Integrating Data Sets to Understand Climate Change Vulnerability for West Virginia Watersheds

Joseph T. Molina[1], Carol C. Arantes[1], Brent Murray[1], James T. Anderson[2]

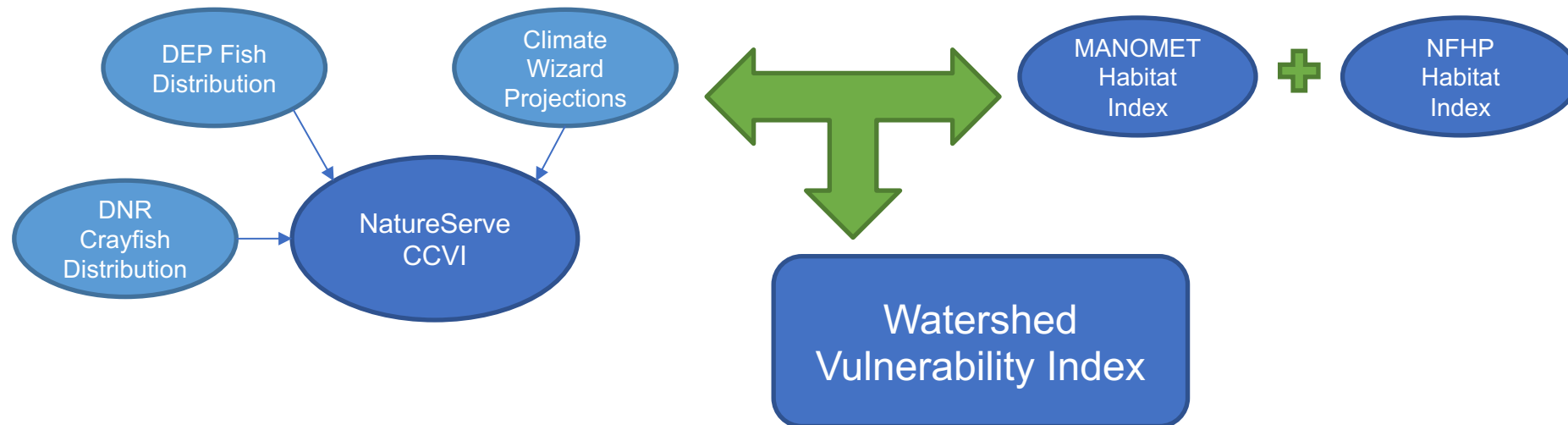[1.] West Virginia University

[2.] Clemson University

Data Integration

A statistical modeling approach that incorporates multiple data sources

Especially useful within macrosystems ecology
- Enhances our ability to understand processes across spatiotemporal scales
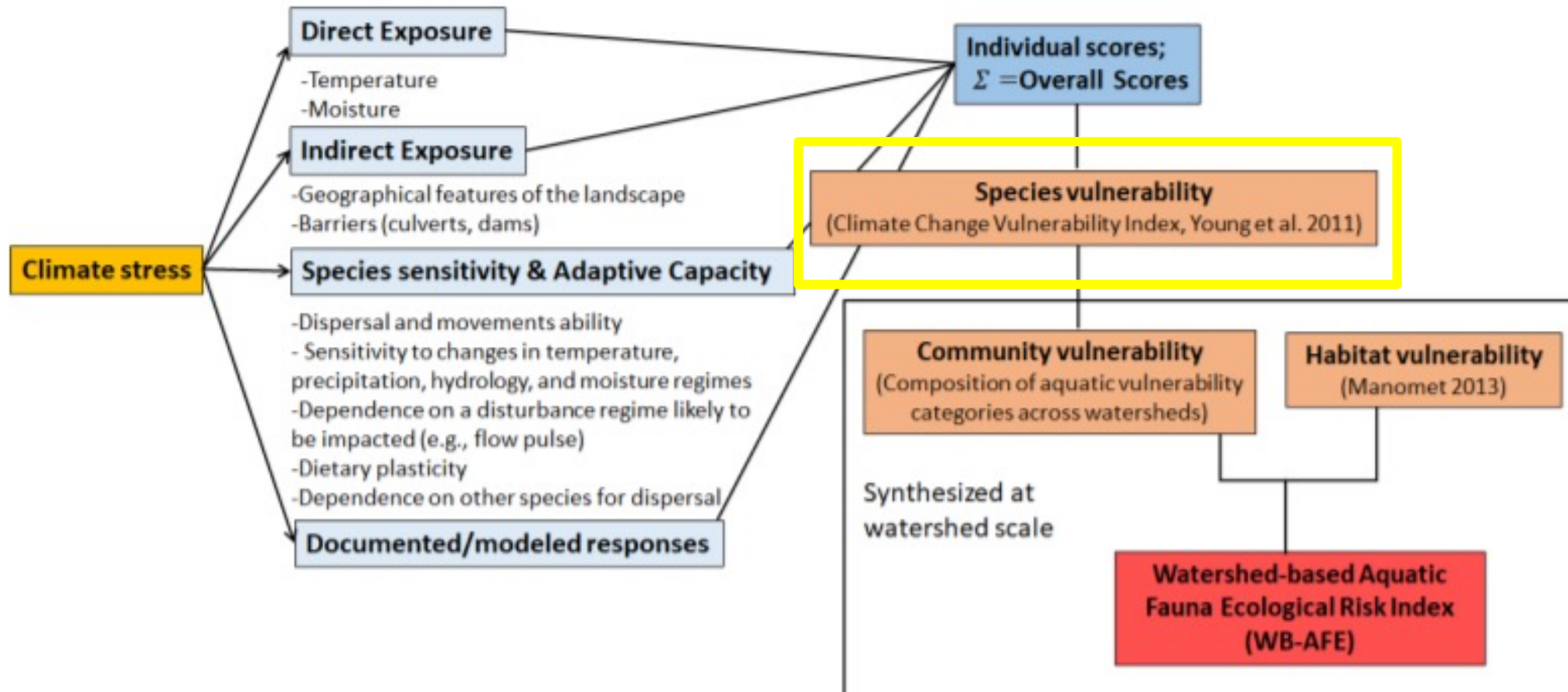
Goals and Objectives

Goal:

Deliver a decision support tool to integrate climate change dynamics into aquatic management decisions

Objectives:

▶ Assess vulnerability for WV crayfish and fish
▶ Develop a community vulnerability index
▶ Synthesize habitat vulnerability assessments
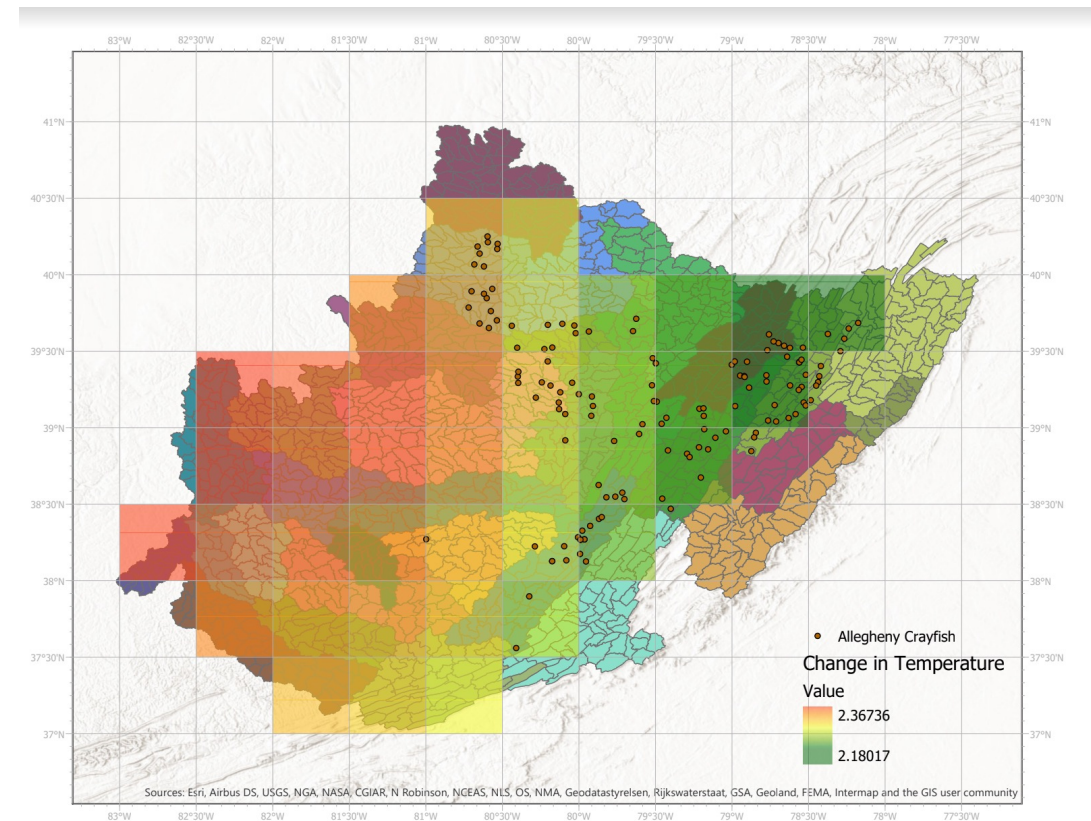▶ Combine community and habitat vulnerability (i.e. WB-AFE)
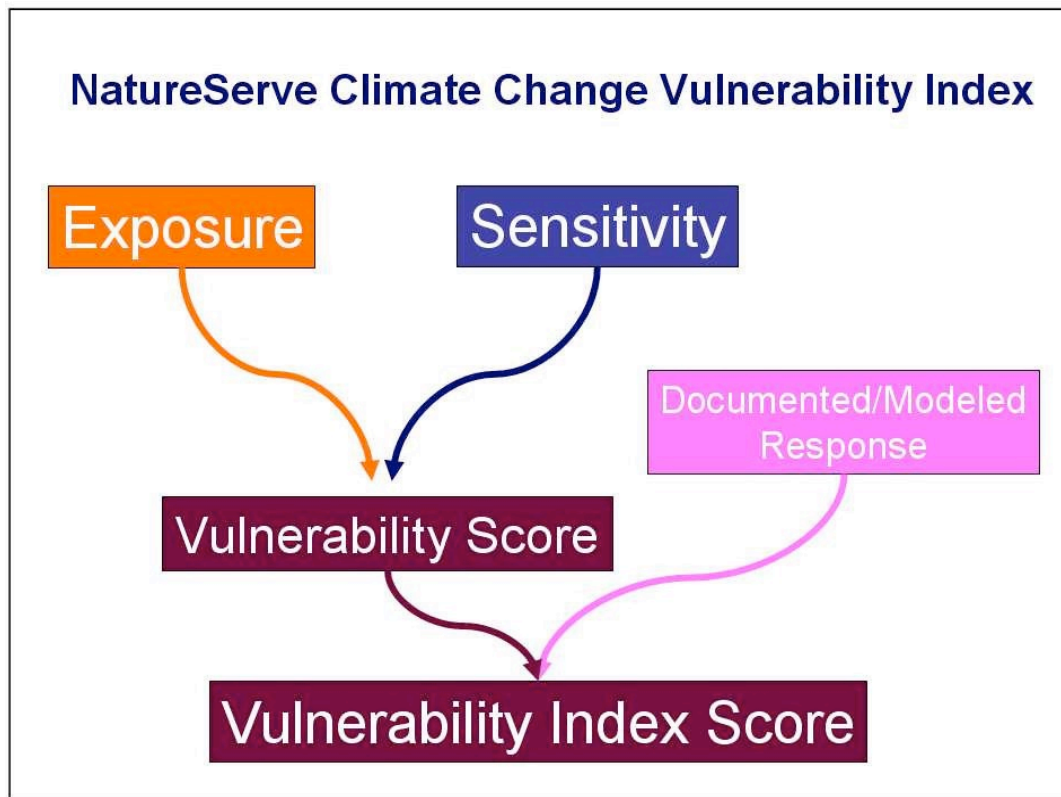
Watershed Model

Vulnerability

Risk of species and habitat loss due to climate change divided into two facets:

- **Exposure:** The intensity at which the species/habitat endures the threat against it

- **Sensitivity:** The ability to withstand climate threats

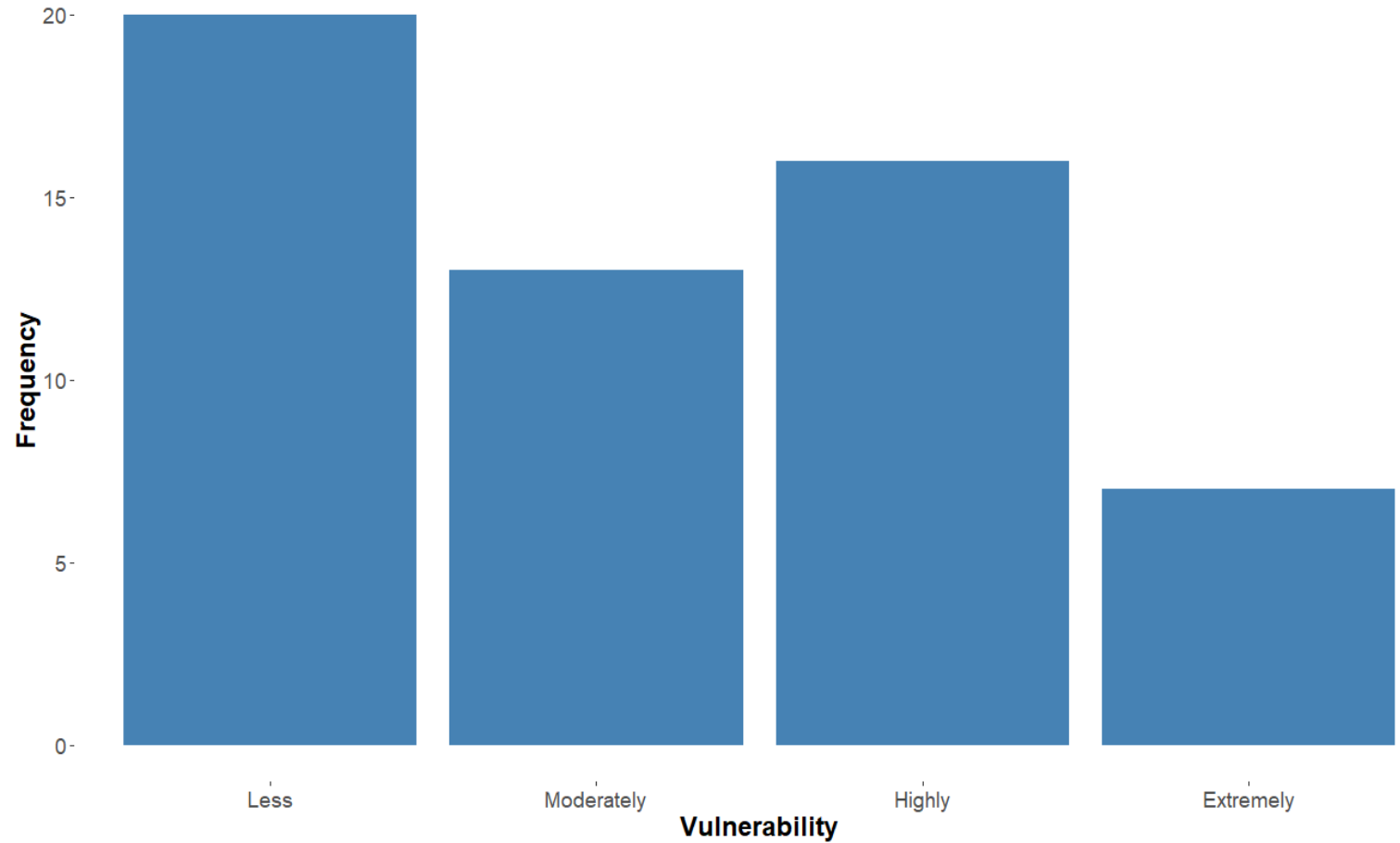# NatureServe Climate Change Vulnerability Index
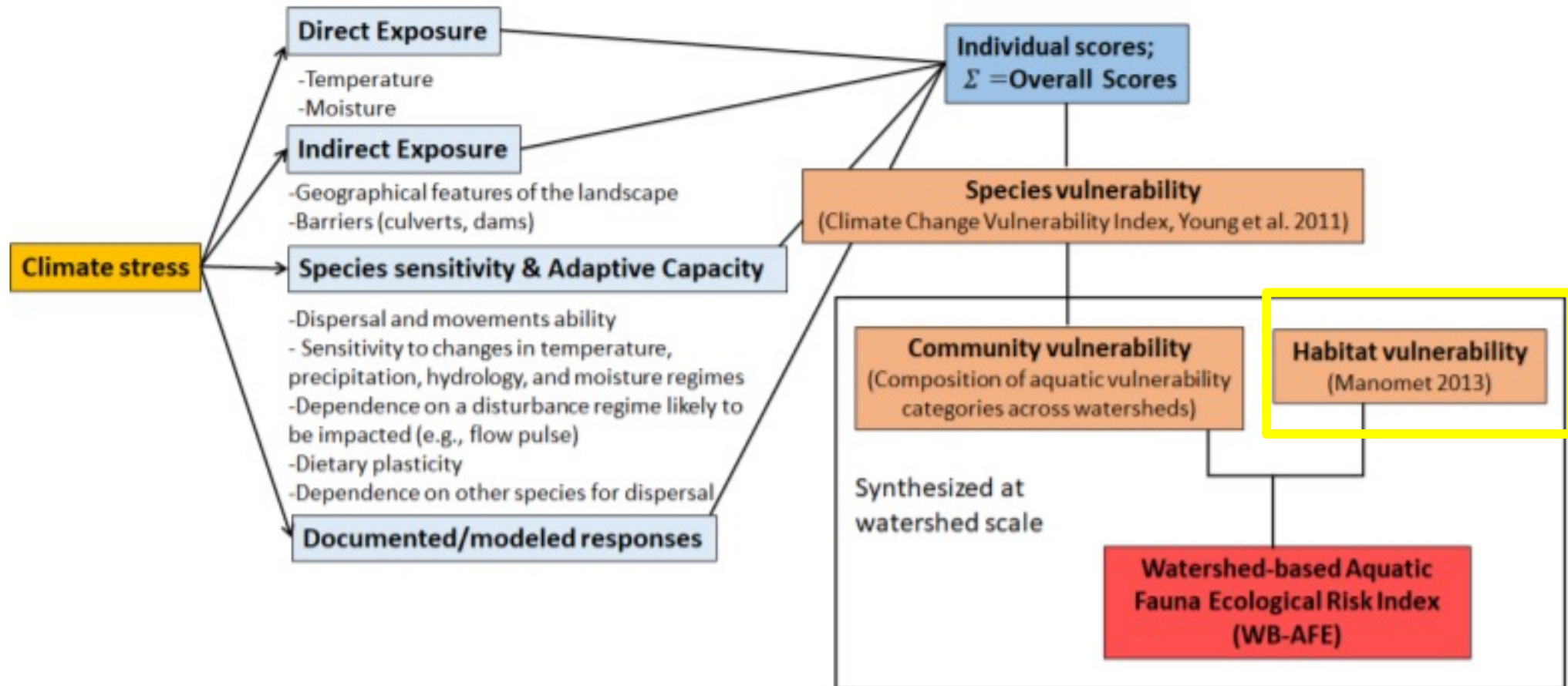
NatureServe Results

56 crayfish and fishes assessed

Majority of species less vulnerable or highly vulnerable

Scores generated with moderate – very high confidence
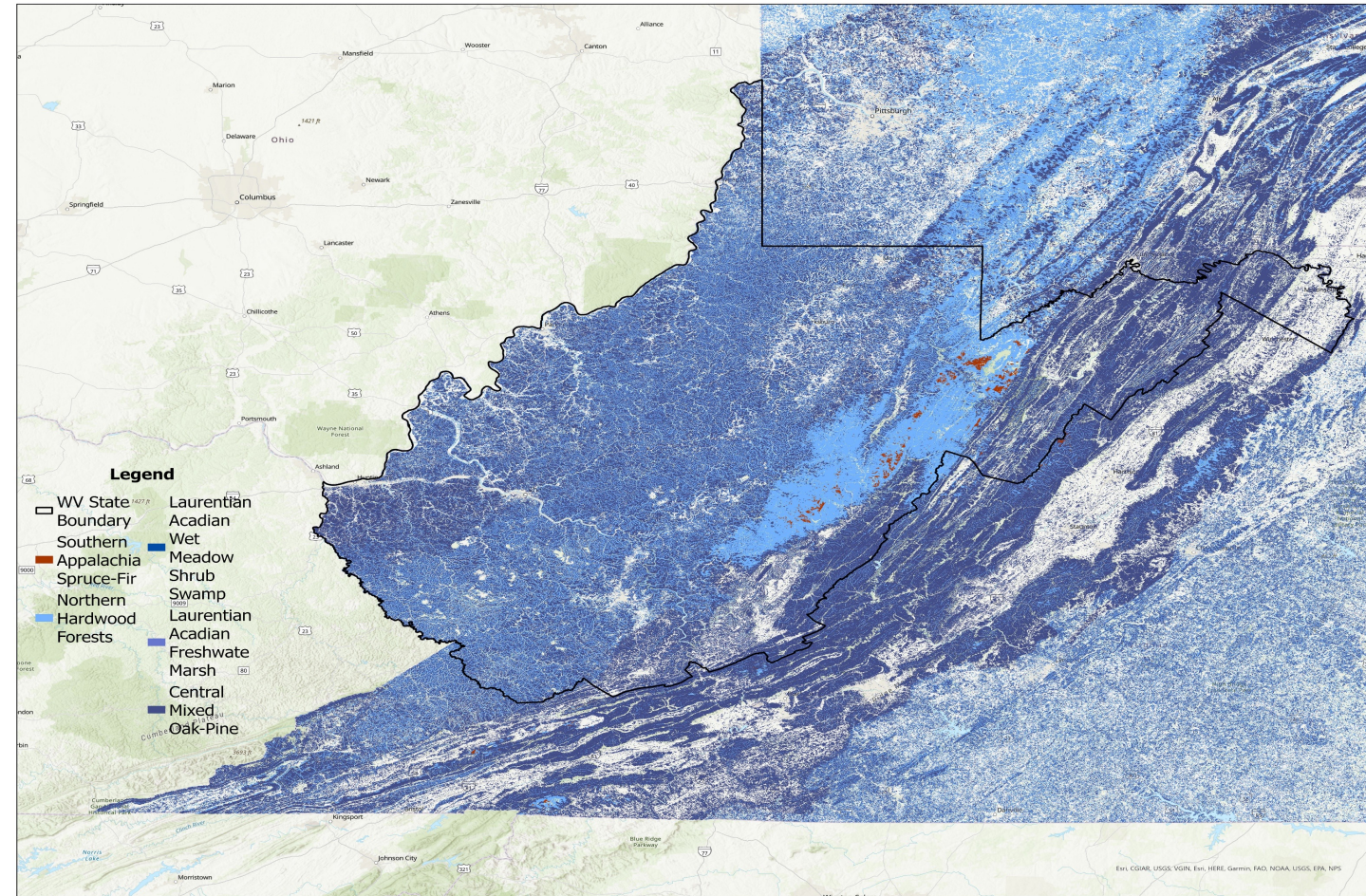
Watershed Model

MANOMET

Five habitat types assessed within WV

Habitat vulnerability within a watershed (HUC8) summarized by a weighted average

Weighted by the proportion of each habitat represented within the watershed
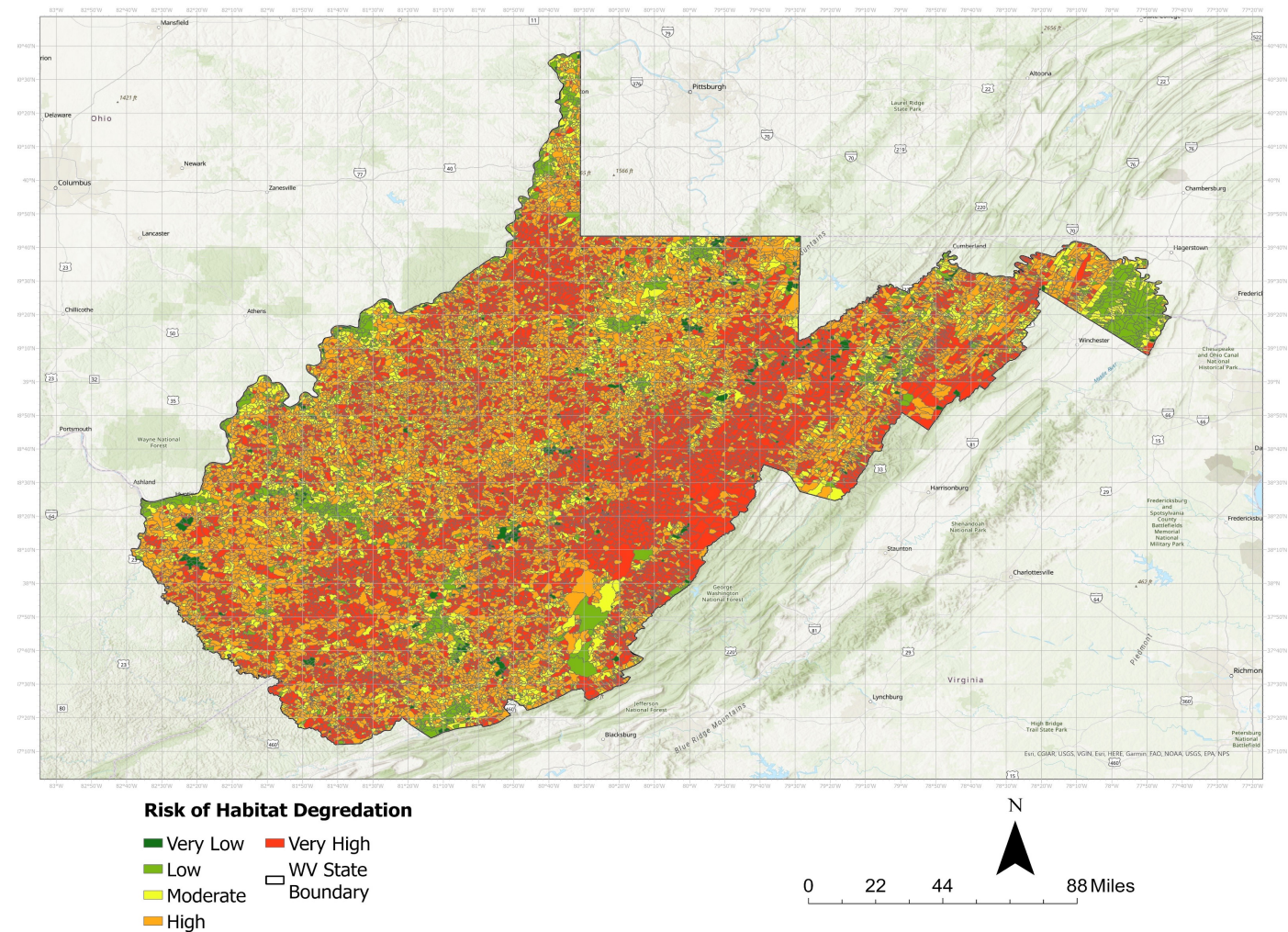
National Fish Habitat Partnership Index

Focus on human effects on aquatic habitats

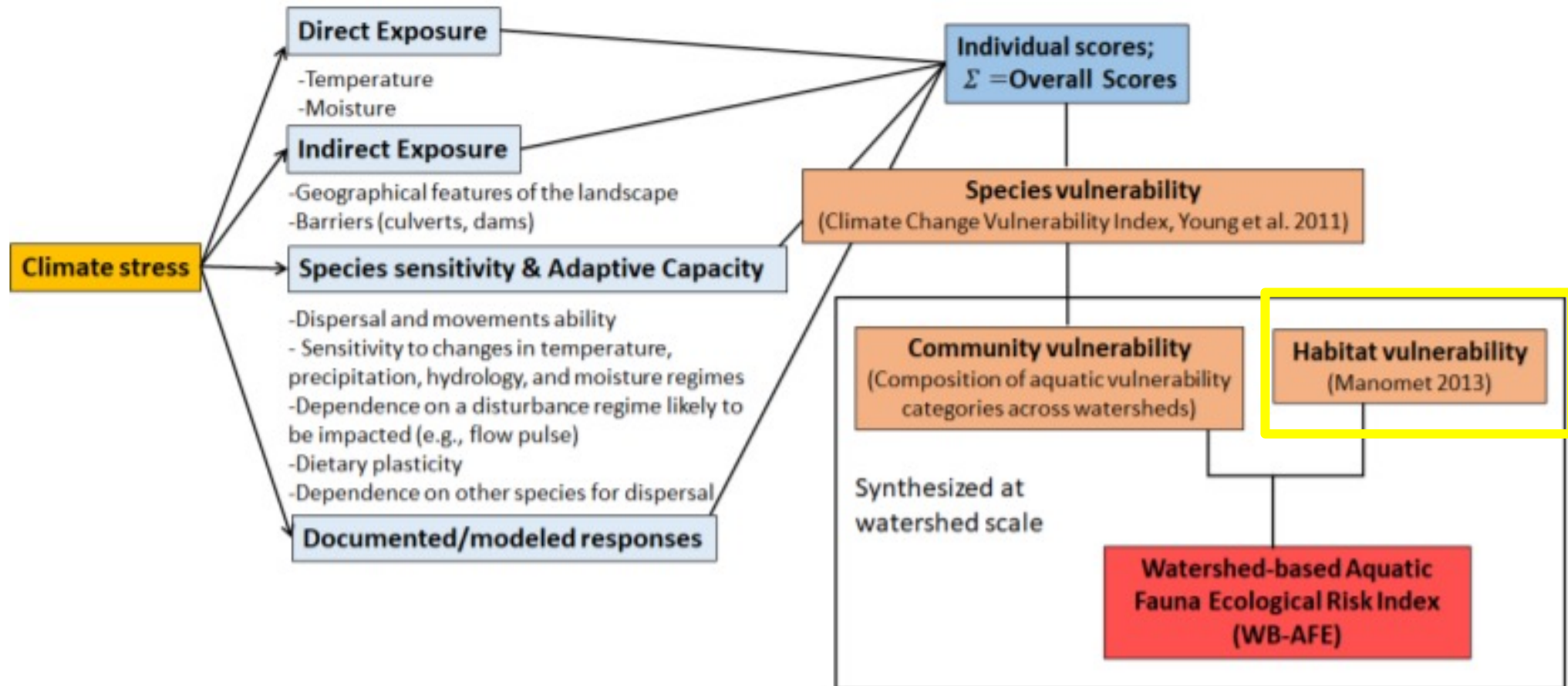26 variables associated with human disturbance

Excludes climate-related impact

NFHP averaged across each watershed (HUC8)

Risk of Habitat Degredation

- Very Low
- Low
- Moderate
- High
- Very High
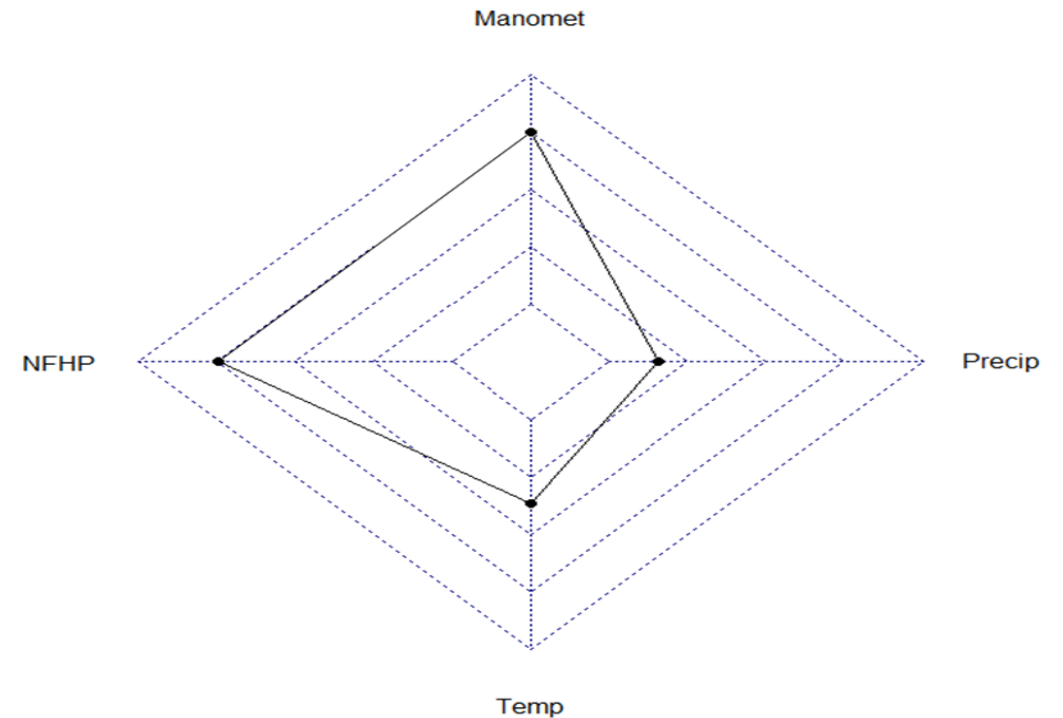- WV State Boundary

0 22 44 88 Miles
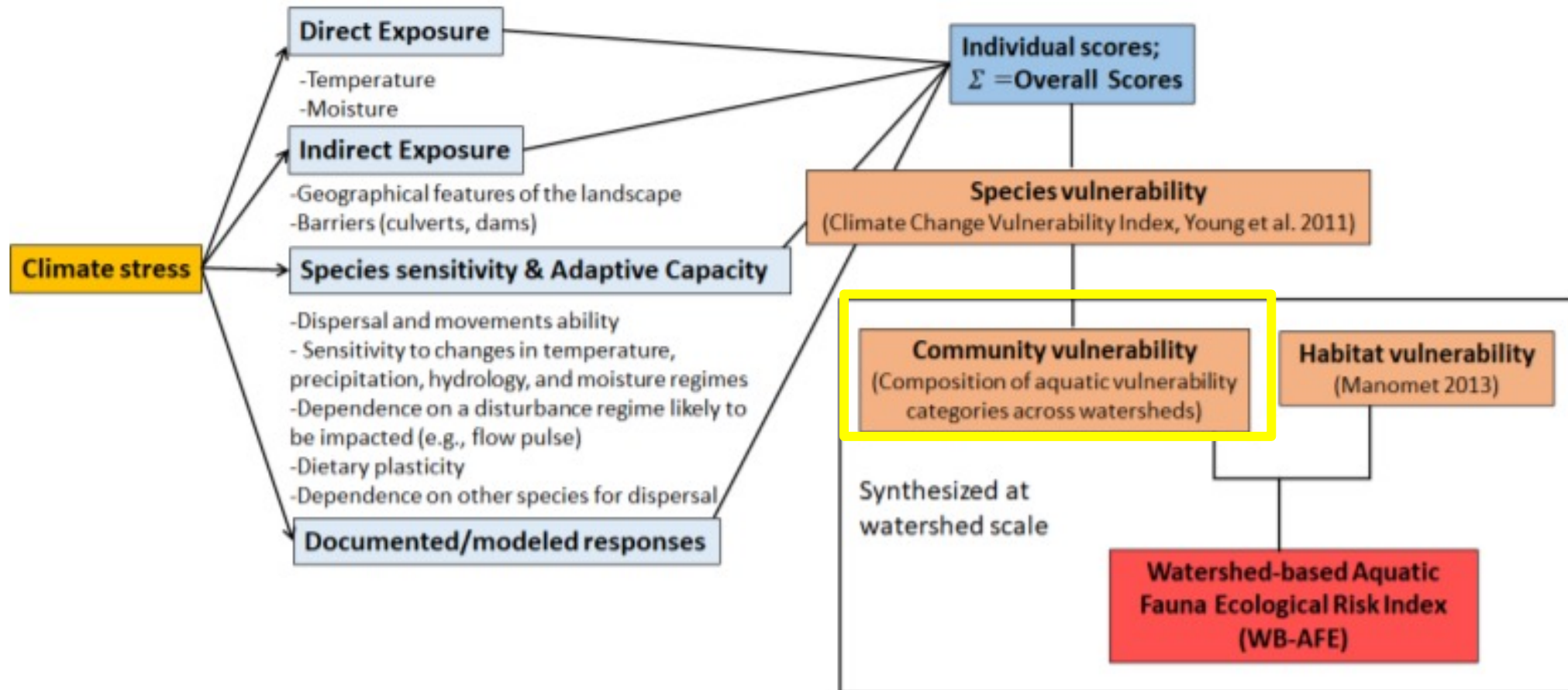
N

Watershed Model

Index Integration

Habitat Integration

- Star plots formed based on the values of habitat scores and climate variables

- Polygon area used as an integrated metric

Watershed Model

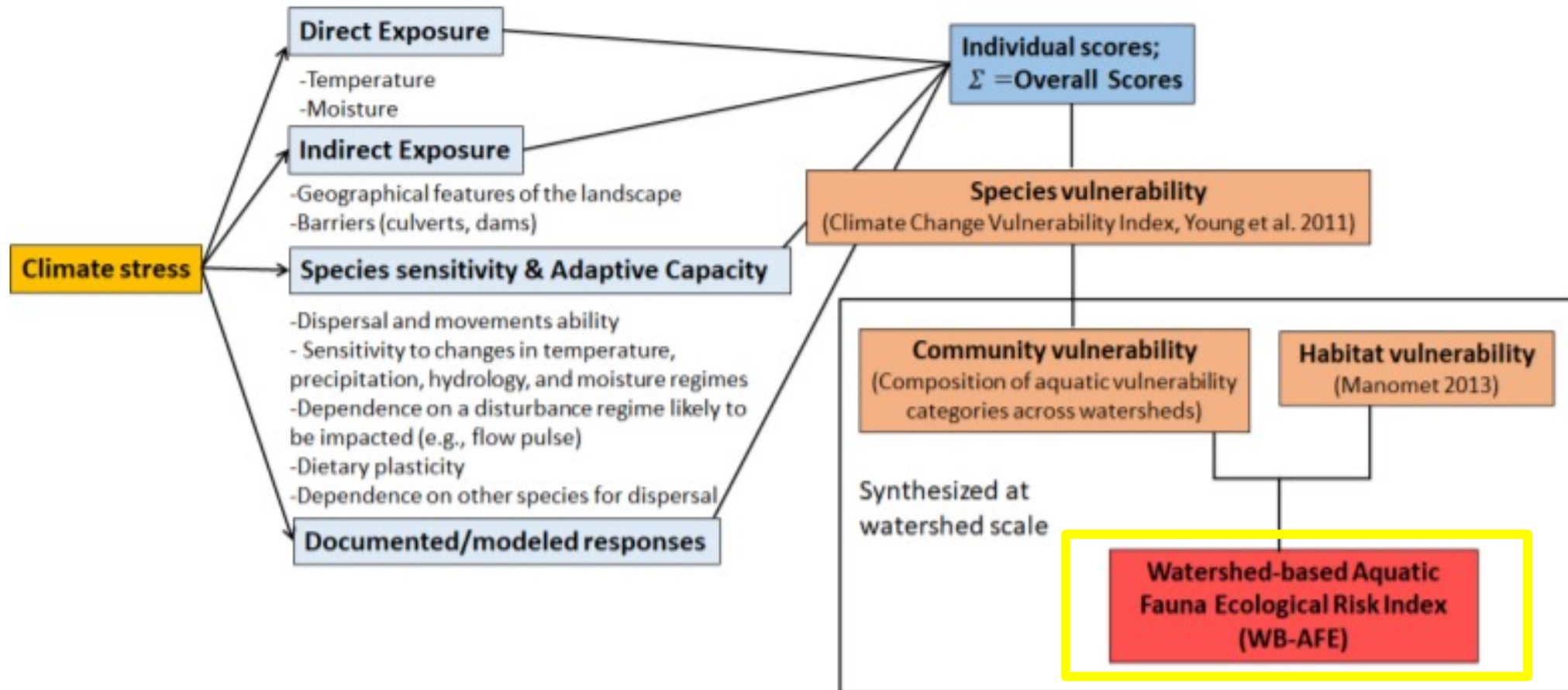# Index Integration

Community Integration

Product of the number of species per vulnerability and associated weight summated by watershed (HUC8)

Weighted by species vulnerability score (1 = Less Vulnerable; 4 = Extremely Vulnerable

$$\text{Watershed Community} = \Sigma(n_{\text{species per vulnerability category}})(\text{vulnerability weight})$$
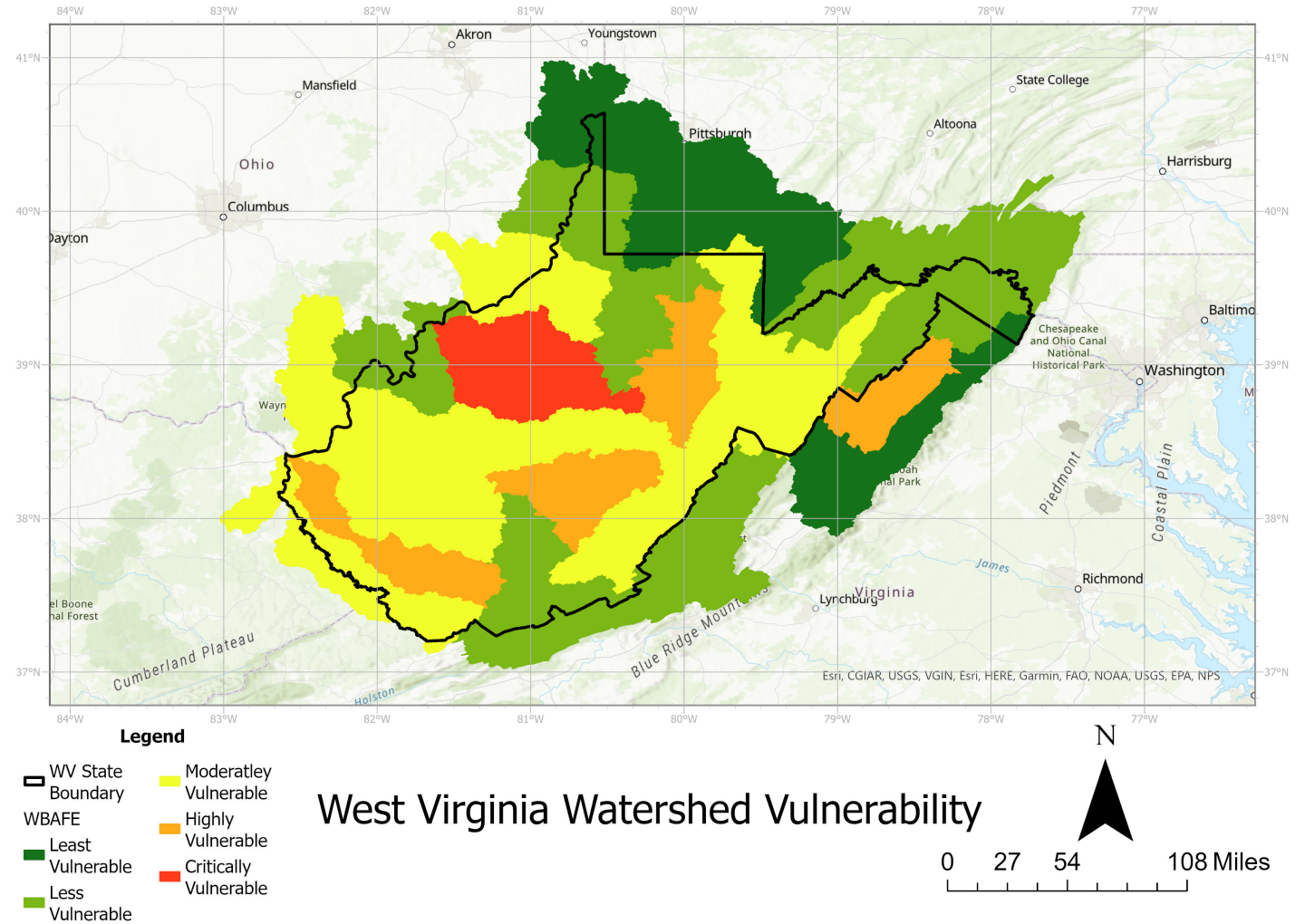
Watershed Model

Watershed Model

Average of habitat vulnerability and community vulnerability

- Scores watersheds between 0 (Least Vulnerable) and 1 (Extremely Vulnerable)

31 watersheds (HUC 8) assessed

- Scores range from 0 to 0.69
- Average score 0.22

Legend

WV State Boundary

WBAFE

- Least Vulnerable
- Less Vulnerable
- Moderatley Vulnerable
- Highly Vulnerable
- Critically Vulnerable

West Virginia Watershed Vulnerability

N

0 27 54 108 Miles

Summary

- Decision support tools are necessary to determine the where and how of management

- Incorporating species, community, and habitat vulnerability could provide holistic assessments of watershed vulnerability

- WB-AFE may support managers in conservation choices related to

  - Land value
  - Periphery watershed partnerships
  - Species, community, and habitat vulnerability

Acknowledgments