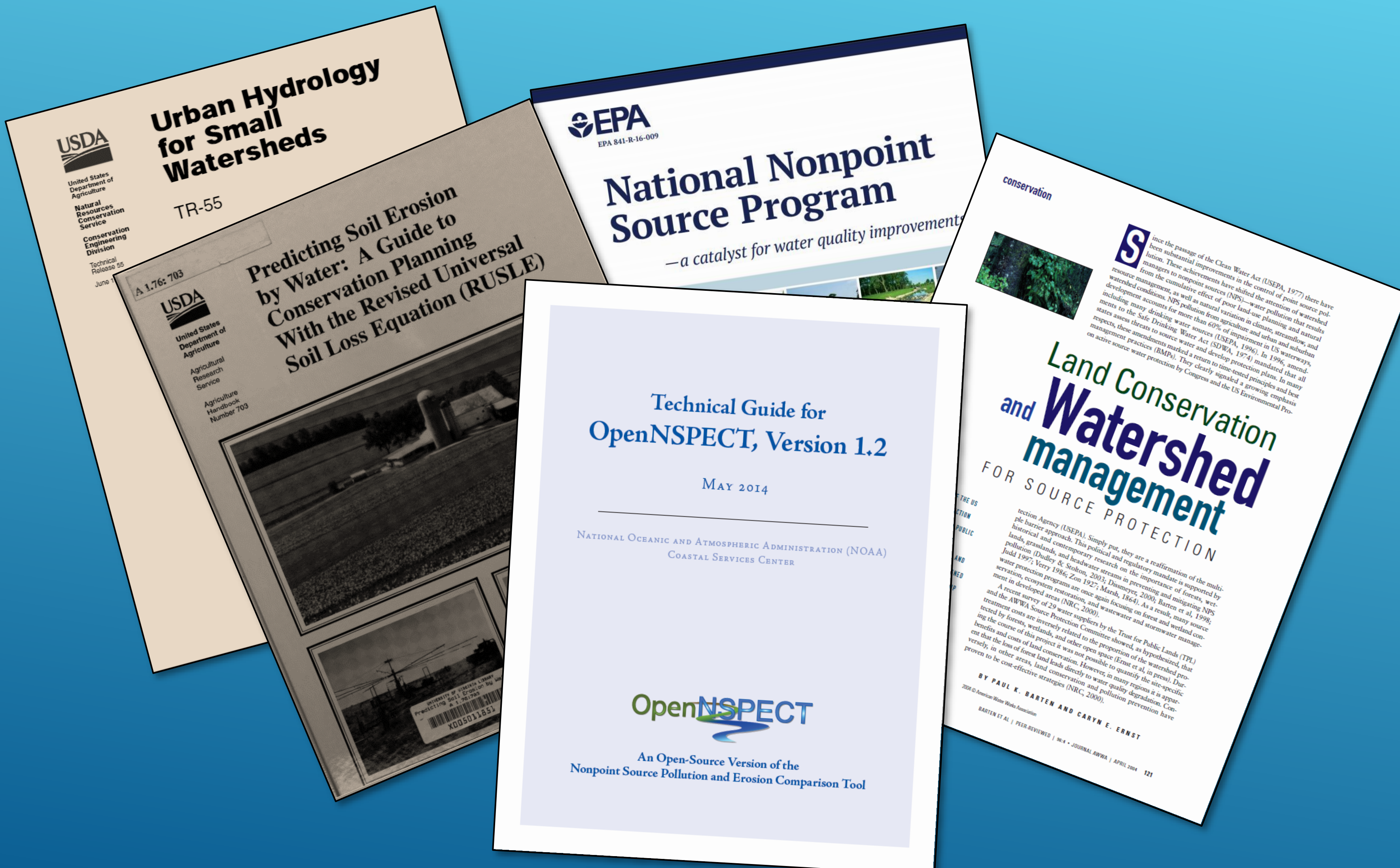




Note:

“Importance” is limited by sampling effort; only documented healthy sites contribute to score.

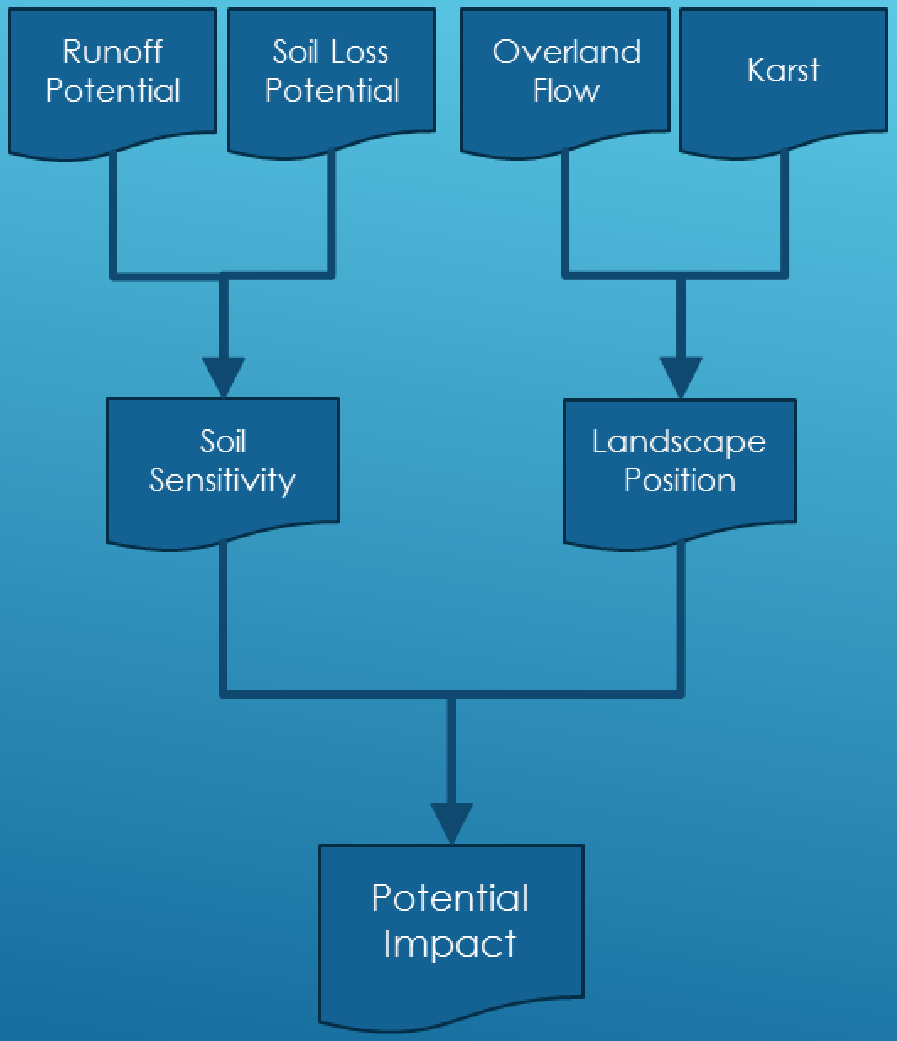
ConservationVision Watershed Protection Model
Guiding Documents



Watershed Protection: Calculating Potential Impact

Potential impact depends on:

- Equations and coefficients from OpenNSPECT program
- Precipitation
- Soil type
- Slope steepness
- Overland flow length
- Prevalence of karst



Soil Sensitivity: Runoff Potential

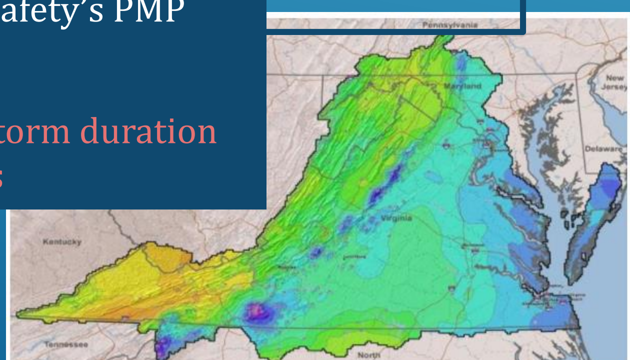
Runoff Curve Number (CN)

- Soil: Hydrologic group from gSSURGO
- Land cover: Assumed barren land

OpenNSPECT
An Open-Source Version of the Nonpoint Source Pollution and Erosion Comparison Tool

Probable Maximum Precipitation (PMP)

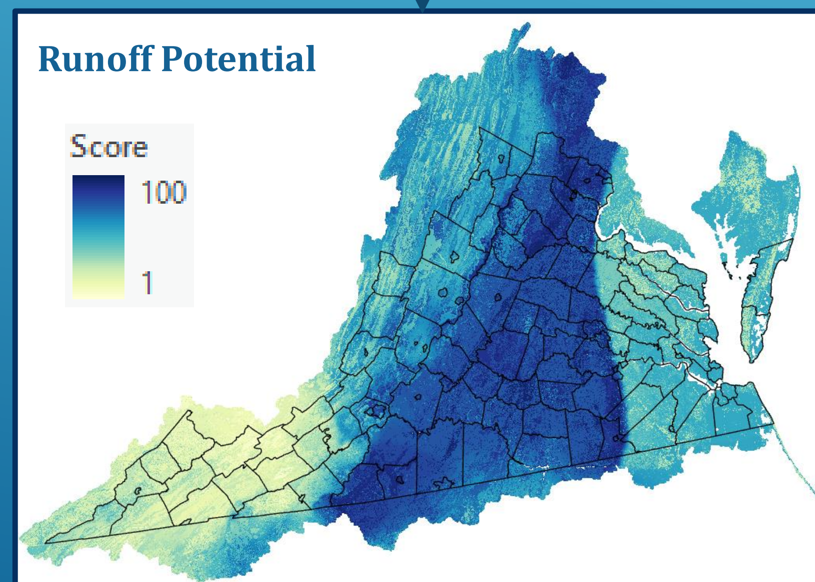
- DCR Dam Safety's PMP tool
- Assumed storm duration of 24 hours



Probable Maximum Precipitation Study for Virginia and Associated PMP Evaluation Tool and Database (November 2015)

Estimate runoff volume:
SCS Runoff Equation

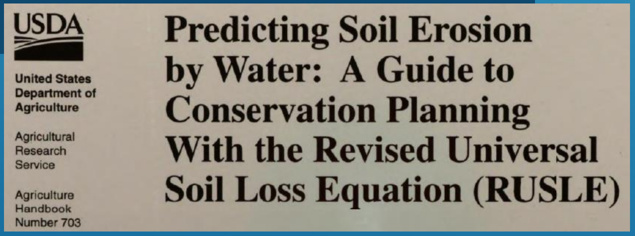
Rescale volume to score
(max volume = 100)



Soil Sensitivity: Soil Loss Potential

Revised Universal Soil Loss Equation (RUSLE) factors

- R-factor: Rainfall/erosivity (OpenNSPECT)
- K-factor: Soil erodibility (gSSURGO)
- S-factor: Slope steepness (3DEP)
- C-factor: Cover management (OpenNSPECT, assuming barren land)
- L-factor: Slope length (not included)
- P-factor: Supporting practices (not included)


USDA

United States Department of Agriculture

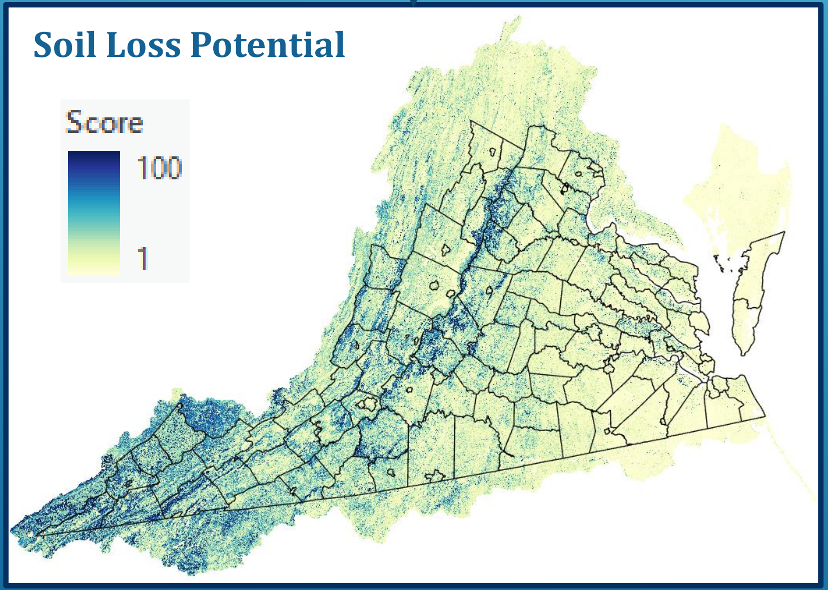
Agricultural Research Service

Agriculture Handbook Number 703

Predicting Soil Erosion by Water: A Guide to Conservation Planning With the Revised Universal Soil Loss Equation (RUSLE)

Multiply RUSLE factors (R*K*S*C)

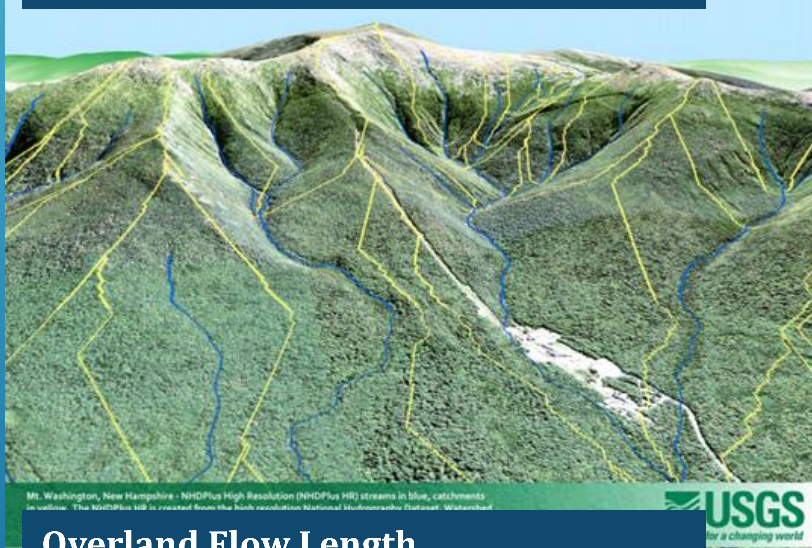
Rescale product to score (max soil loss = 100)



Landscape Position: Overland Flow

Headwaters

- Presence within a headwater catchment (NHDPlus-HR)

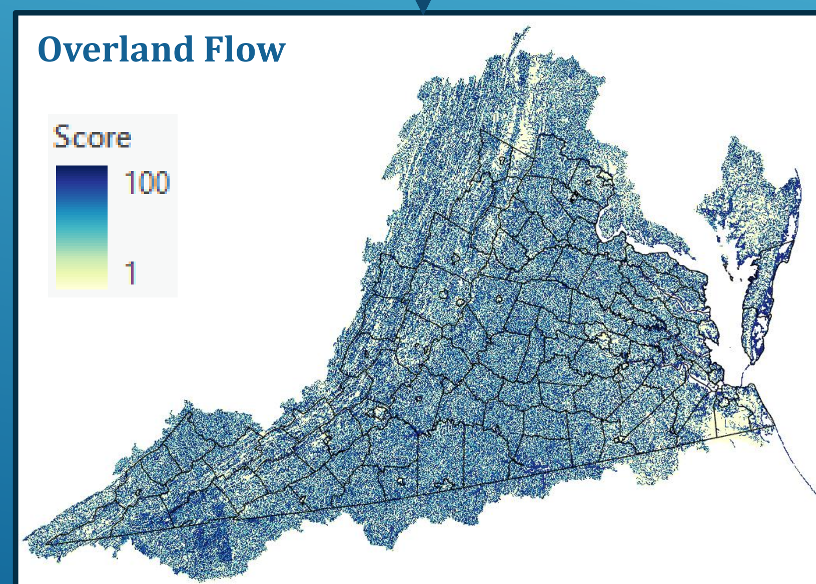


Overland Flow Length

- Distance along flow path to stream, river, or water body (NHDPlus-HR)

Rescale flow length to score (adjacent to water = 100)

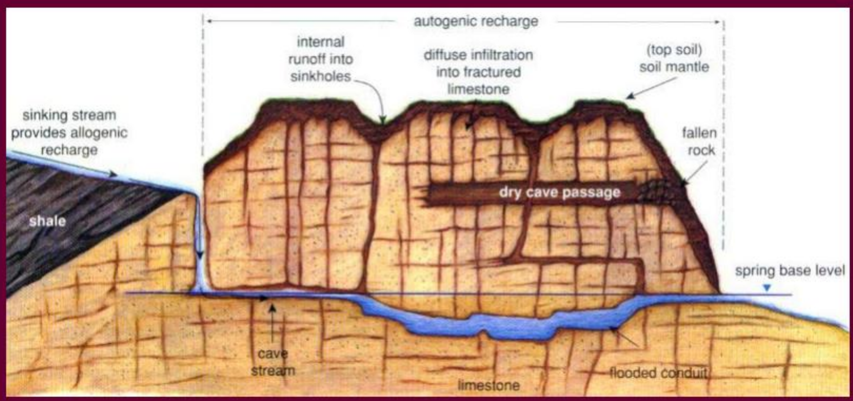
Discount score (x 90%) for areas outside of a headwater catchment



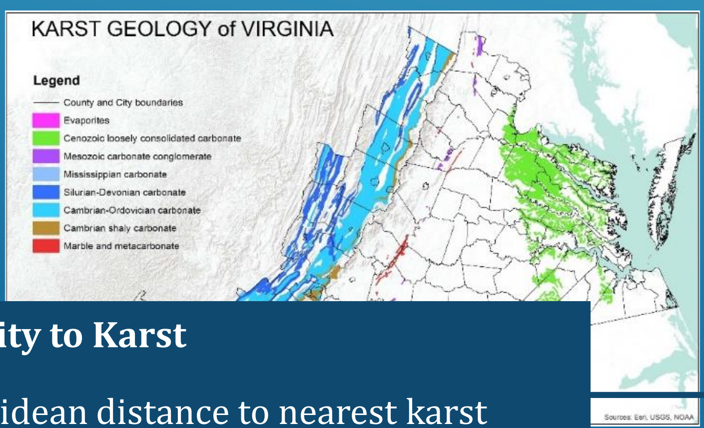
Landscape Position: Karst

Prevalence of Sinkholes

- Kernel density of sinkholes (DMME)



Cross-section diagram by David Culver, American University.



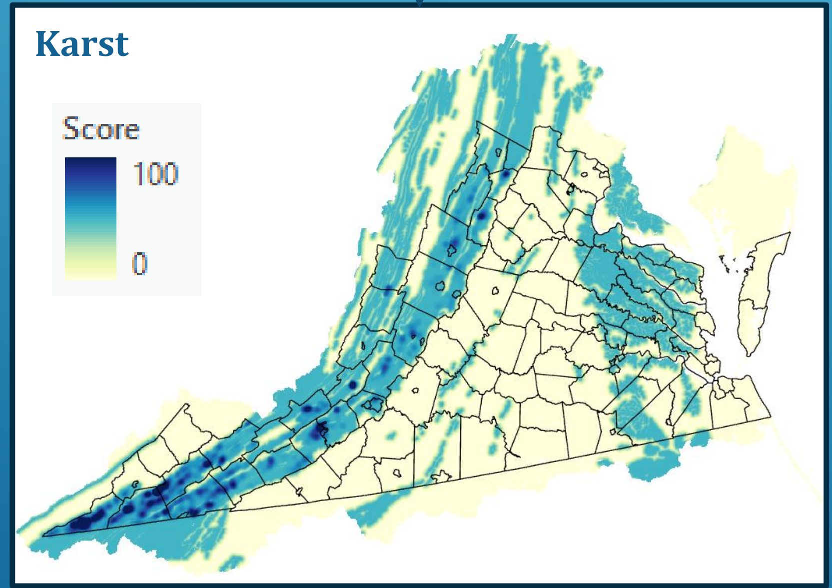
Proximity to Karst

- Euclidean distance to nearest karst geology (Weary & Doctor 2014)

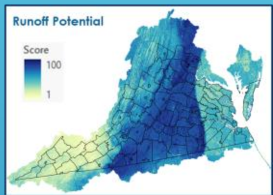
Rescale sinkhole density to score (max density = 100)

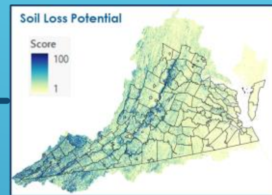
Rescale karst distance to score (adjacent to karst = 100)

Calculate mean score

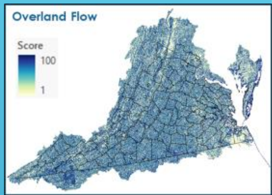


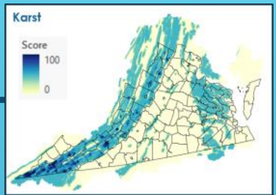
Potential Impact: Soil Sensitivity and Landscape Position



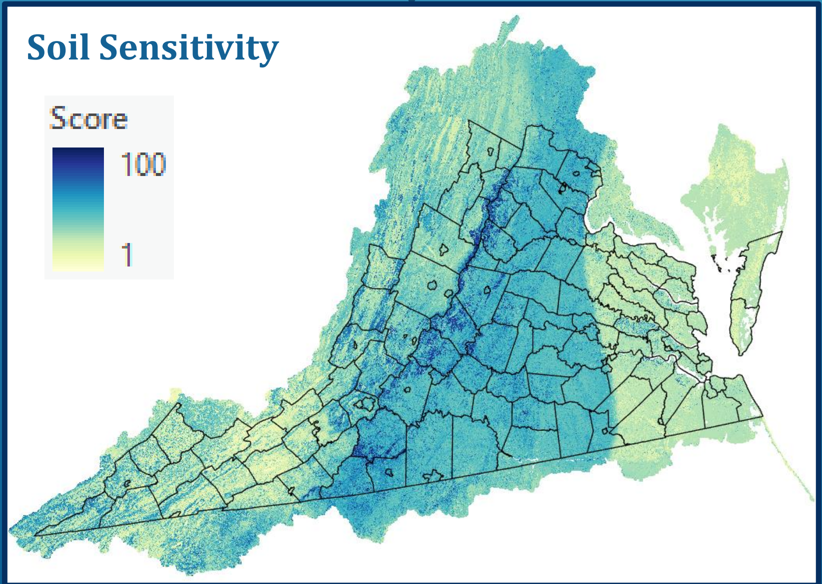


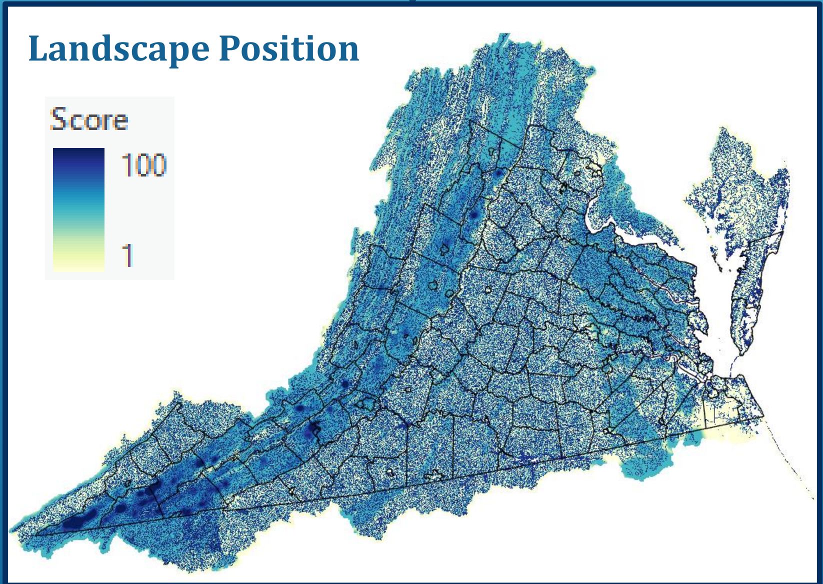
Calculate Mean



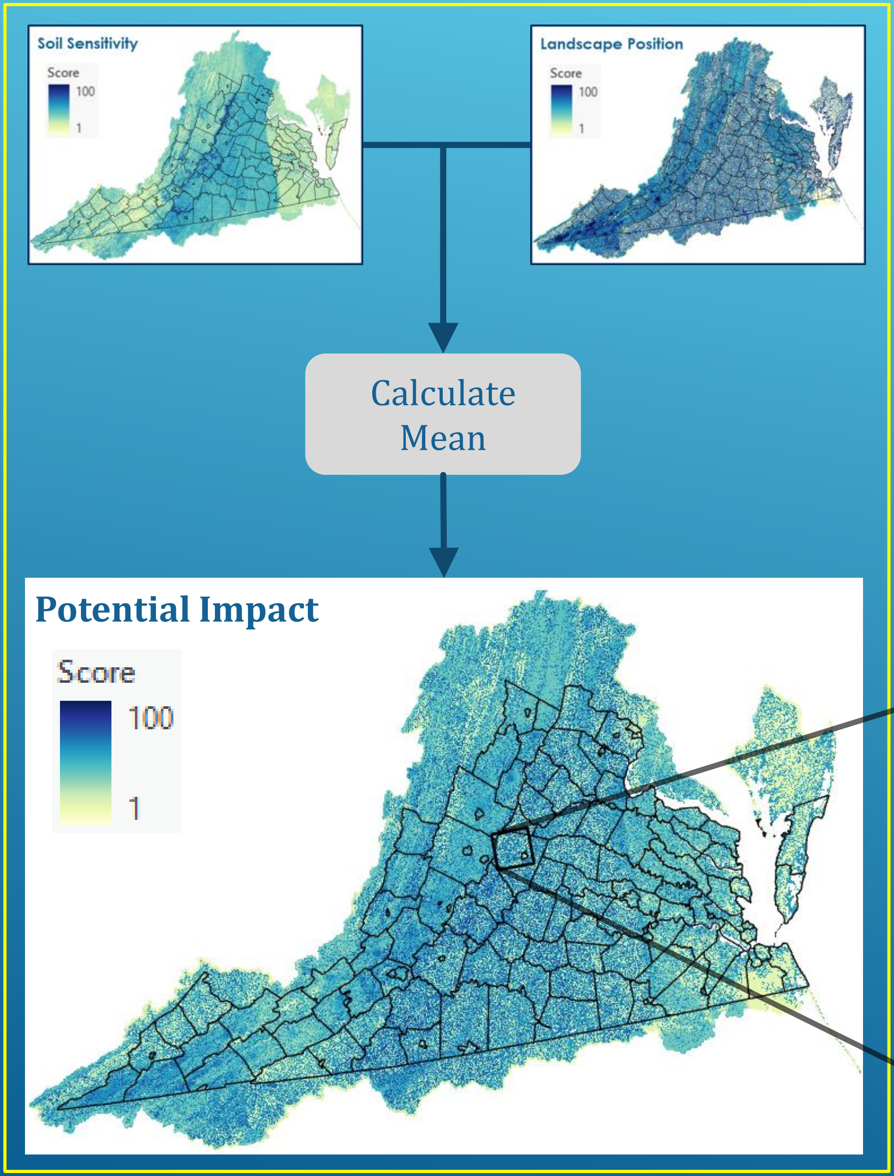


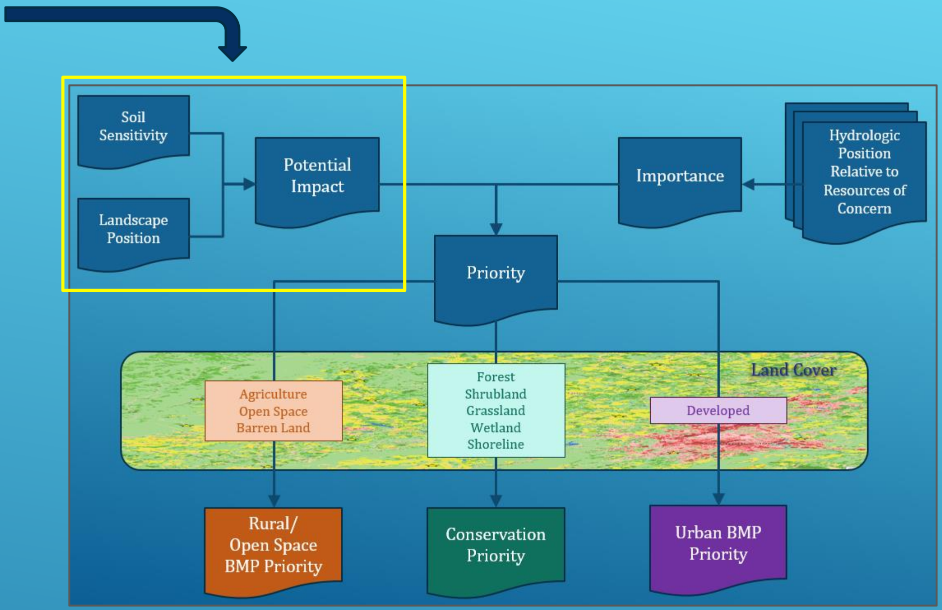
Calculate Maximum

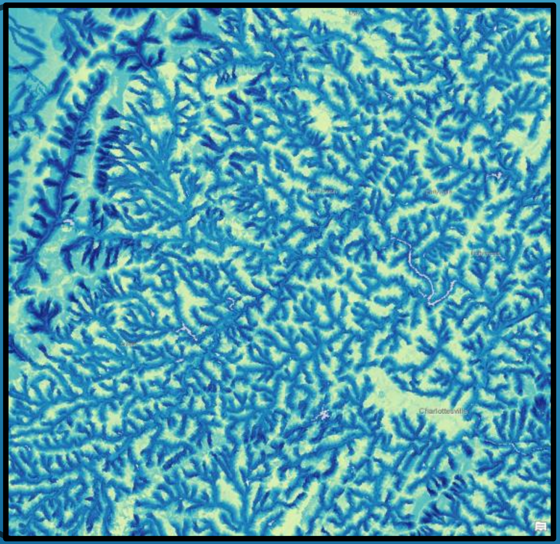




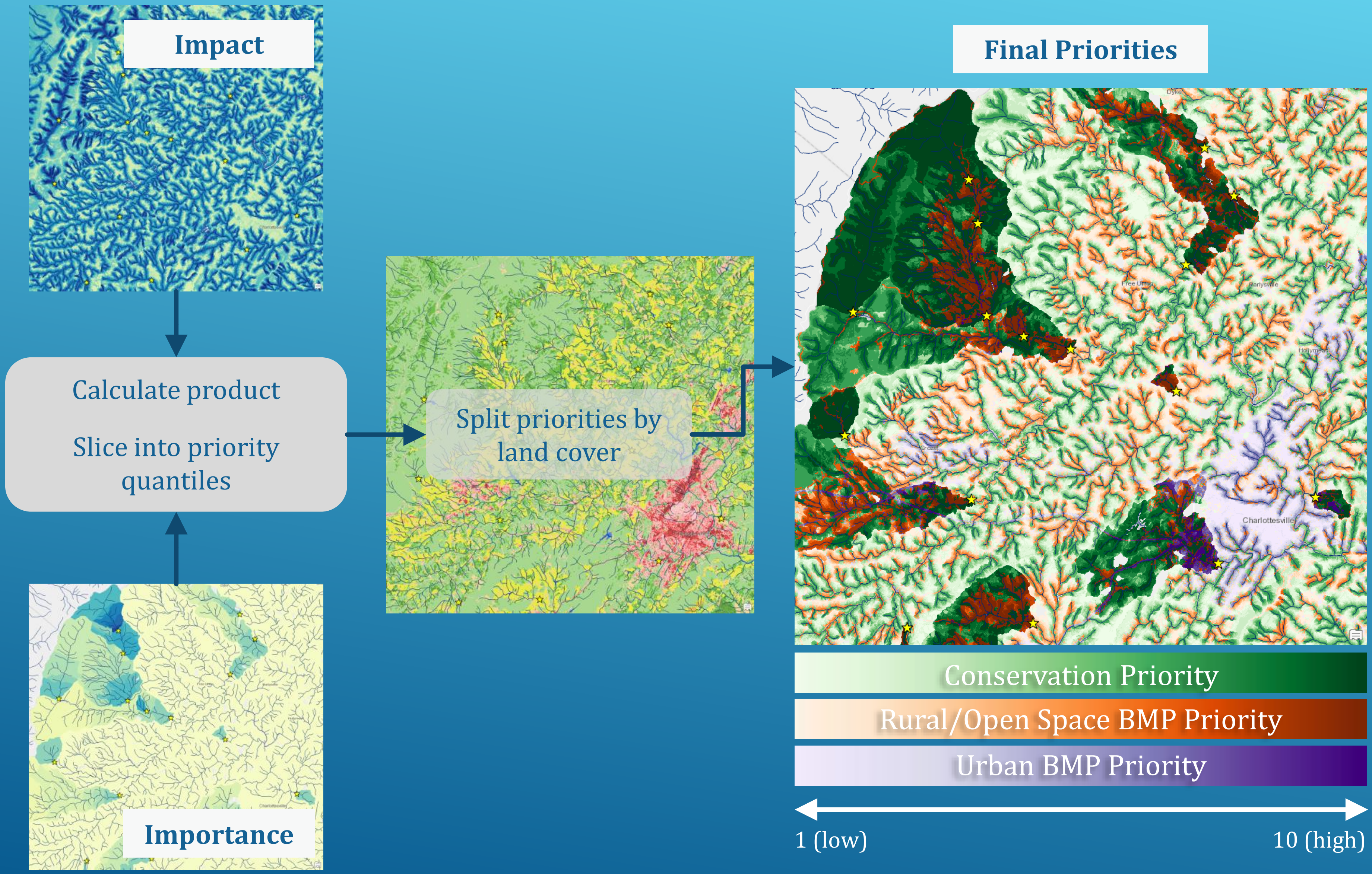
Potential Impact





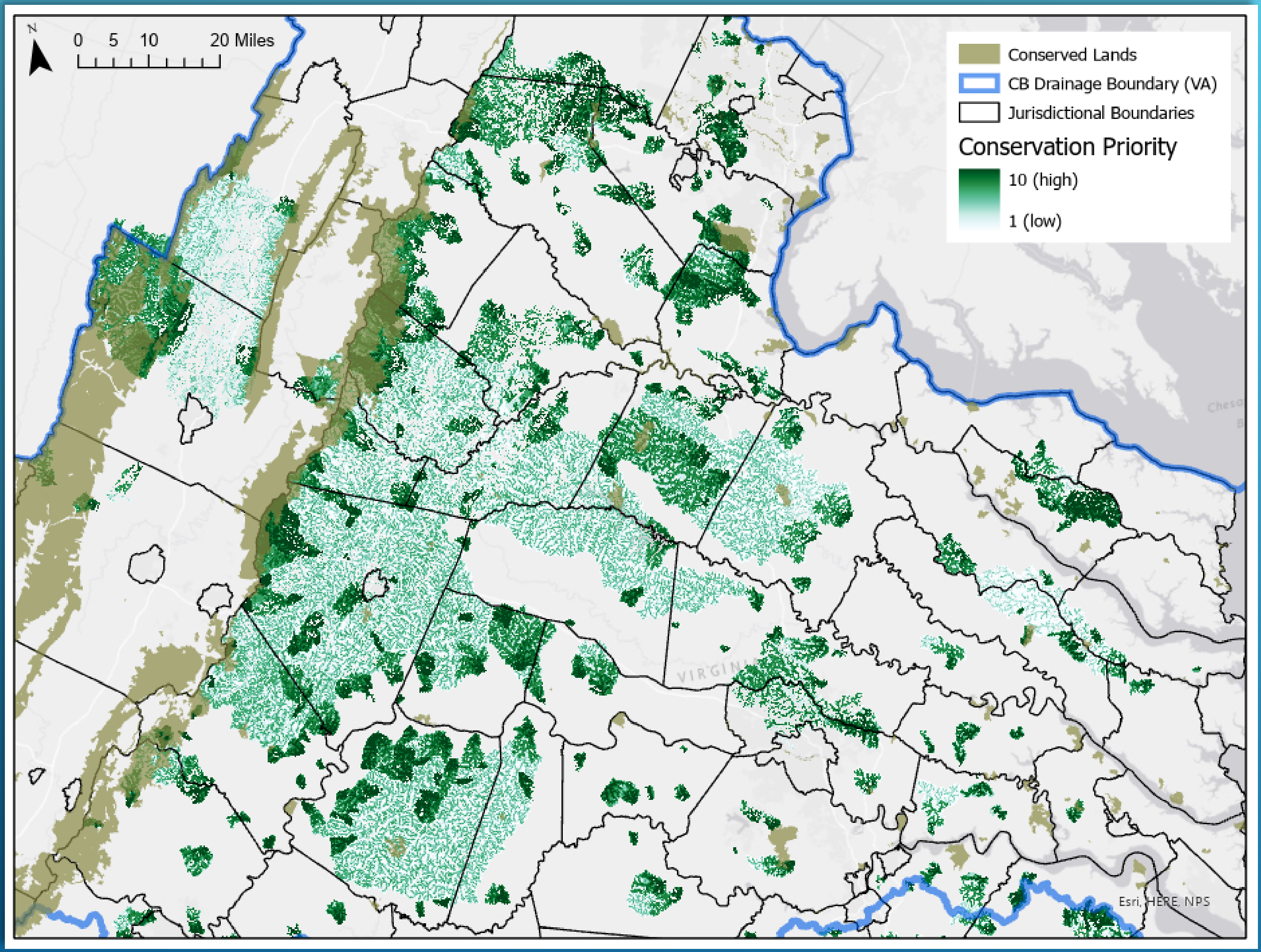


Final Prioritization

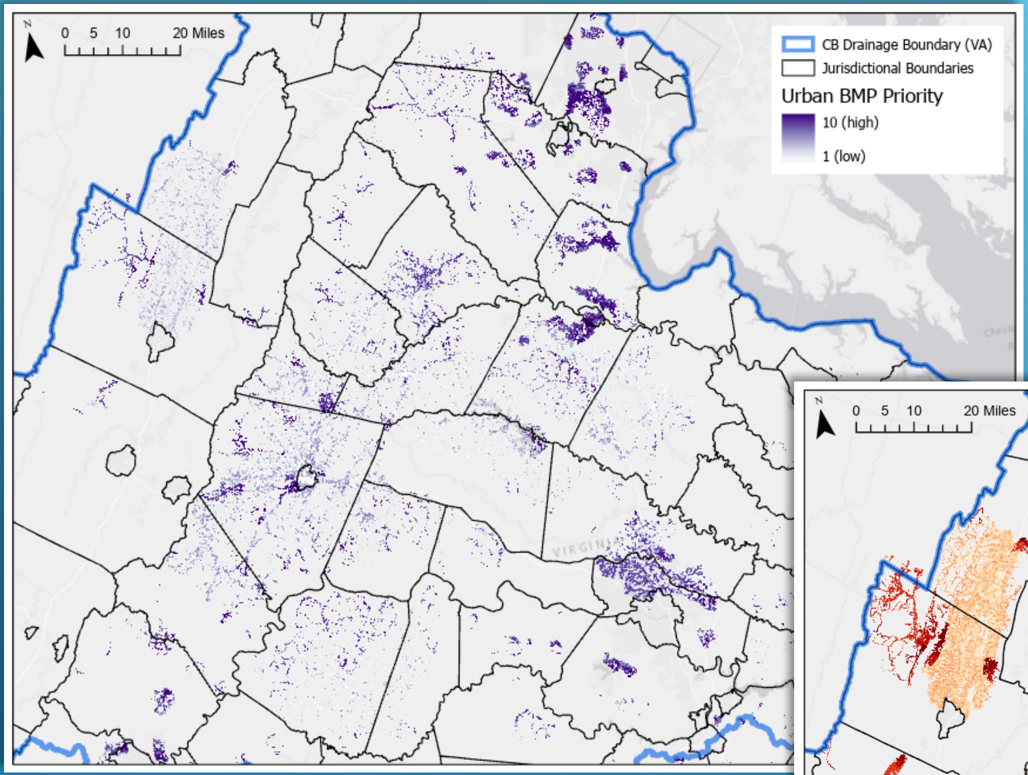


Healthy Waters Prioritization Model: Conservation

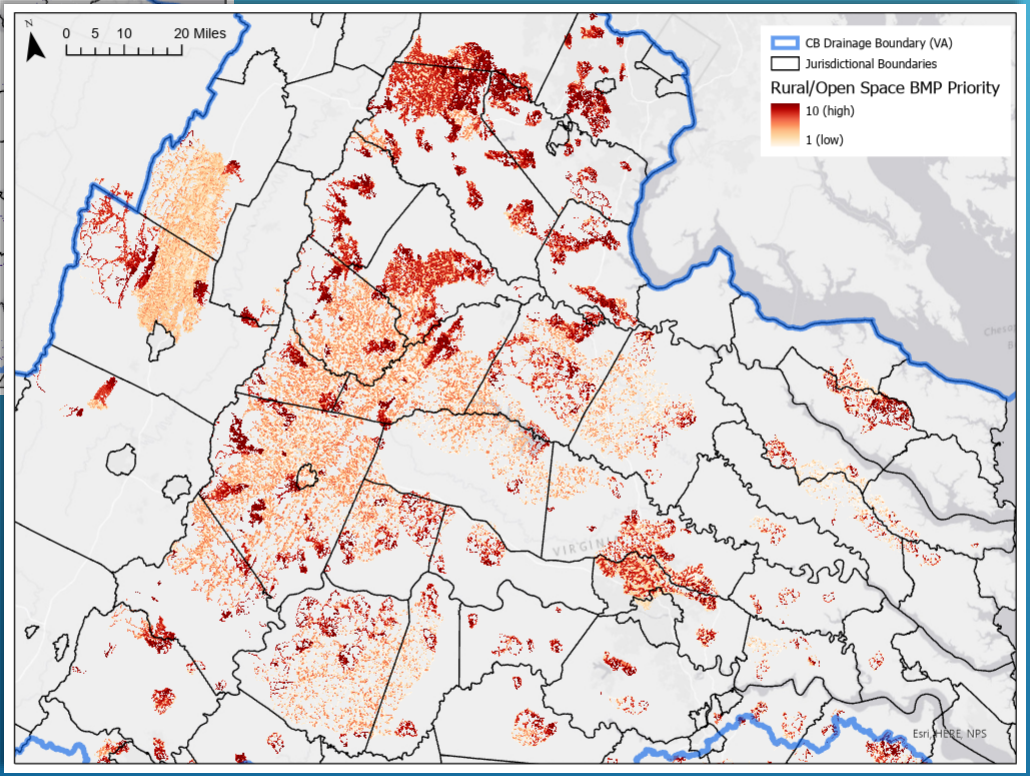
Target areas for land acquisition and conservation easements



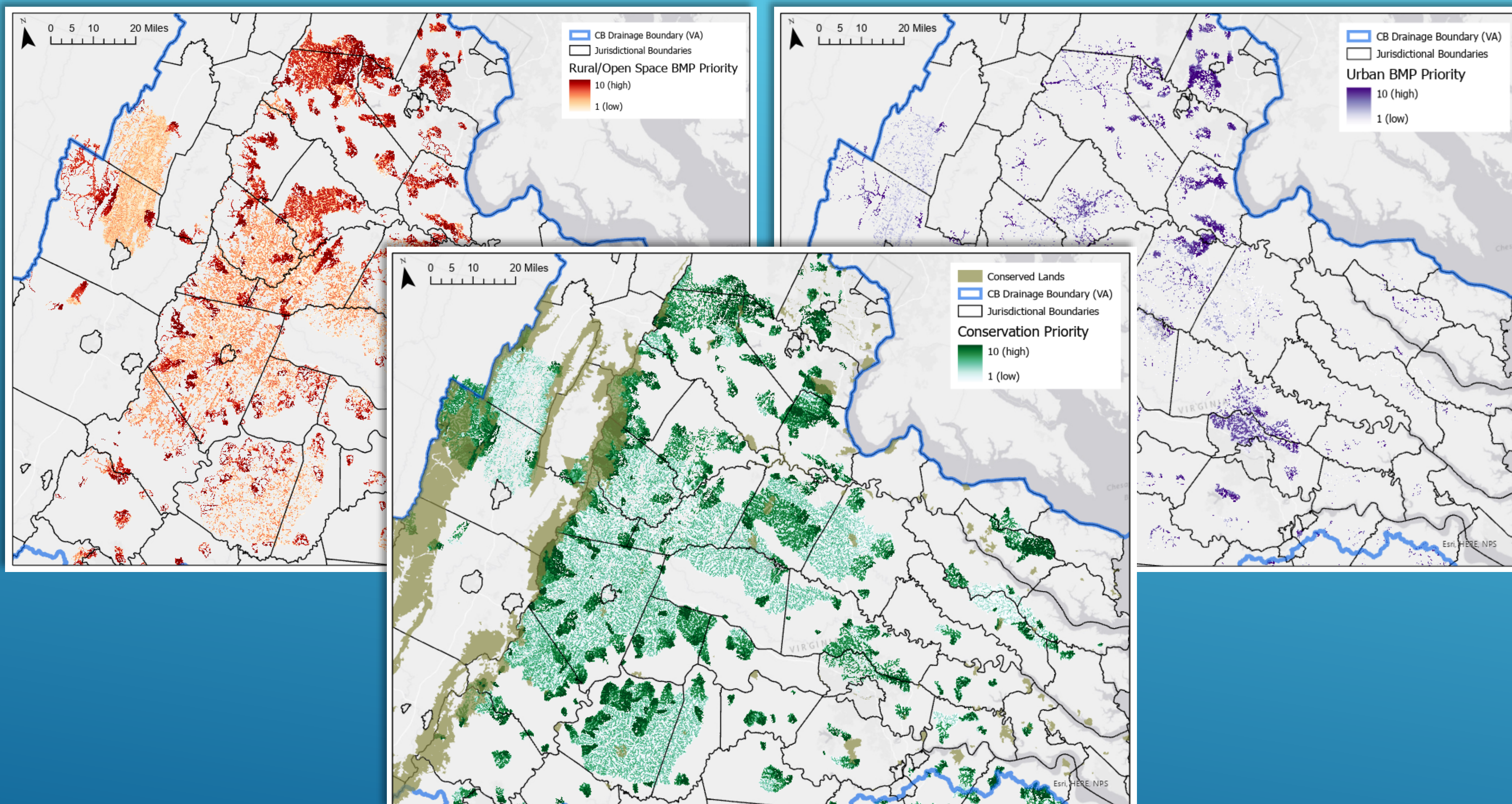
Healthy Waters Prioritization Model: BMPs



Target areas for Best Management Practices and restoration of natural vegetation



Healthy Waters Prioritization Model



Questions? Comments?