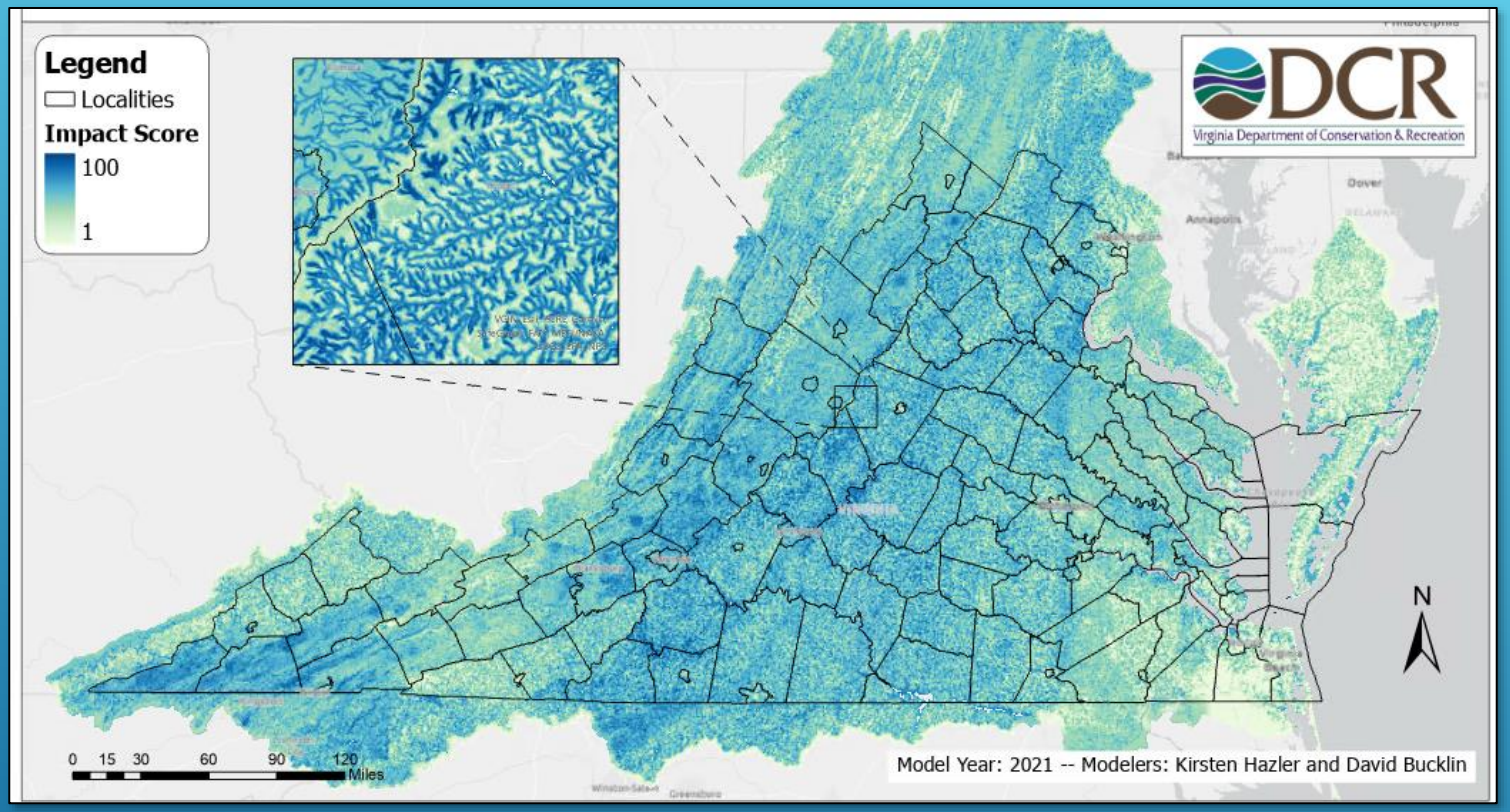
Introduction to the Virginia ConservationVision
Watershed Impact Model



Presenter:
Dr. Kirsten Hazler
Natural Heritage
Landscape Ecologist

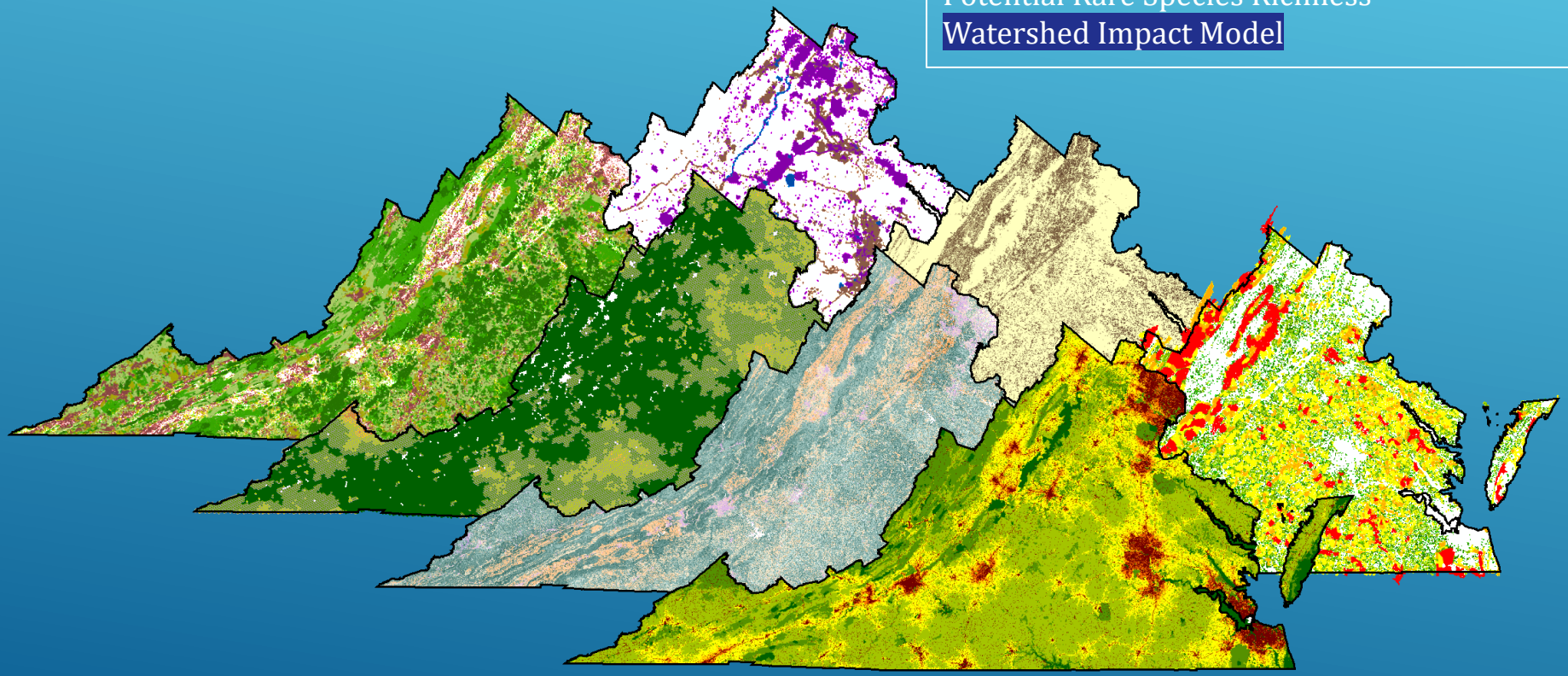
ENVIRONMENT VIRGINIA SYMPOSIUM

March 30, 2022

About Virginia ConservationVision

A digital atlas for strategic conservation planning in Virginia

- Natural Landscape Assessment
- Agricultural Model
- Forest Conservation Values (VDOF)
- Cultural Resource Preservation Index (VDHR)
- Nature-based Recreation Access Model
- Development Vulnerability Model
- Potential Rare Species Richness
- **Watershed Impact Model**



www.dcr.virginia.gov/natural-heritage/vaconvision

Watershed Impact Model - Purpose

A geospatial screening tool for assessing where activities on the land are expected to have the greatest impact on water

- Conceptual focus on non-point sources of pollutants
- Where can you expect the greatest returns on investment?
- Considerations:
  - Precipitation
  - Geology
  - Soils
  - Topography
  - Hydrology
  - (Land Cover)

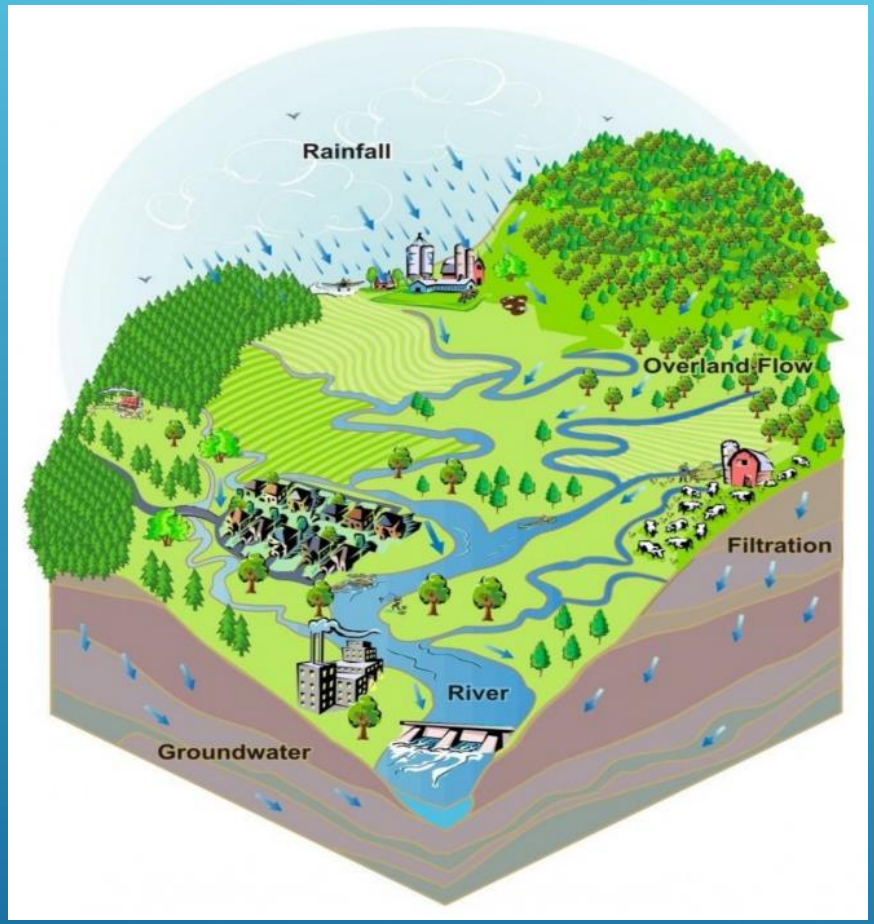
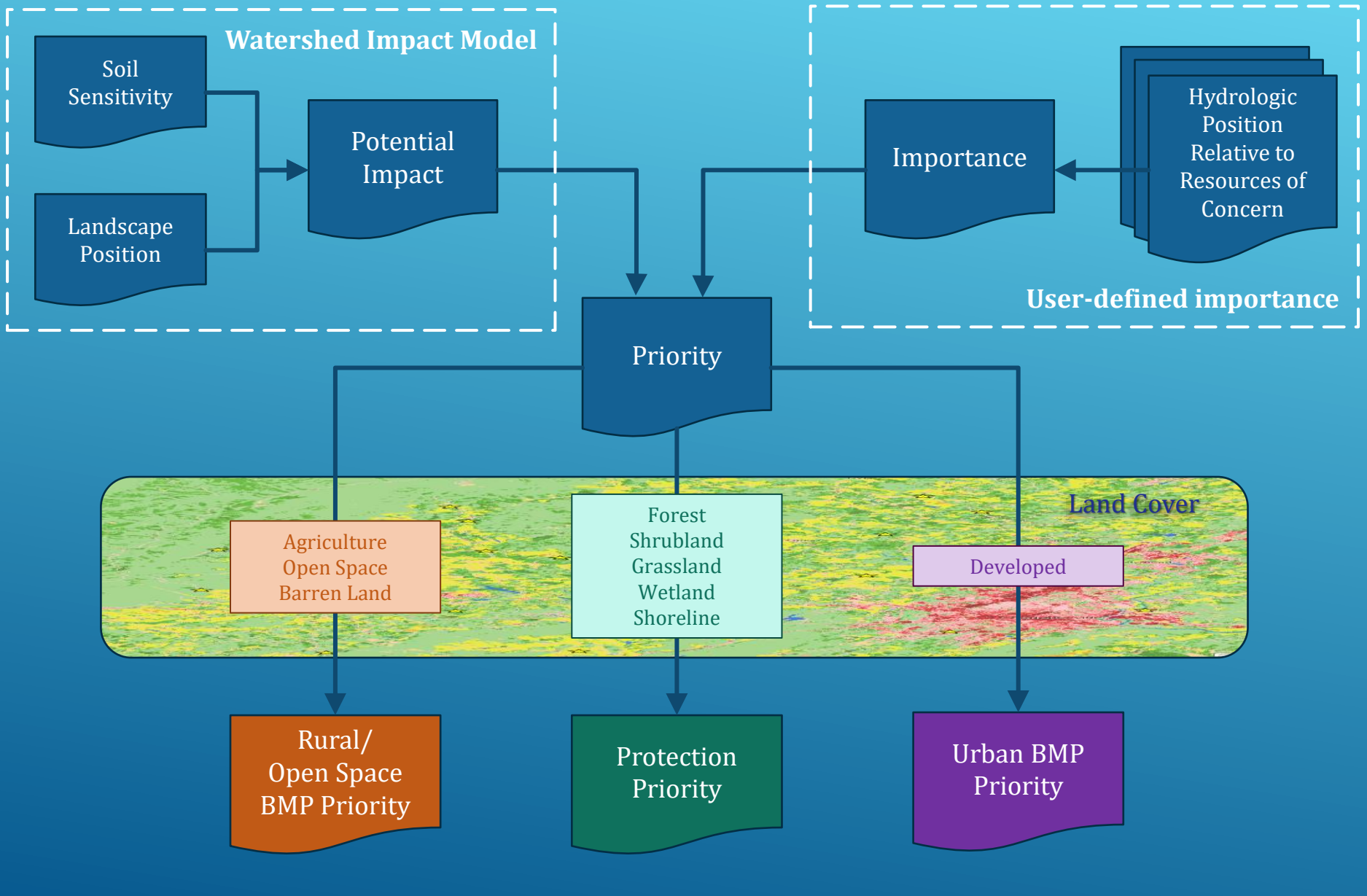
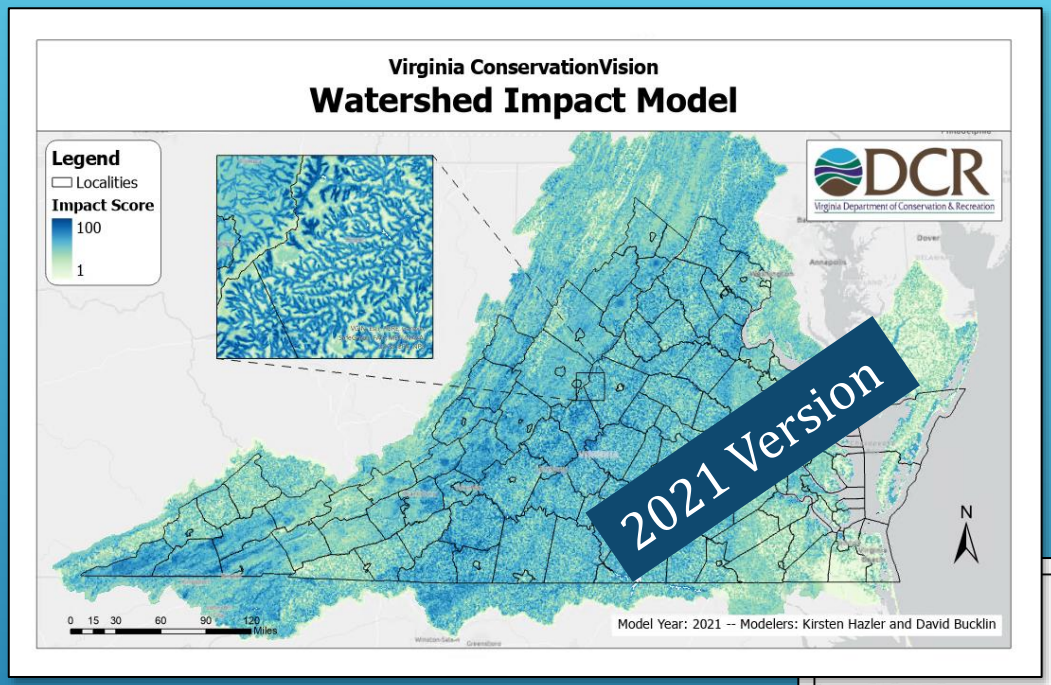


Image source: clearinghouse.starnetlibraries.org/life-science/618-a-watershed-community.html

Model Output as a Prioritization Input

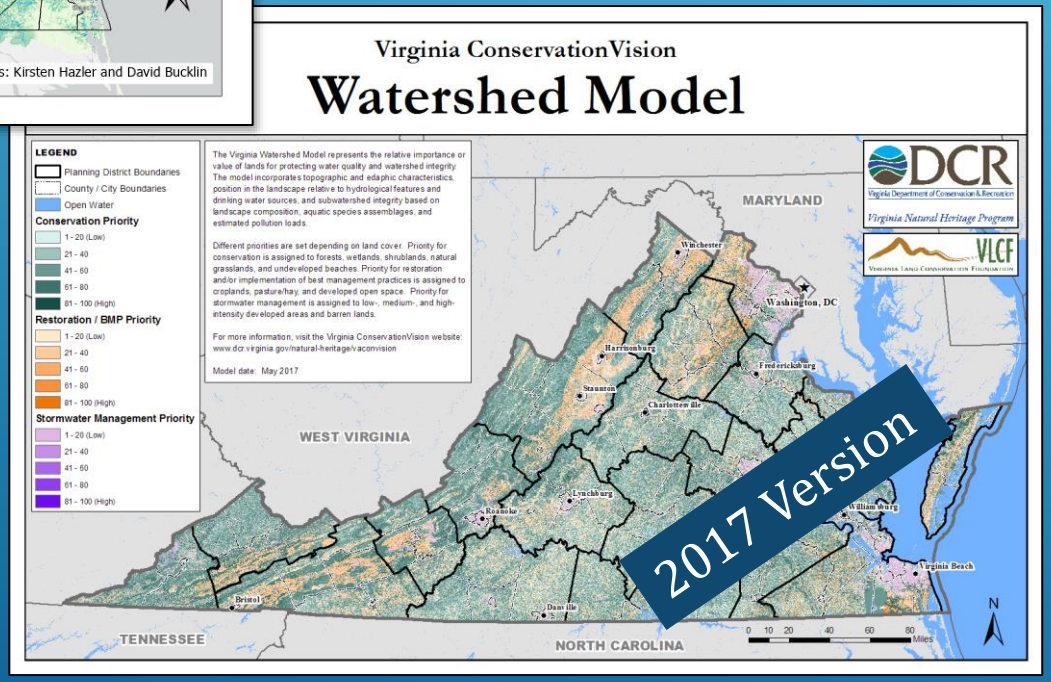


Current vs Previous Model



2021 Model

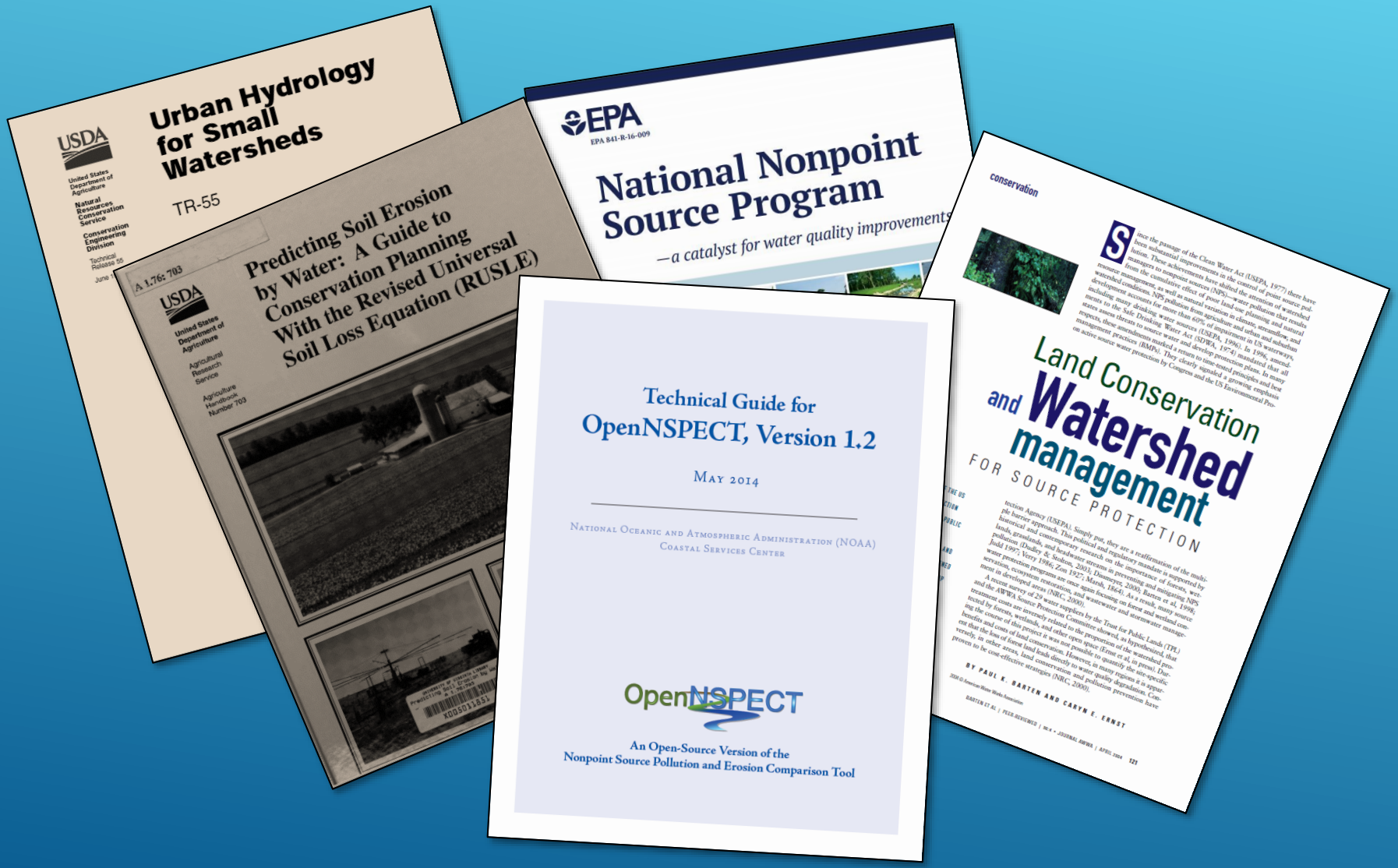
- User supplies resource areas of concern
- User supplies best available land cover
- No HUC-12 attributes used
- 1 primary output as input to user-specified prioritization process



2017 Model

- Baked in resource areas of concern
- Used 2011 NLCD land cover
- Incorporated attributes of HUC-12 units
- 3 primary outputs as a “final” prioritization

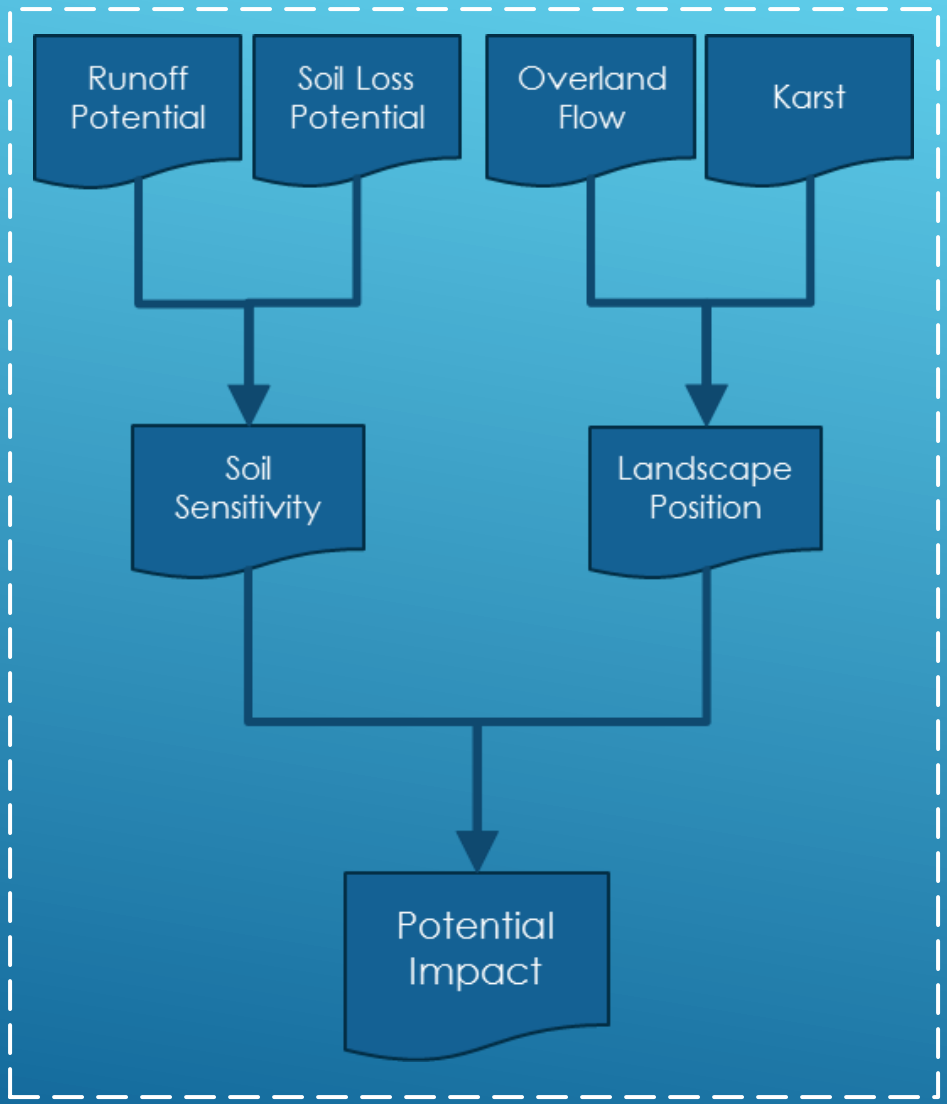
Guiding Documents



Model Overview

Potential impact depends on:

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



Soil Sensitivity: Runoff Potential

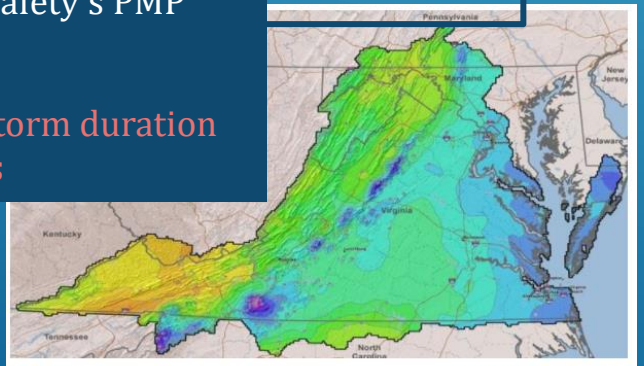
Runoff Curve Number (CN)

- 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)

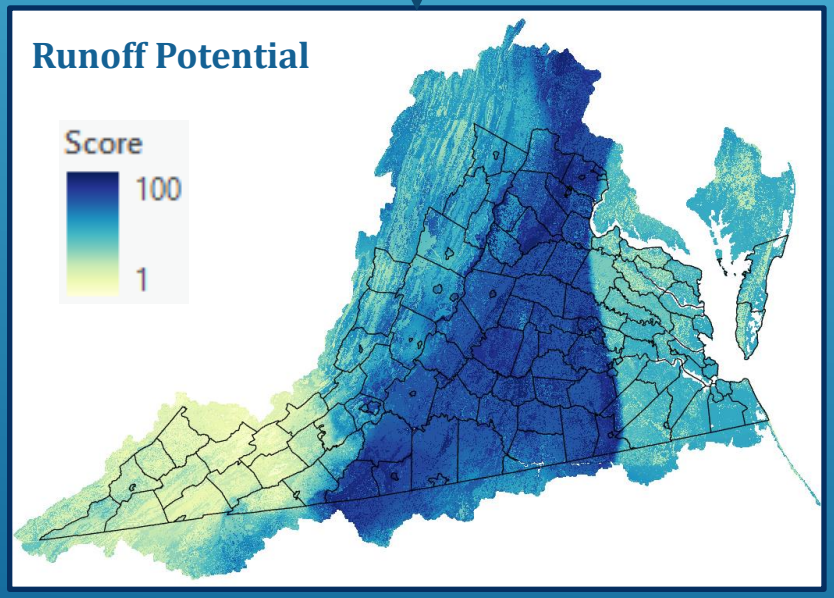
- DCR Dam Safety's PMP tool
- Assumed storm duration of 24 hours



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

Estimate runoff volume:
SCS Runoff Equation

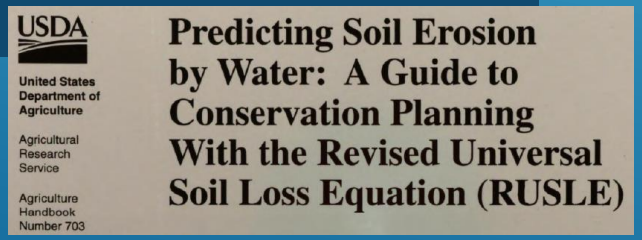
Rescale volume to score
(max volume = 100)



Soil Sensitivity: Soil Loss Potential

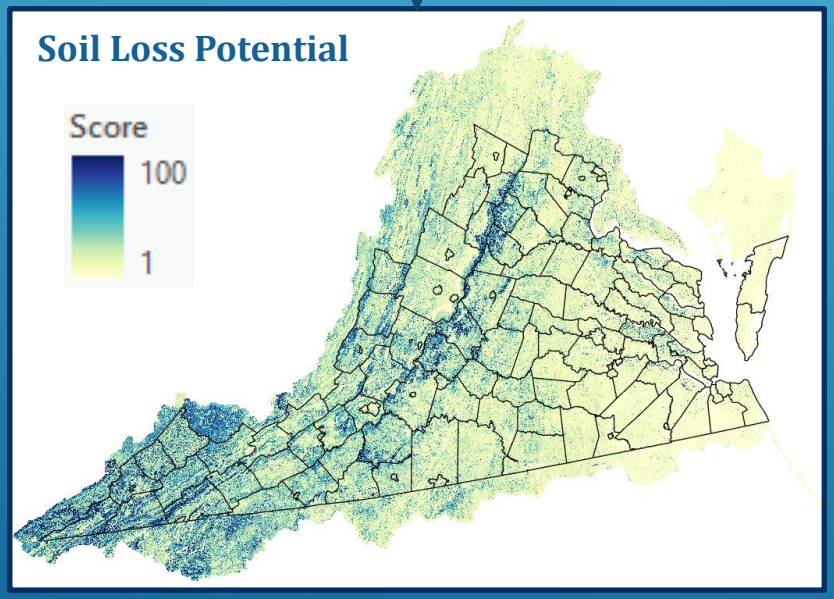
Revised Universal Soil Loss Equation (RUSLE) factors

- 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)



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

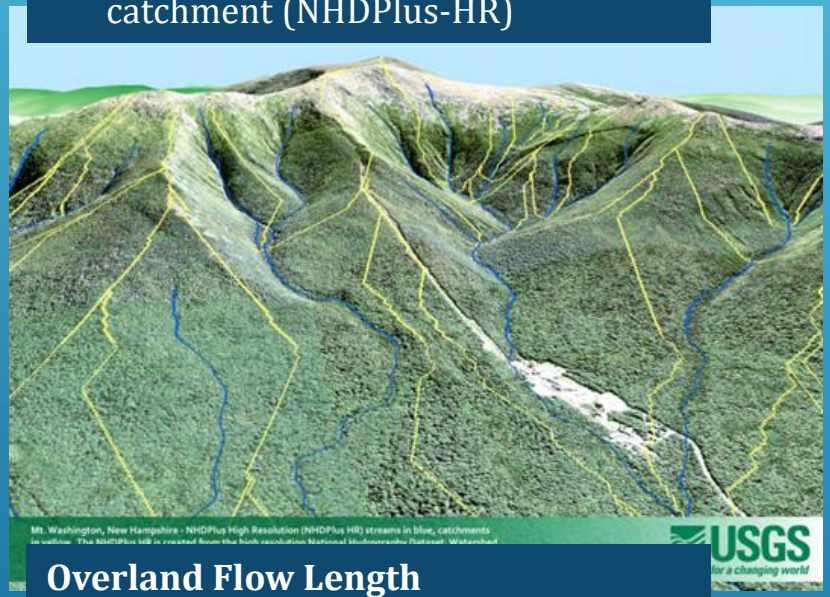
Rescale product to score (max soil loss = 100)



Landscape Position: Overland Flow

Headwaters

- Presence within a headwater catchment (NHDPlus-HR)

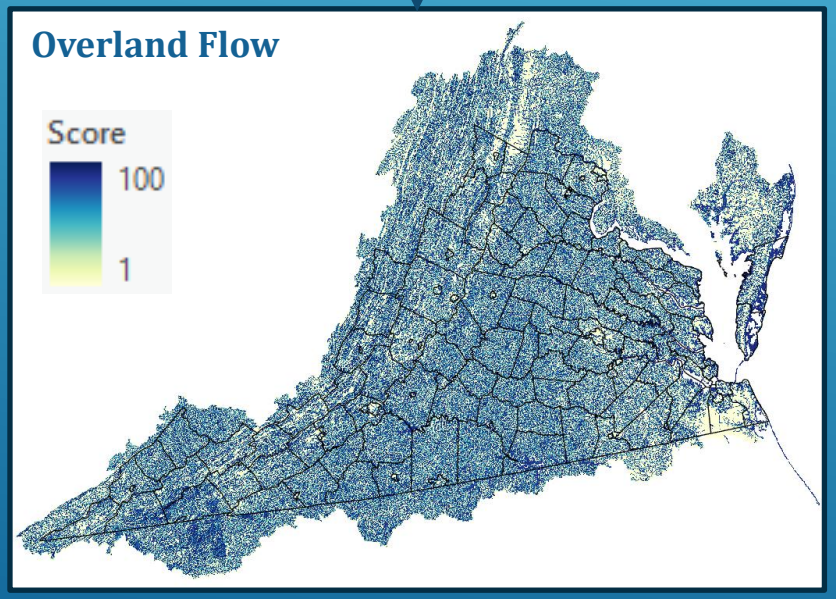


Overland Flow Length

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

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

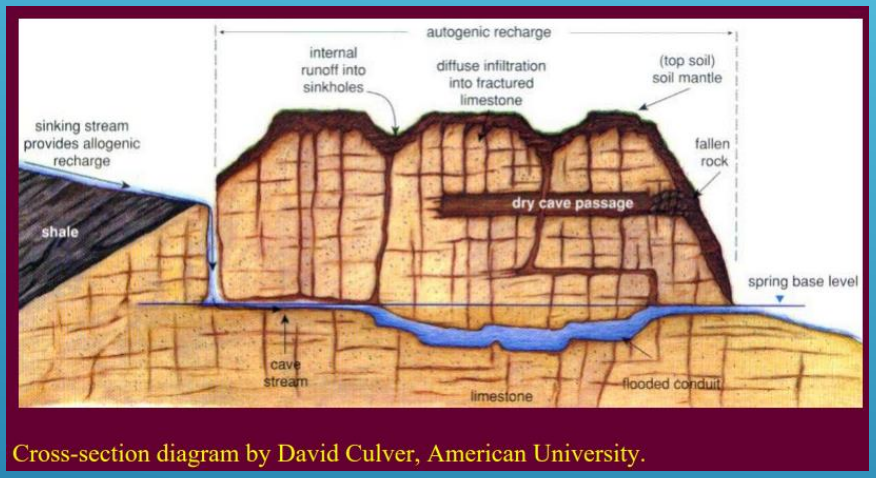
Discount score (x 90%) for areas outside of a headwater catchment



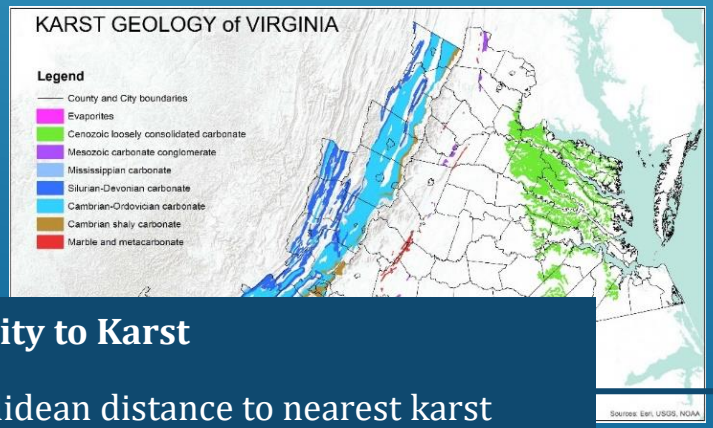
Landscape Position: Karst

Prevalence of Sinkholes

- Kernel density of sinkholes (DMME)



Cross-section diagram by David Culver, American University.



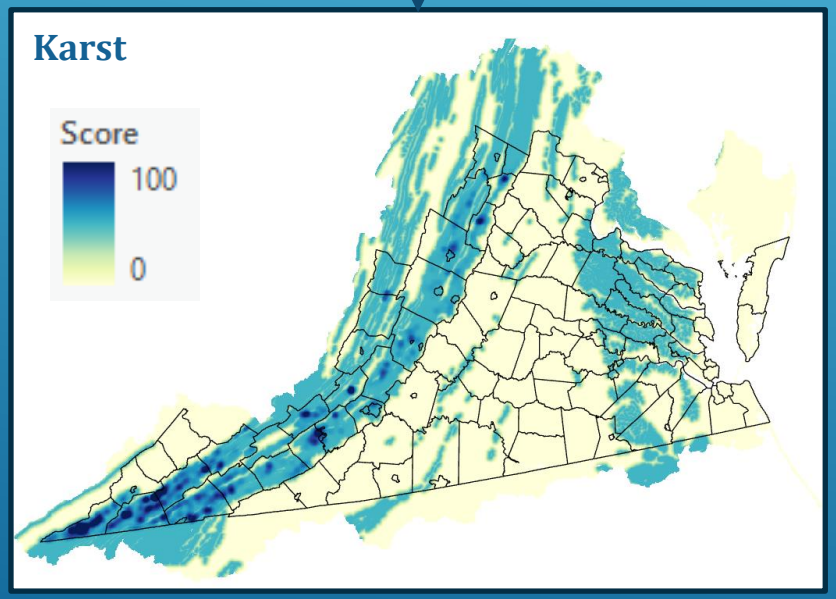
Proximity to Karst

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

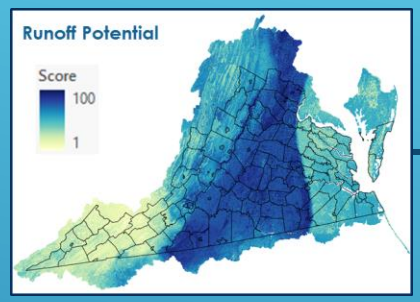
Rescale sinkhole density to score (max density = 100)

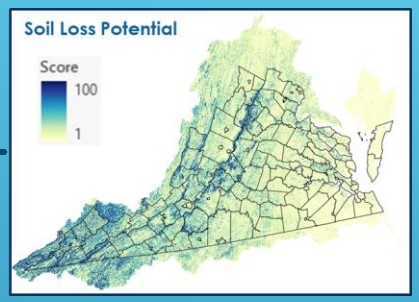
Rescale karst distance to score (adjacent to karst = 100)

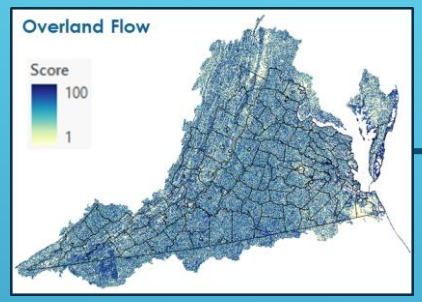
Calculate mean score

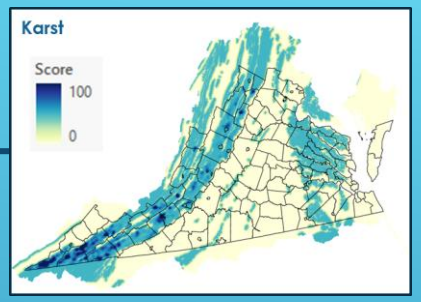


Potential Impact: Soil Sensitivity and Landscape Position



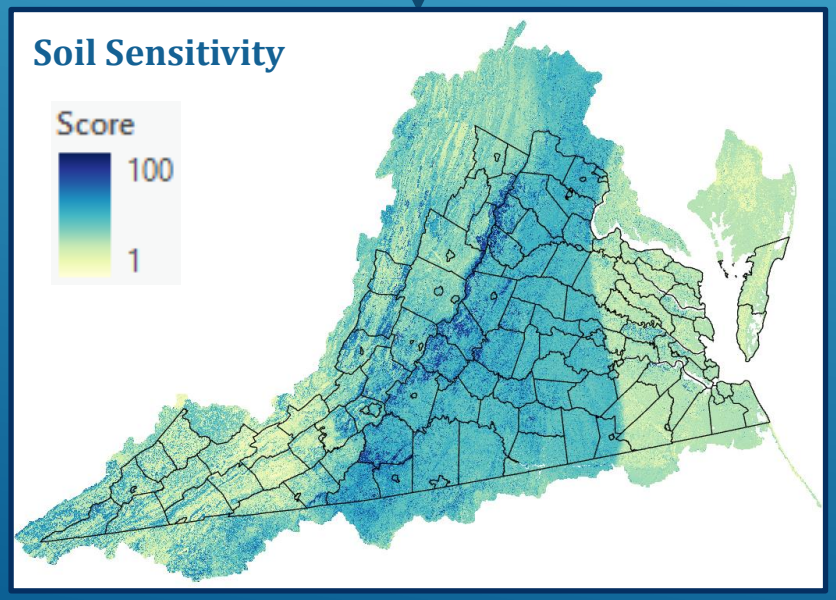


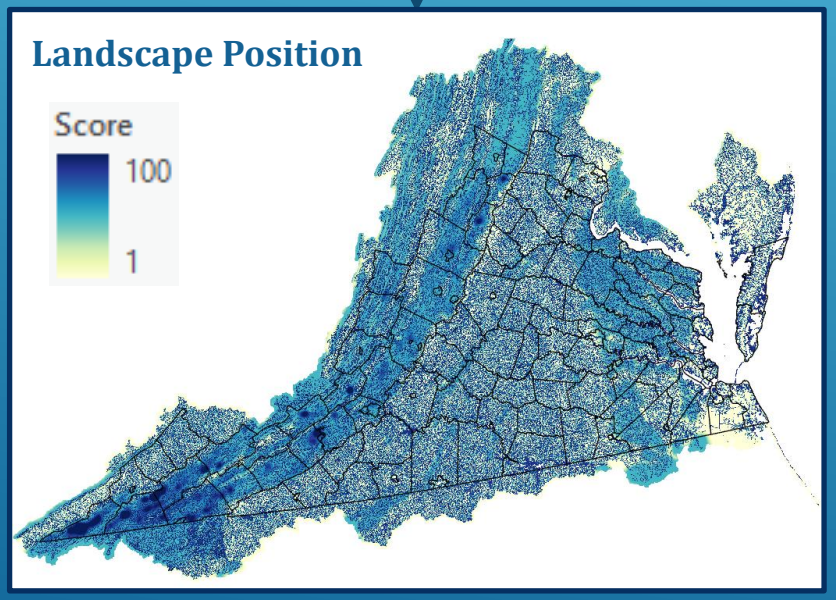




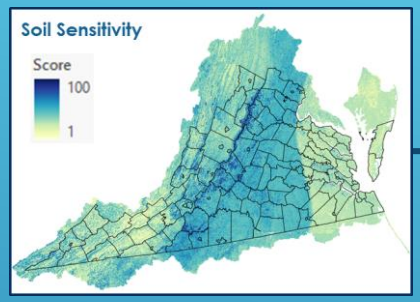
Calculate Mean

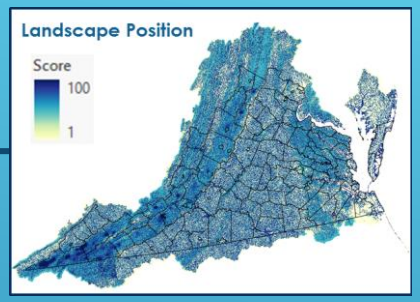
Calculate Maximum



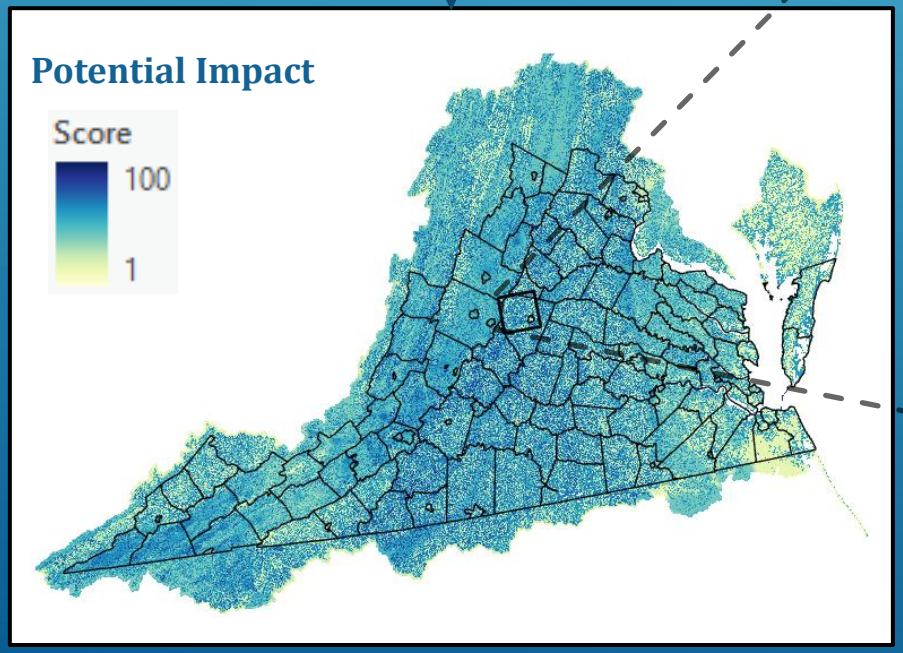


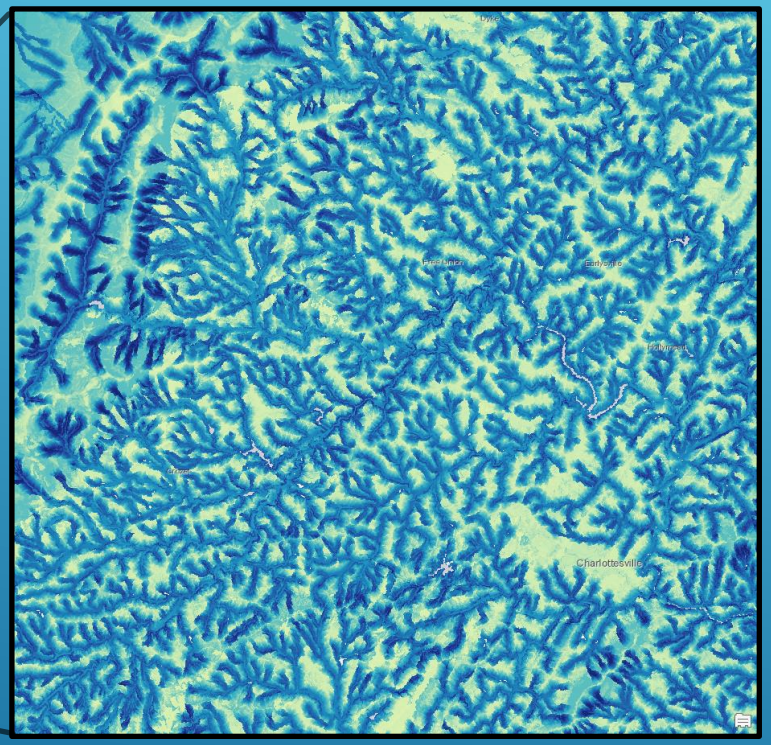
Potential Impact



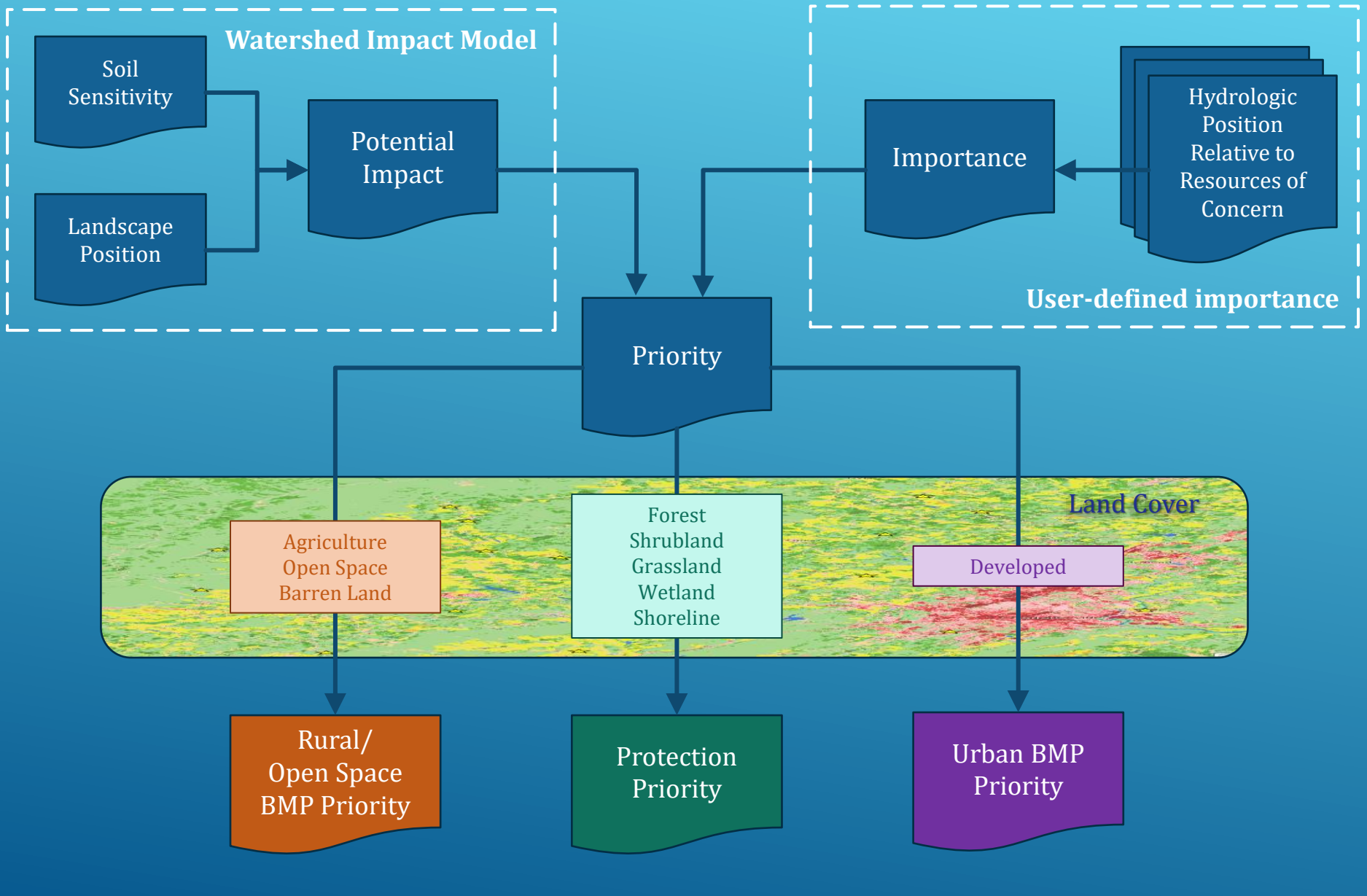


Calculate Mean





Model Output as a Prioritization Input



Applying the Model

Step 1:

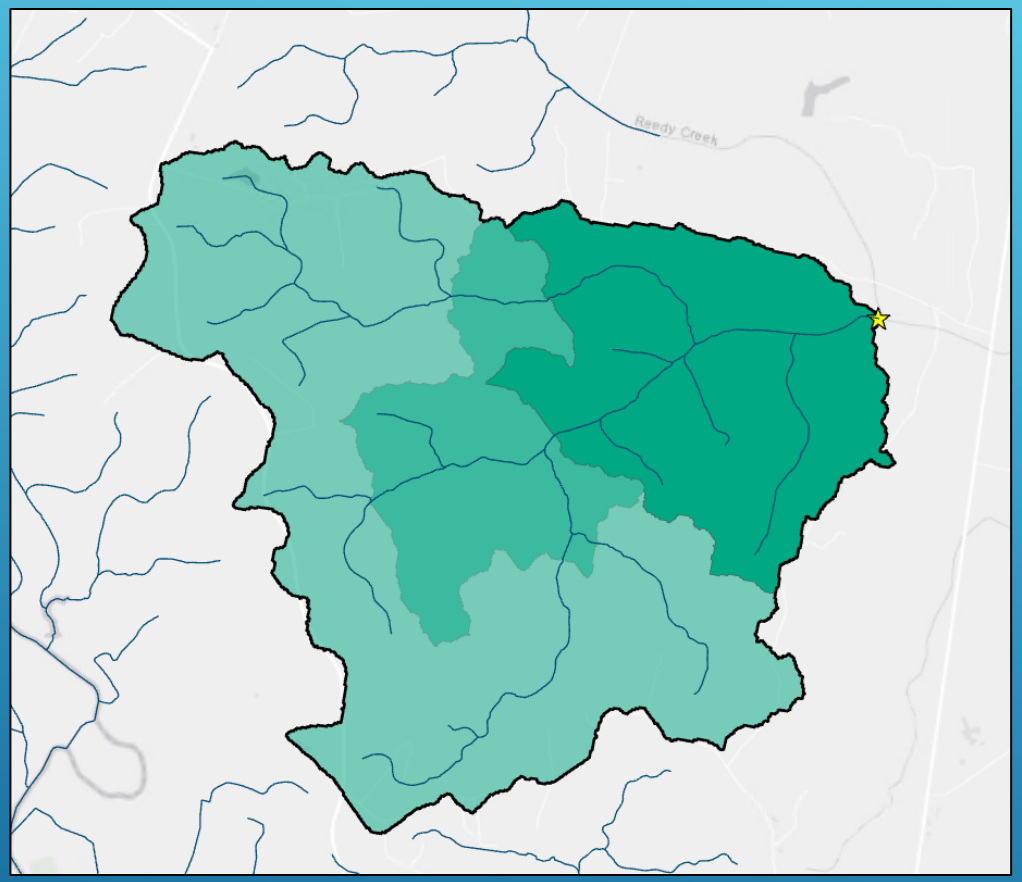
Identify goals. Examples:

- Protect drinking water sources
- Protect trout streams
- Reduce pollution loads in key hydrologic units
- Maintain known Healthy Waters

Step 2:

Delineate areas relevant to achieving goals.

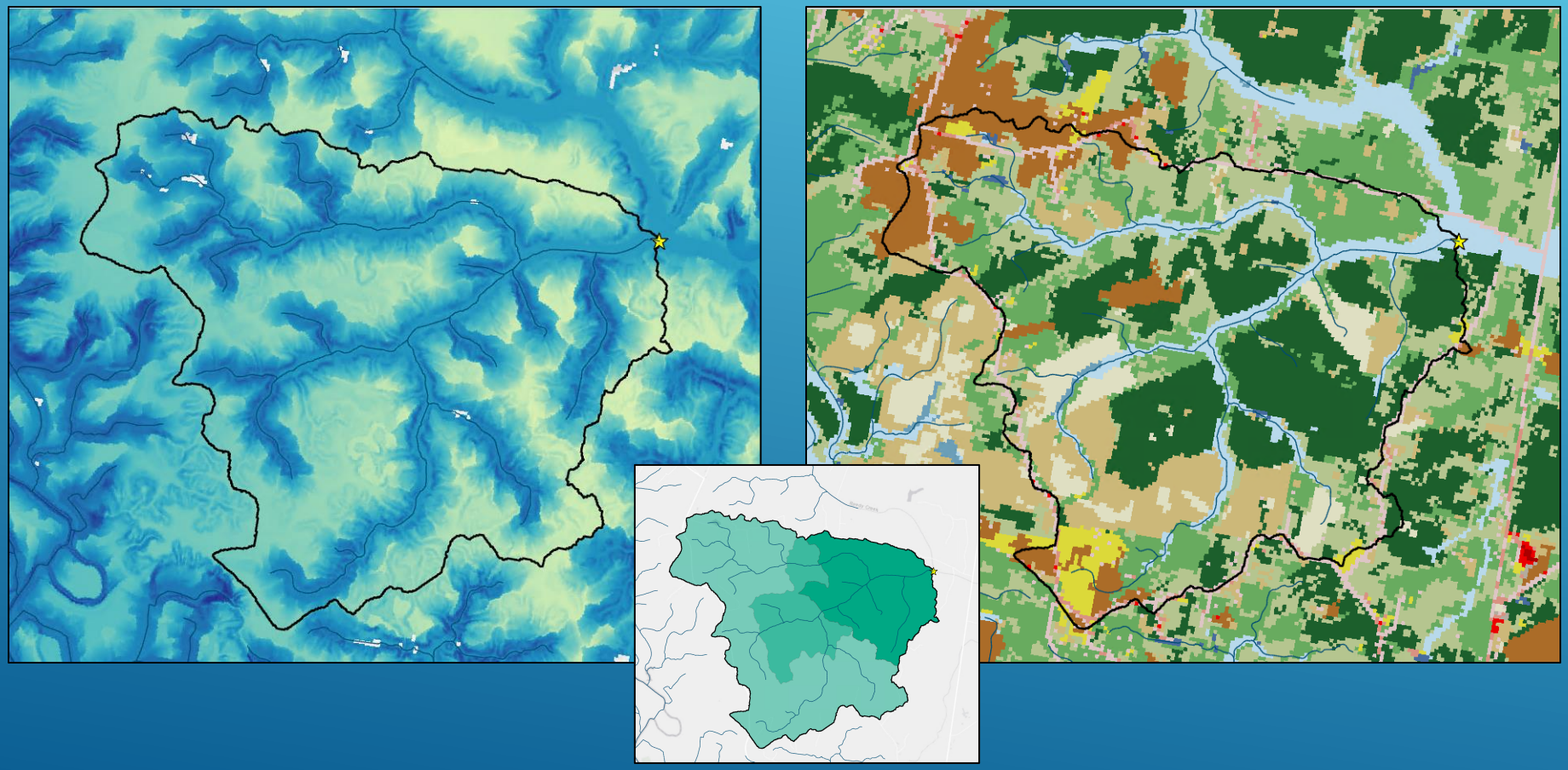
Optionally, score relative importance within delineated areas.



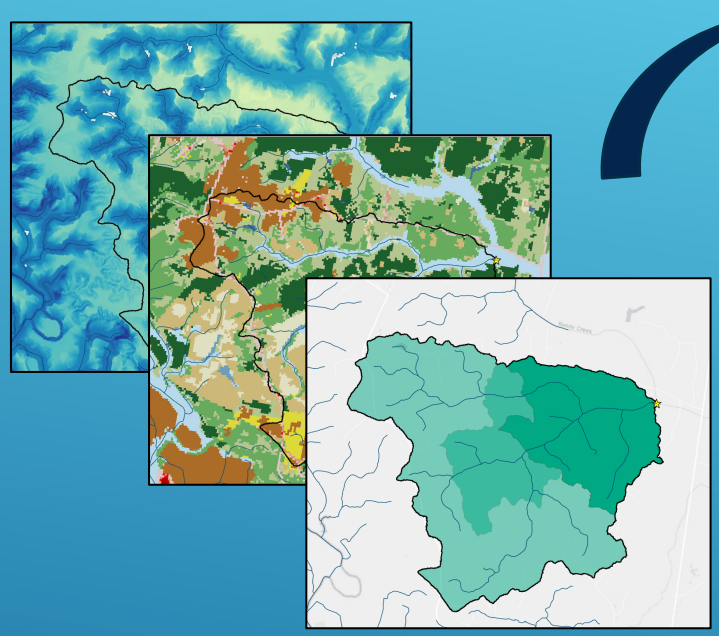
Applying the Model

Steps 3-4:

Extract watershed impact scores and land cover in area of interest

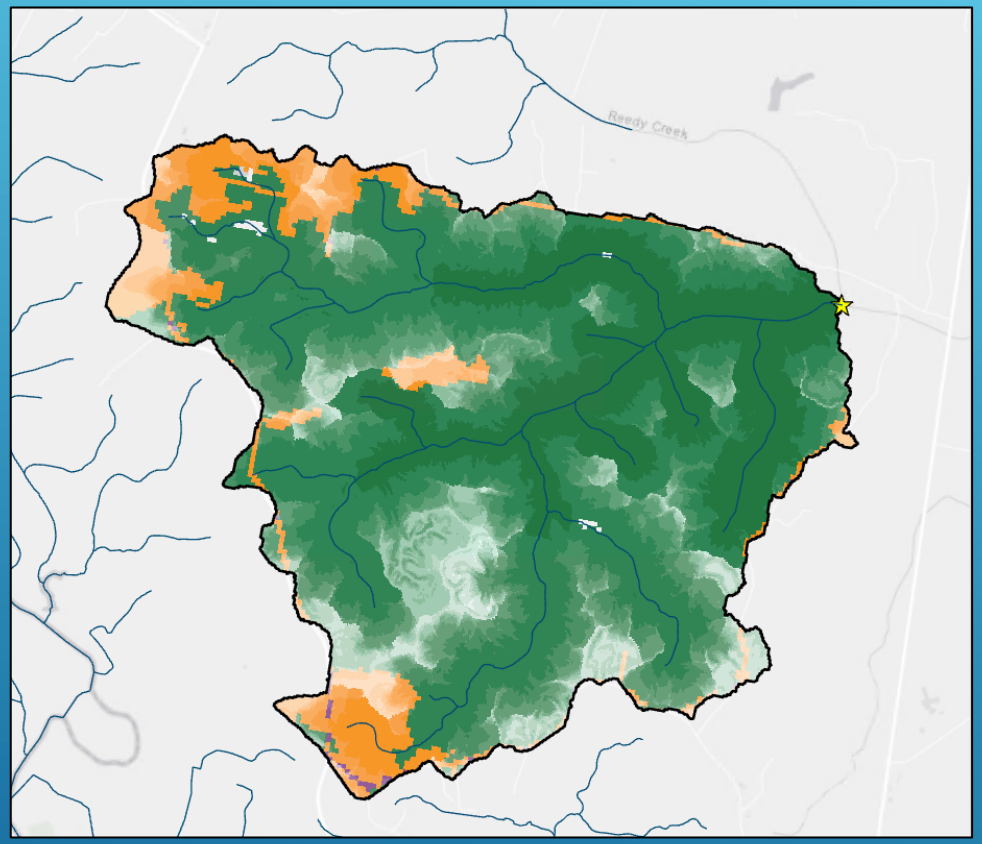


Applying the Model



Step 5:

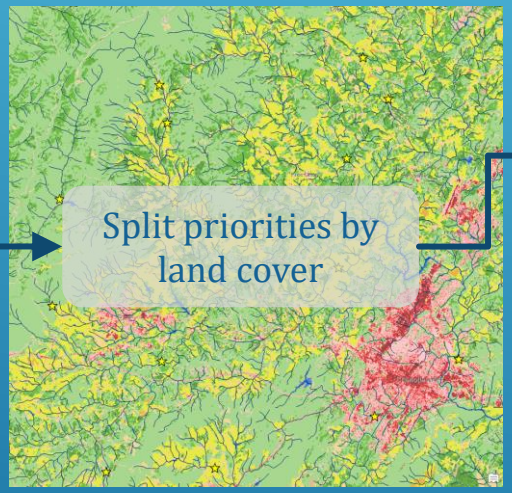
Combine resource importance scores, watershed impact scores, and land cover to derive priorities for conservation action: protection, restoration, BMPs, etc.



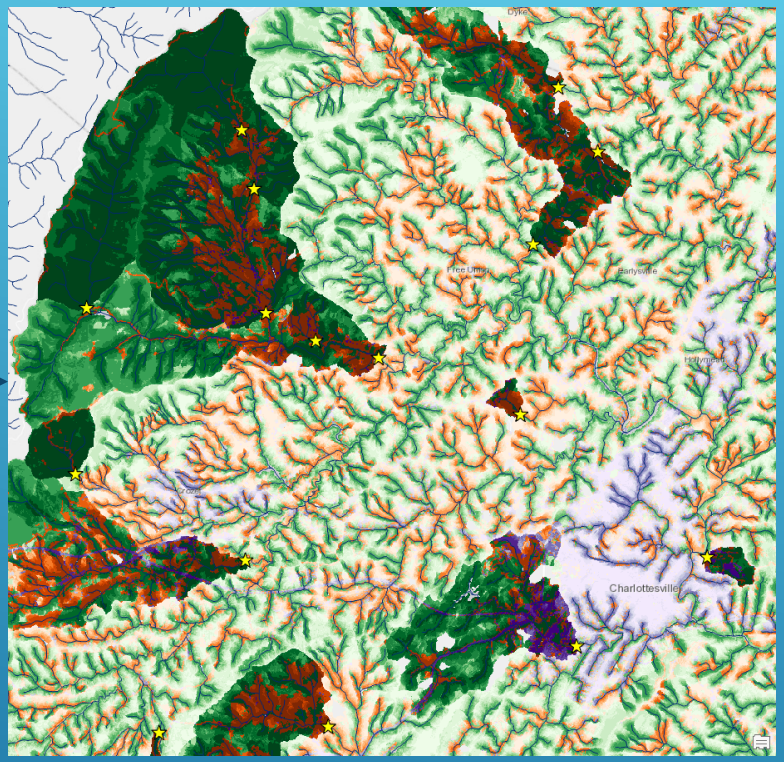
Example Application: Maintaining Healthy Waters

Calculate product

Slice into priority quantiles



Final Priorities



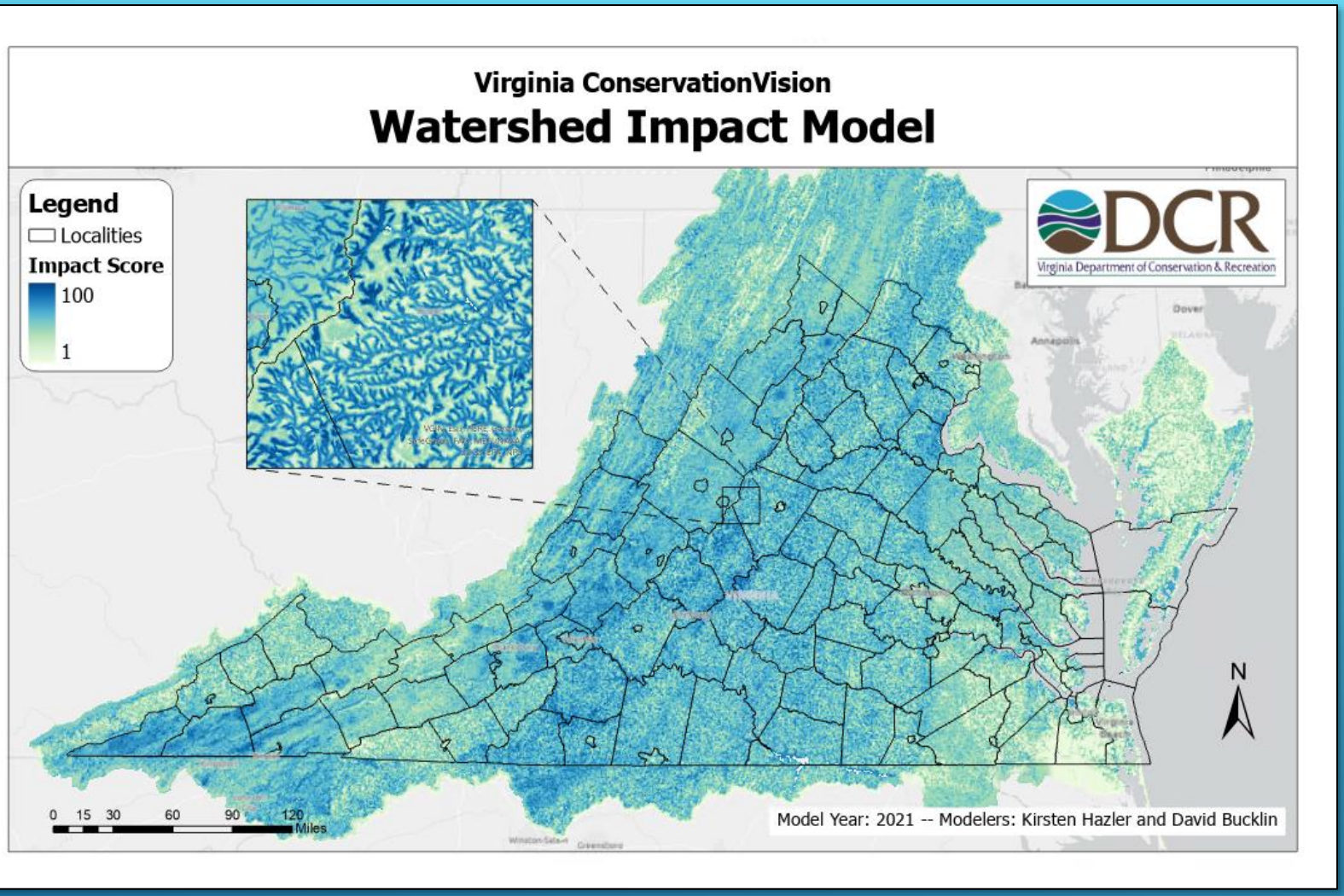
Considerations for Model Use

THIS MODEL DOES…

- Serve as a geospatial screening tool
- Incorporate information on site conditions
- Help identify areas where land activities will have highest impact on surface waters
- Incorporate empirical equations related to soil erosion and runoff

THIS MODEL DOES NOT…

- Replace on-the-ground site assessments
- Incorporate information on current land cover conditions
- Weight areas based on relevance to specific aquatic resources of concern
- Calculate specific amounts of nitrogen, phosphorus, sediment entering a watershed



More information:
www.dcr.virginia.gov/natural-heritage/vaconviswater-2021

Kirsten.Hazler@dcr.virginia.gov