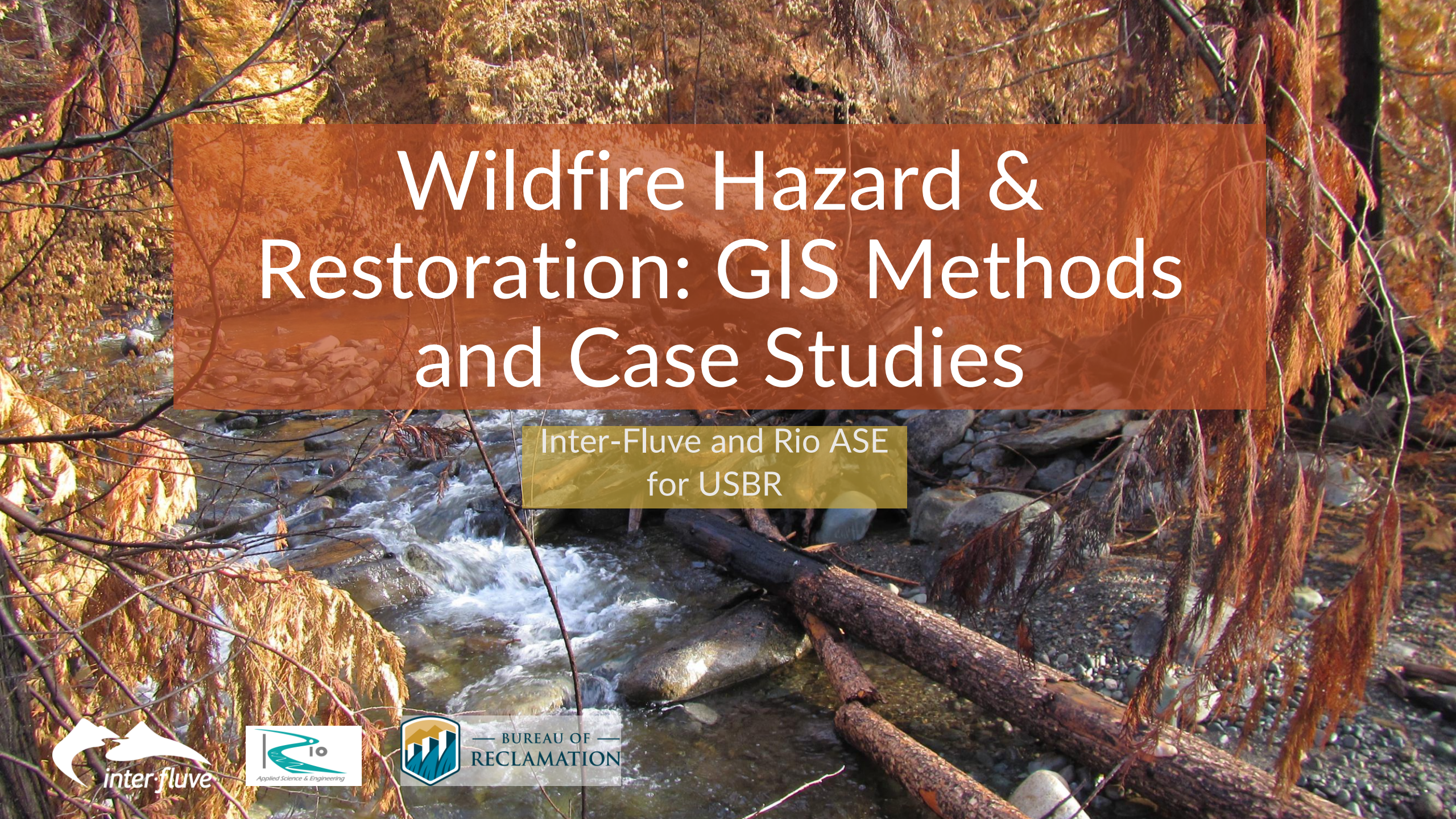


Wildfire Hazard & Restoration: GIS Methods and Case Studies

Inter-Fluve and Rio ASE
for USBR

inter·fluve

Rio
Applied Science & Engineering

BUREAU OF
RECLAMATION

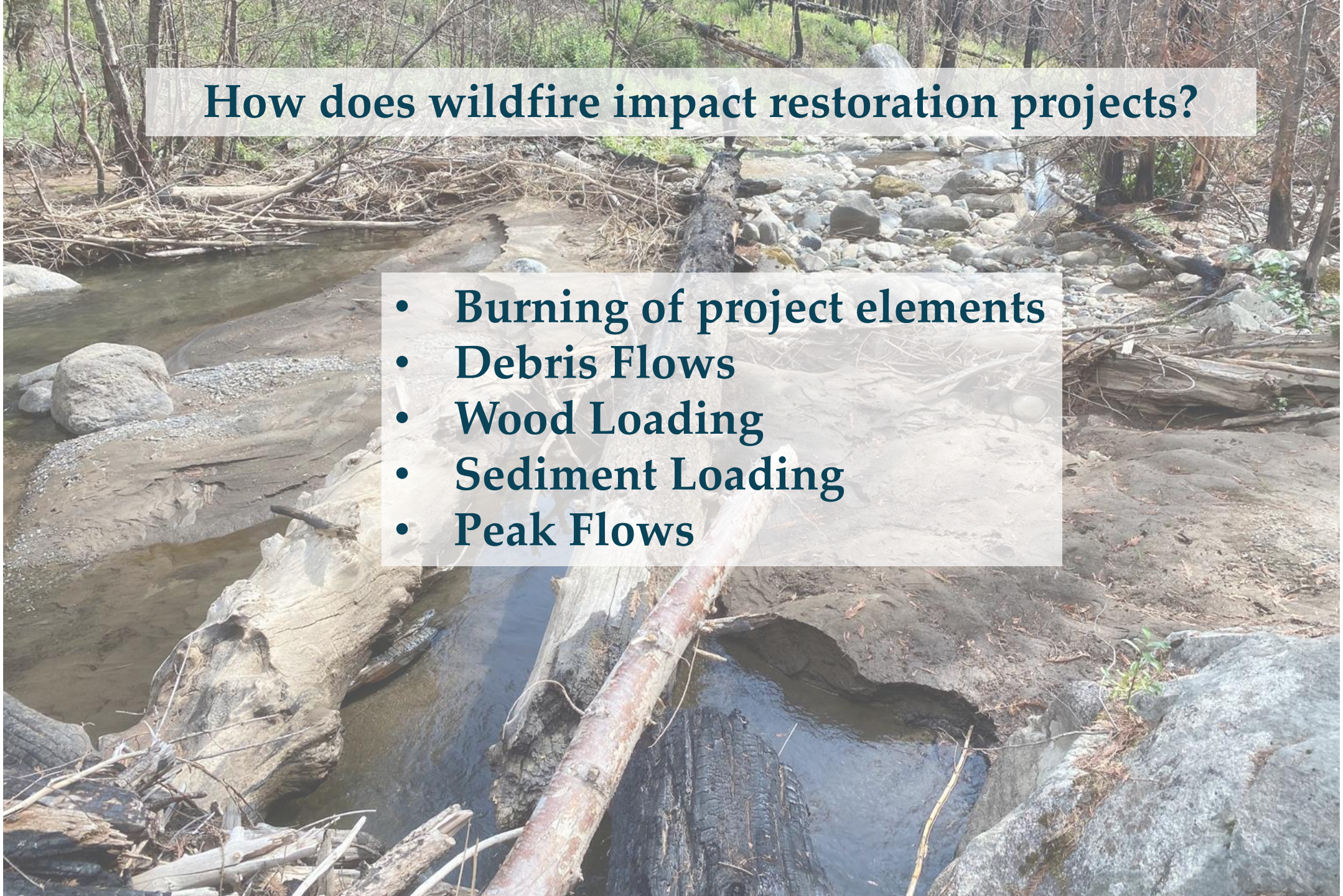
Zach Sudman, PE – Staff Engineer

Sara Windoloski– Hydrologist

Oregon and Washington had the largest acreage burned from wildfires across the country in 2024

Cedar Creek Fire in 2021 on Wolf Creek

1. Background & Purpose
2. GIS Methods
3. Case Study
4. Conclusions



How does wildfire impact restoration projects?

- Burning of project elements
- Debris Flows
- Wood Loading
- Sediment Loading
- Peak Flows

Burned constructed jam on the Chewuch River (Cub Creek fire 2021)

Debris flows impacts on the Chewuch River (Cub Creek fire 2021)

Debris flows impacts on the Chewuch River (Cub Creek fire 2021)

Changes in wood on Wolf Creek (Cedar Creek Fire 2021)

Cedar Creek Fire in 2021 on Wolf Creek

Sediment loading impacts on Wolf Creek (pre-Cedar Creek Fire 2021)

Peak flow impacts on Beaver Creek (Carlton Complex Fire 2014)

What drives wildfire related landscape response?

Wildfire Characteristics

+

Landscape Characteristics

=

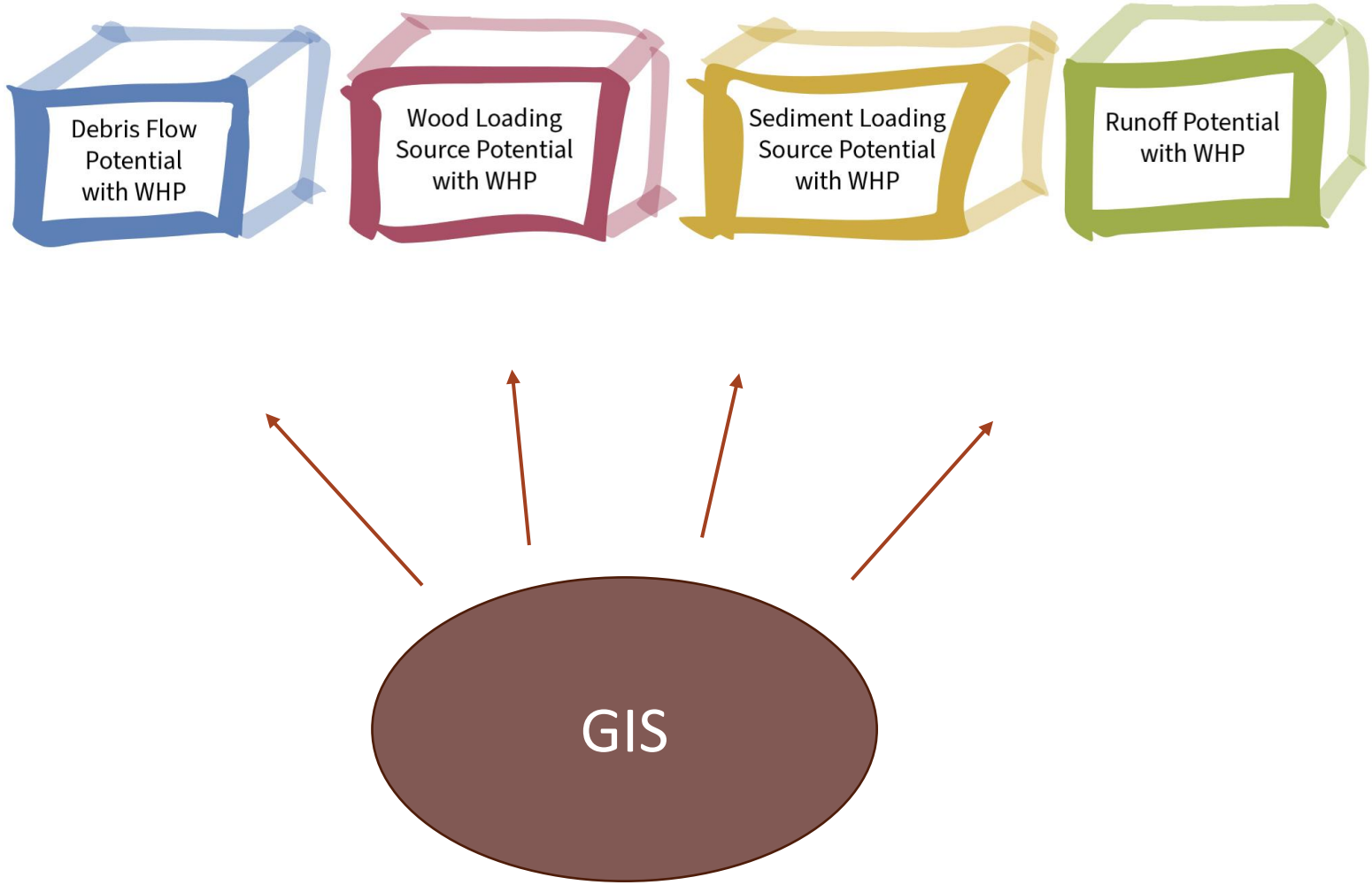
Landscape Response to Wildfire

How does landscape response impact a project site?

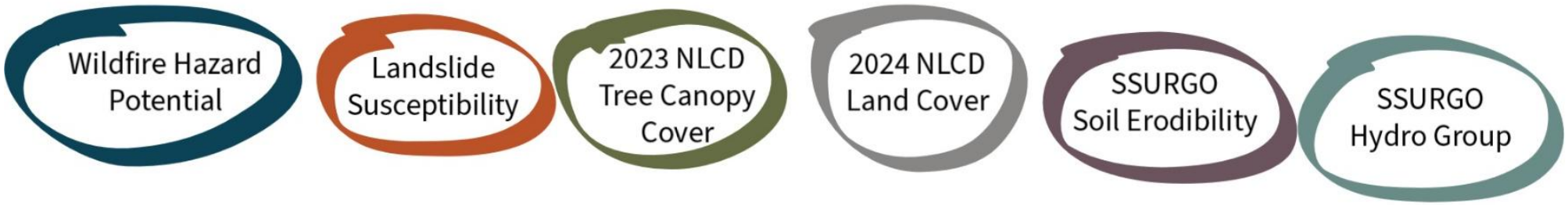
GIS Methodology

- User-friendly
- Early stages of project design

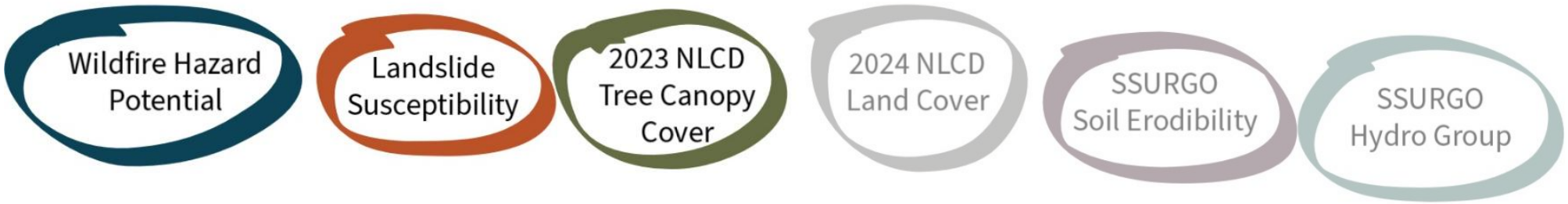
Outputs


Debris Flow Potential with WHP
Wood Loading Source Potential with WHP
Sediment Loading Source Potential with WHP
Runoff Potential with WHP
GIS

Inputs


Wildfire Hazard Potential
Landslide Susceptibility
2023 NLCD Tree Canopy Cover
2024 NLCD Land Cover
SSURGO Soil Erodibility
SSURGO Hydro Group

Inputs


Wildfire Hazard Potential
Landslide Susceptibility
2023 NLCD Tree Canopy Cover
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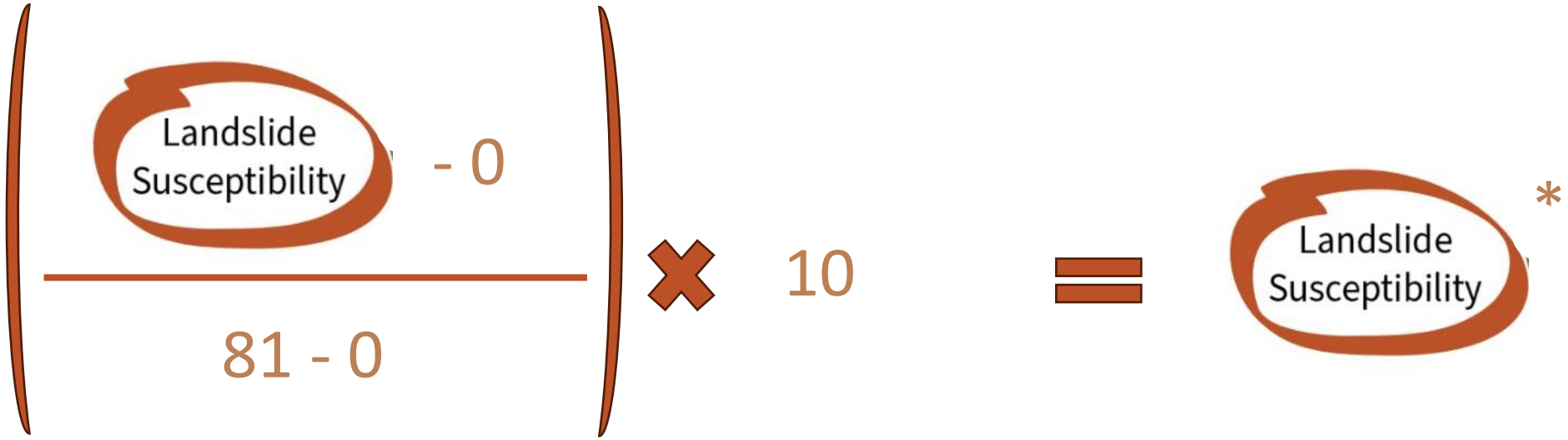
SSURGO Soil Erodibility
SSURGO Hydro Group

$$\text{Scaled input rasters} = \left(\frac{x - \min(x)}{\max(x) - \min(x)}\right) \text{x } 10$$

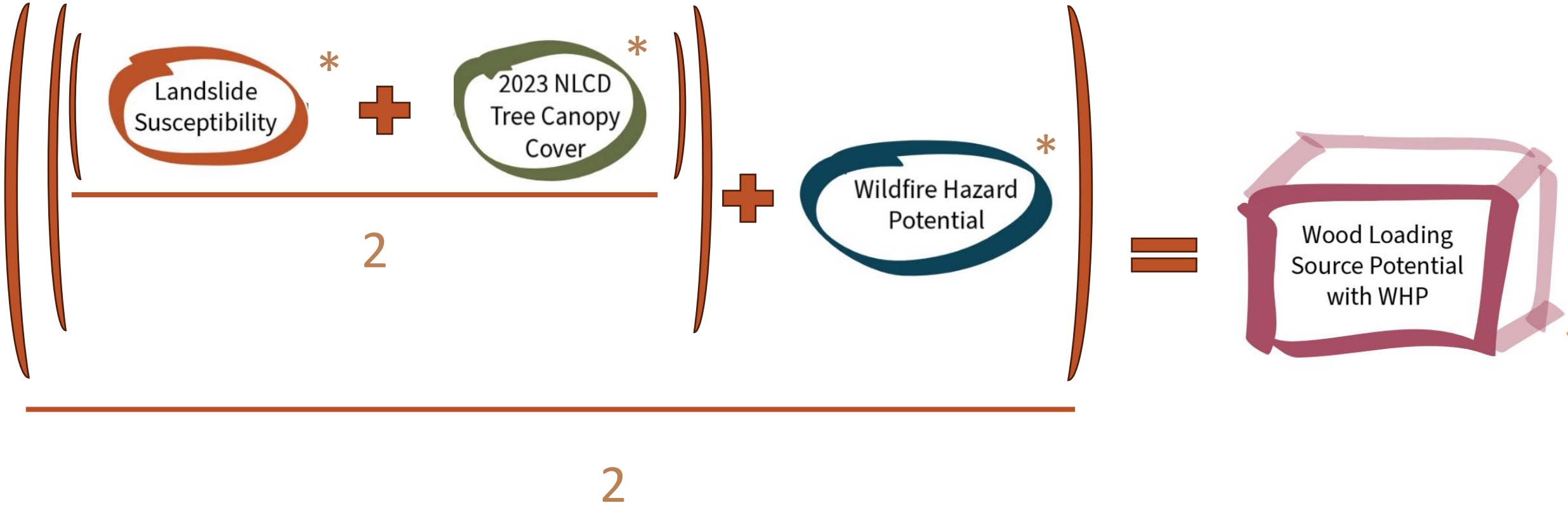
$$\left(\frac{x - \min(x)}{\max(x) - \min(x)}\right) \times 10$$



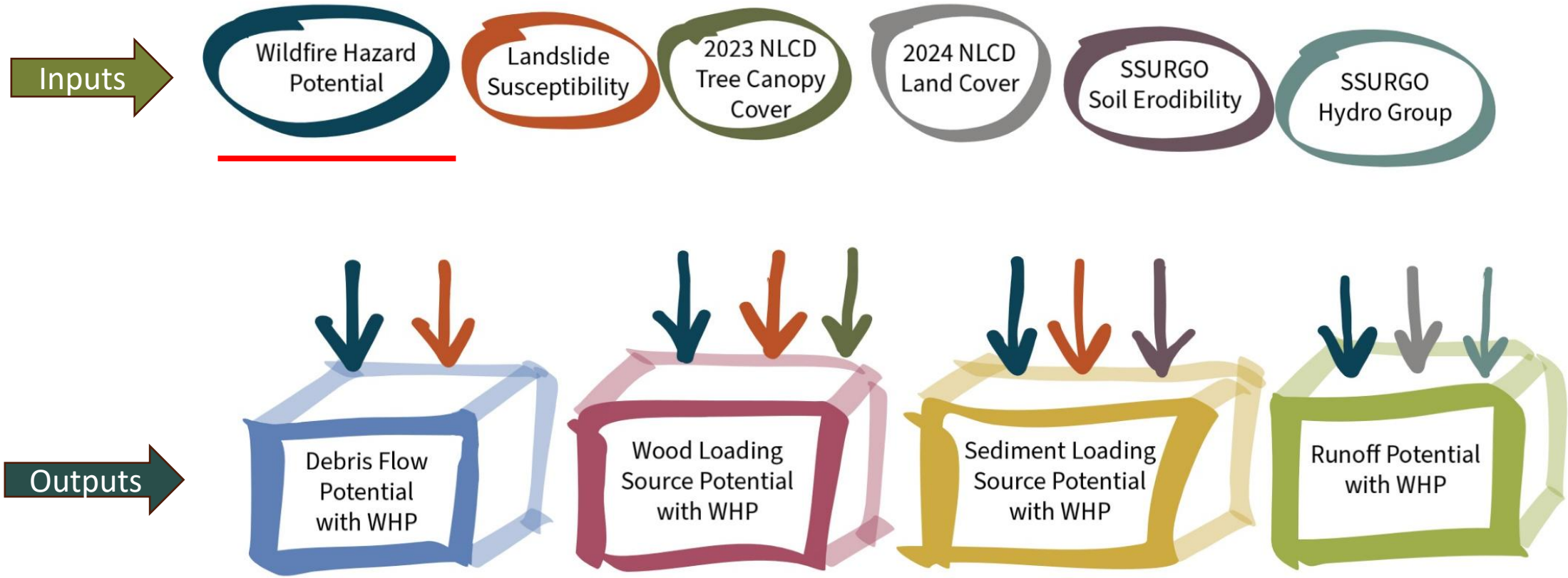
Min: 0
Max: 81

* = Scaled from 0 - 10

Inputs



* = Scaled from 0 - 10


Inputs
Wildfire Hazard Potential
Landslide Susceptibility
2023 NLCD Tree Canopy Cover
2024 NLCD Land Cover
SSURGO Soil Erodibility
SSURGO Hydro Group
Outputs
Debris Flow Potential with WHP
Wood Loading Source Potential with WHP
Sediment Loading Source Potential with WHP
Runoff Potential with WHP

Wildfire Hazard Potential

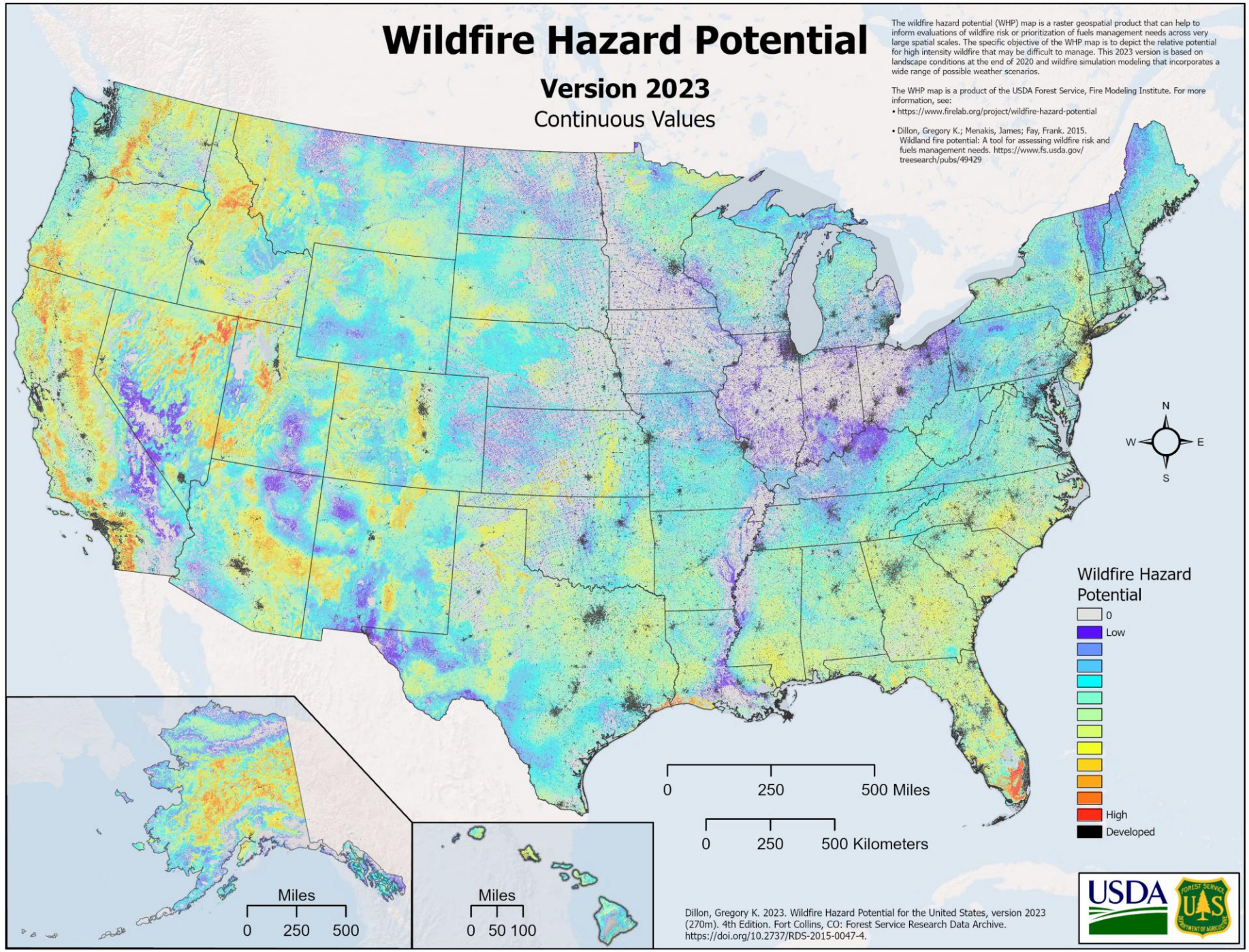
Version 2023

Continuous Values

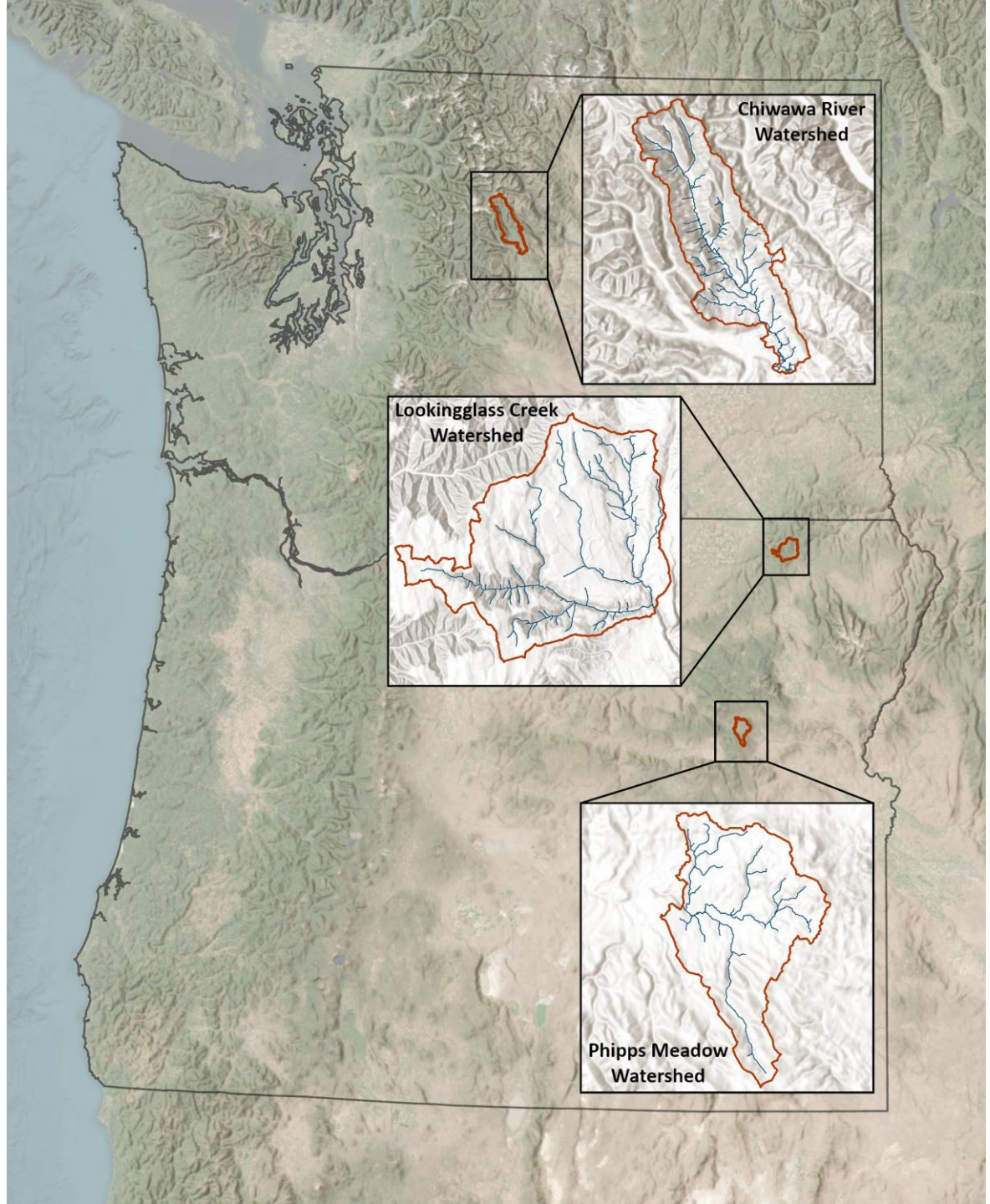
The wildfire hazard potential (WHP) map is a raster geospatial product that can help to inform evaluations of wildfire risk or prioritization of fuels management needs across very large spatial scales. The specific objective of the WHP map is to depict the relative potential for high intensity wildfire that may be difficult to manage. This 2023 version is based on landscape conditions at the end of 2020 and wildfire simulation modeling that incorporates a wide range of possible weather scenarios.

The WHP map is a product of the USDA Forest Service, Fire Modeling Institute. For more information, see:

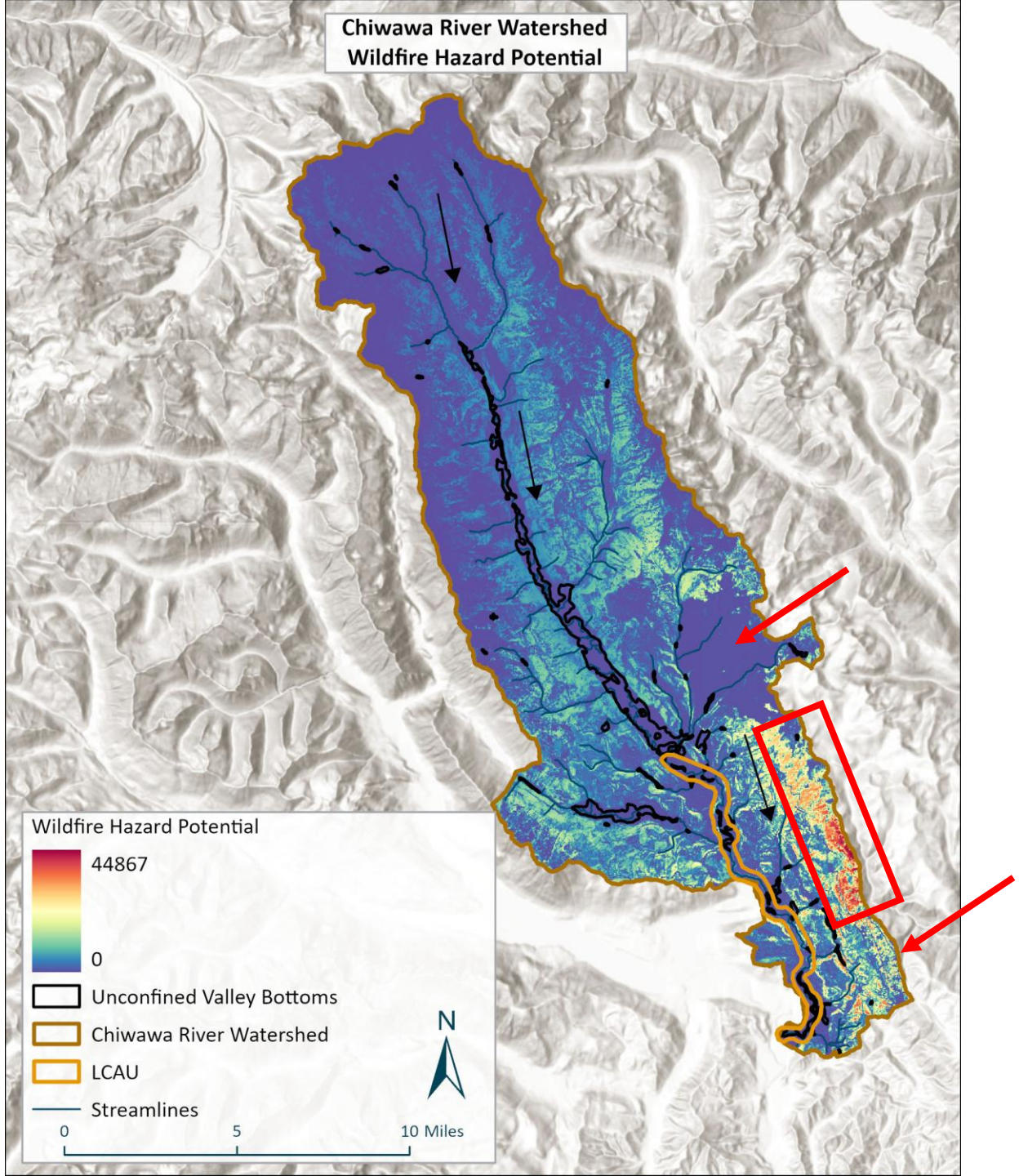
- https://www.firelab.org/project/wildfire-hazard-potential
- Dillon, Gregory K.; Menakis, James; Fay, Frank. 2015. Wildland fire potential: A tool for assessing wildfire risk and fuels management needs. https://www.fs.usda.gov/treesearch/pubs/49429

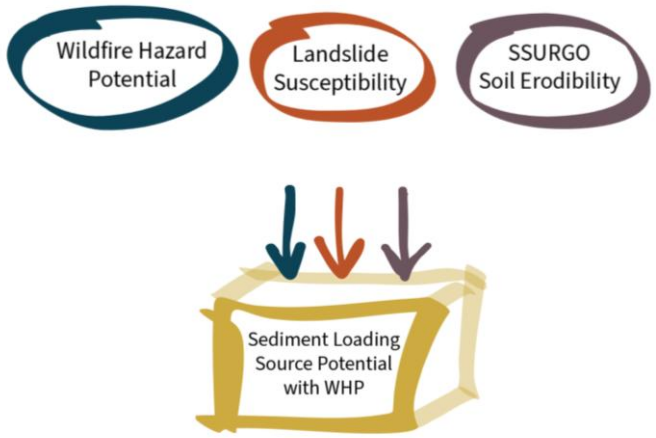


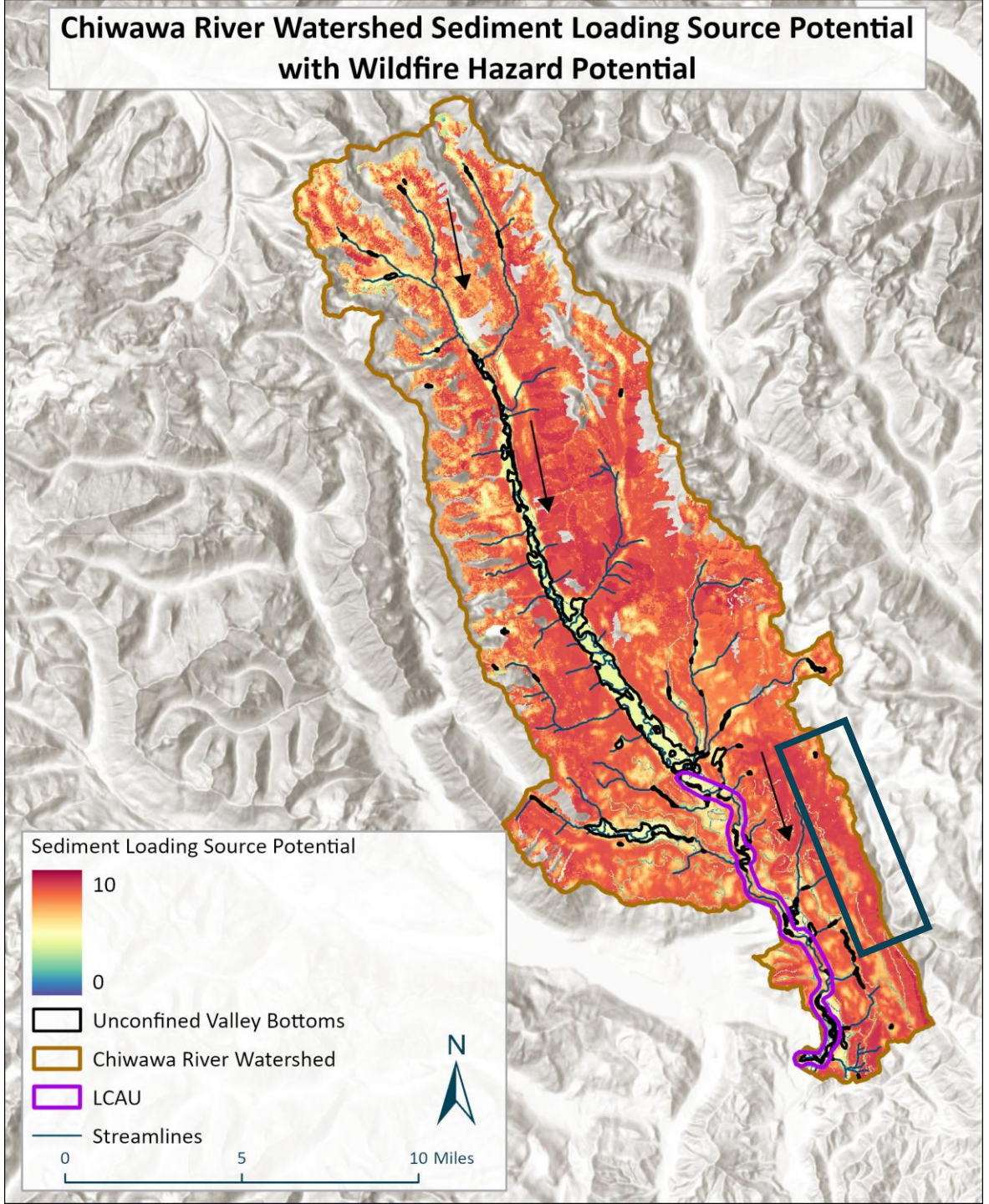
Dillon, Gregory K. 2023. Wildfire Hazard Potential for the United States, version 2023 (270m). 4th Edition. Fort Collins, CO: Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2015-0047-4.


Chiwawa River
Watershed
Lookingglass Creek
Watershed
Phipps Meadow
Watershed

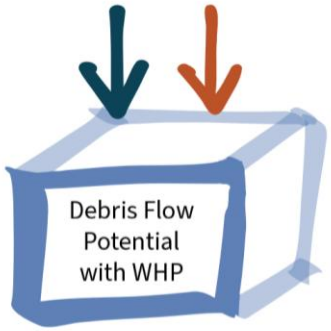
Wildfire hazard potential in the Chiwawa River Watershed

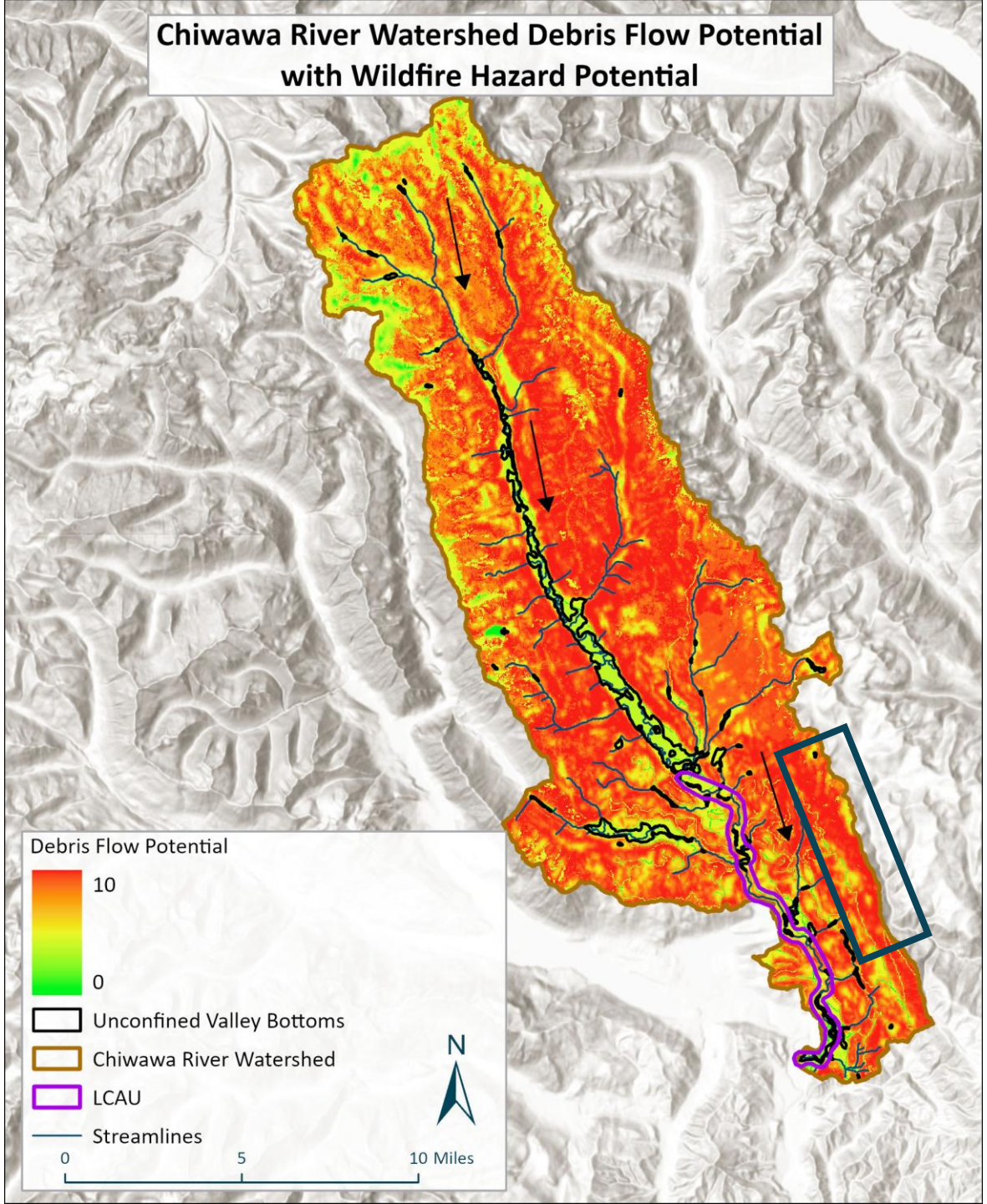



Wildfire Hazard Potential
Landslide Susceptibility
SSURGO Soil Erodibility
Sediment Loading Source Potential with WHP


Chiwawa River Watershed Sediment Loading Source Potential with Wildfire Hazard Potential
Sediment Loading Source Potential
10
0
Unconfined Valley Bottoms
Chiwawa River Watershed
LCAU
Streamlines
N
0
5
10 Miles


Wildfire Hazard Potential
Landslide Susceptibility


Debris Flow Potential with WHP

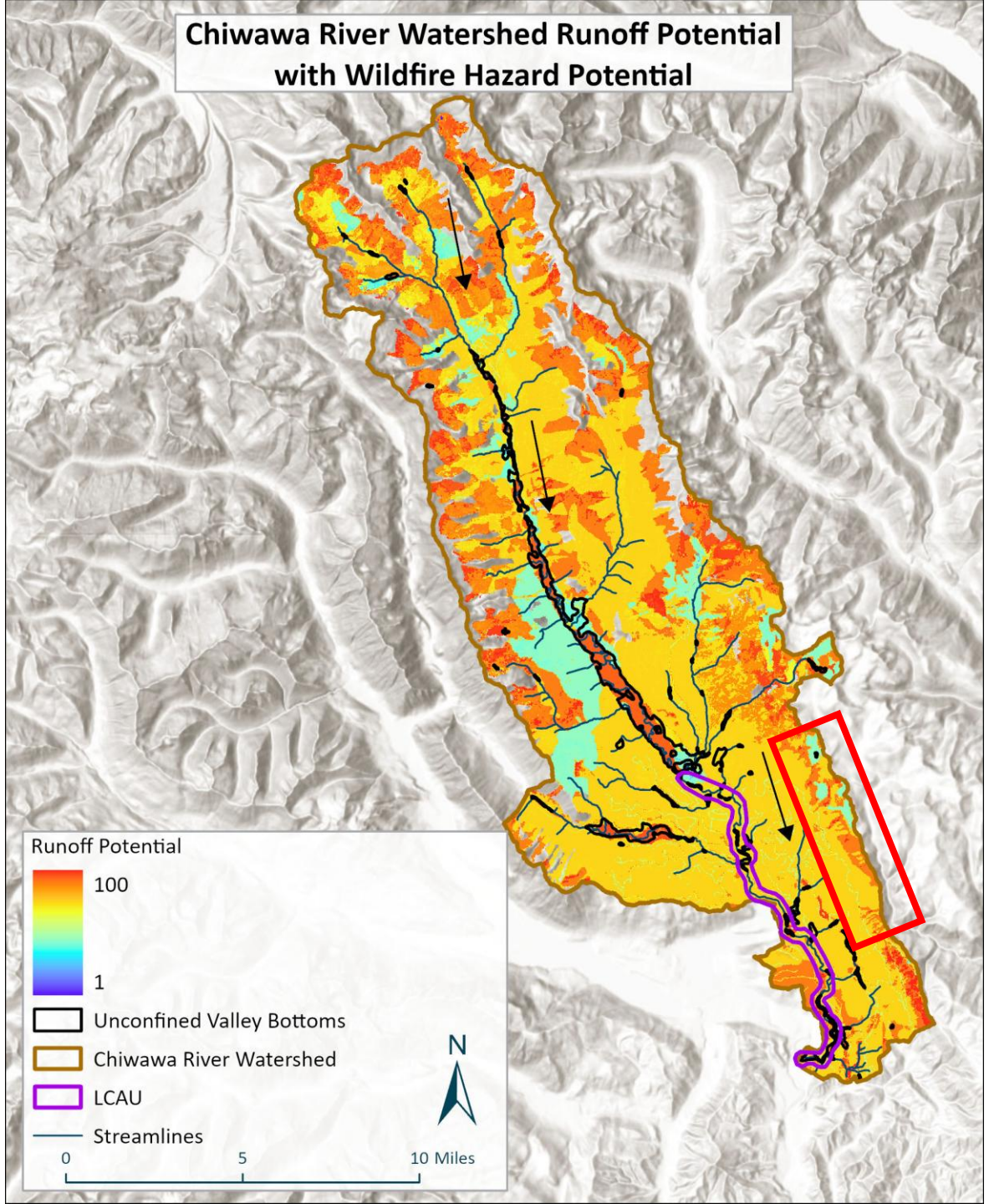

Chiwawa River Watershed Debris Flow Potential with Wildfire Hazard Potential
Debris Flow Potential
10
0
Unconfined Valley Bottoms
Chiwawa River Watershed
LCAU
Streamlines
N
0
5
10 Miles

Wildfire Hazard Potential

2024 NLCD Land Cover

SSURGO Hydro Group

Runoff Potential with WHP

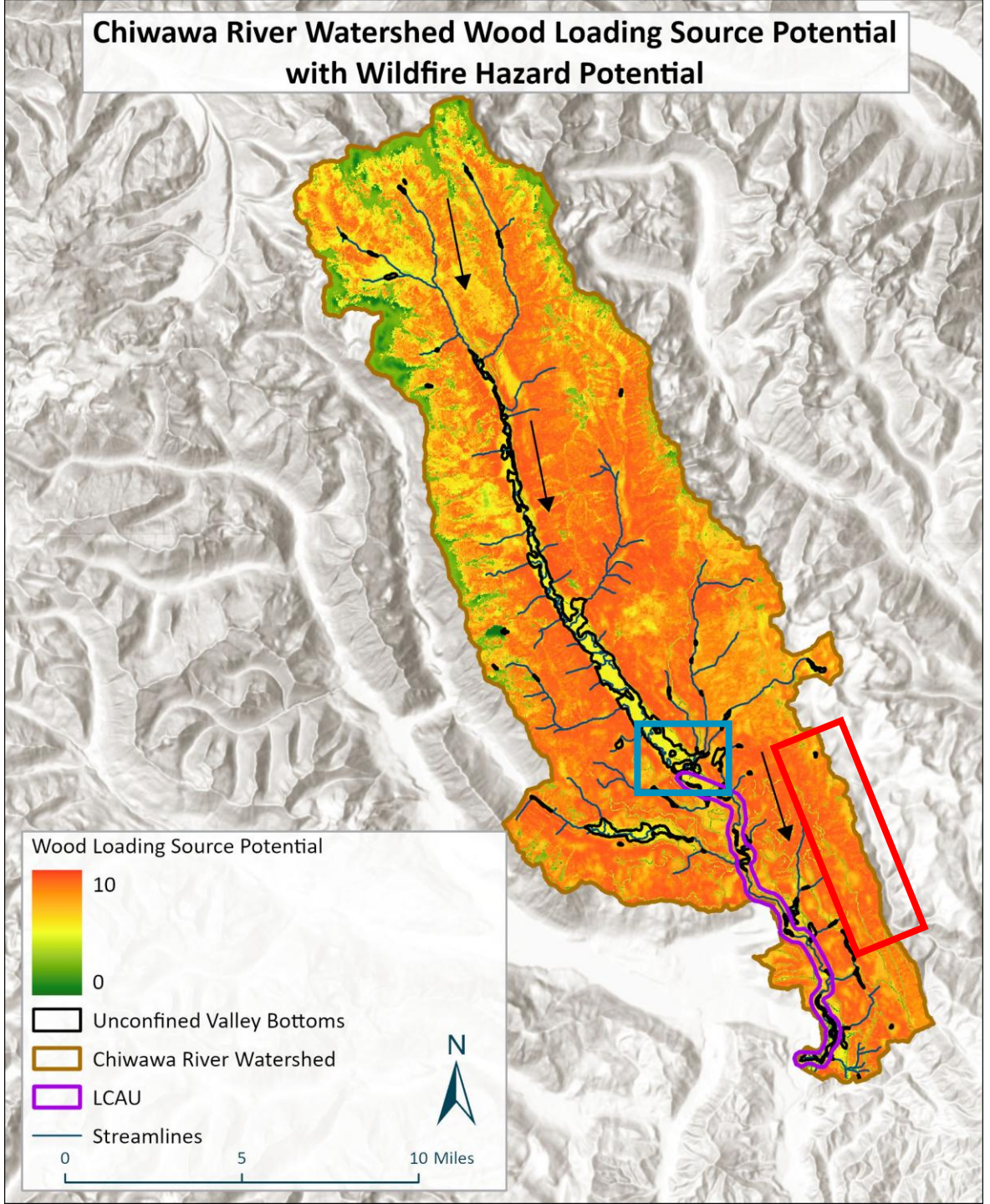


Wildfire Hazard Potential

Landslide Susceptibility

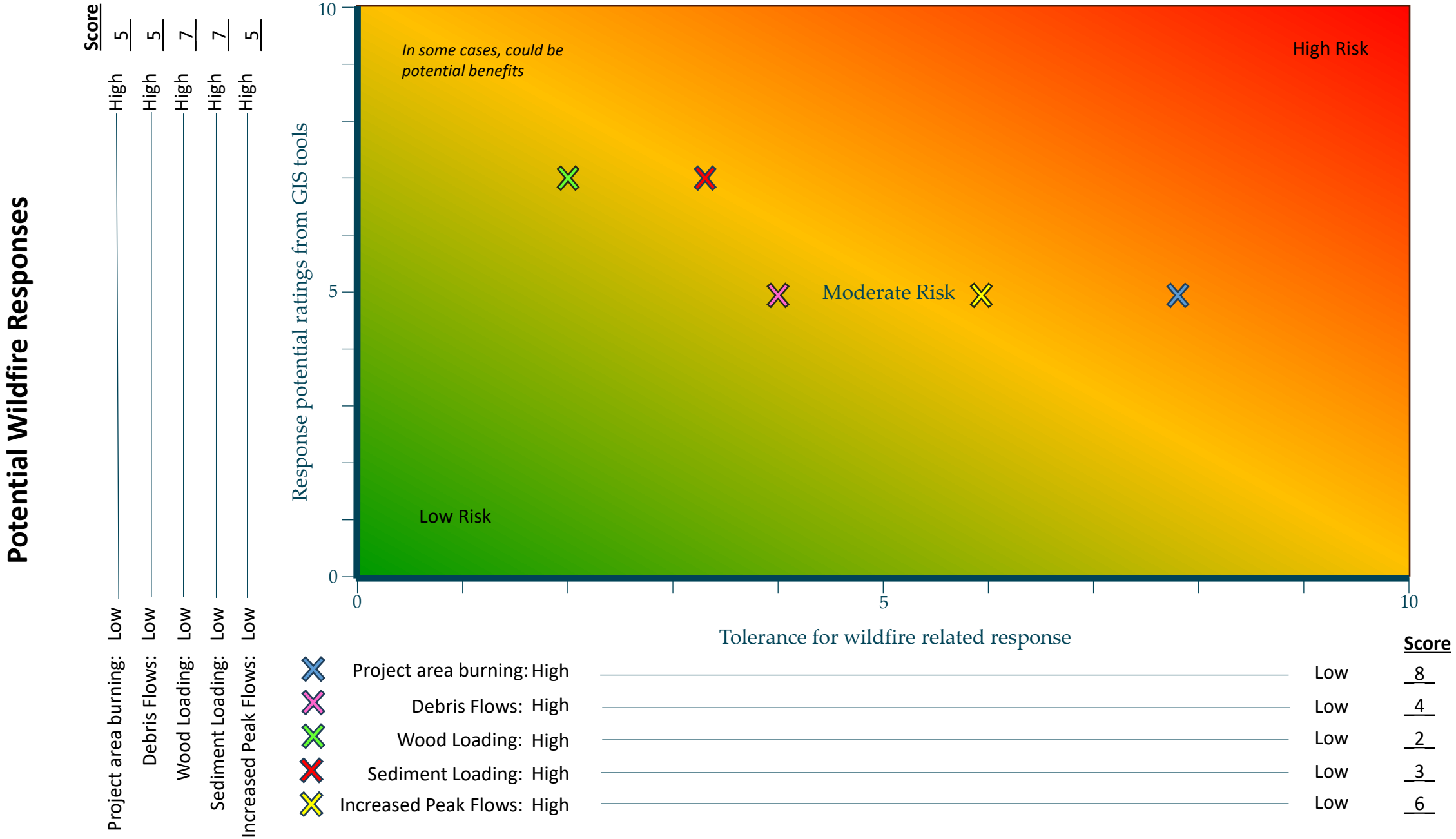
2023 NLCD Tree Canopy Cover

Wood Loading Source Potential with WHP




Upper Chiwawa
Chiwawa River
Chikamin Creek
Lower Chiwawa
Chiwawa River
Huckleberry Ford
Campground

Lower Chiwawa Risk Matrix



Design Considerations

- Project Element Design
- Increased floodplain connectivity
- Strategic accumulation of
  - Wood
  - Sediment
- Fuels reduction treatments
- Post-wildfire response

Recovery and Resiliency

Conclusions

- Many restoration projects are susceptible to wildfire impacts—A simple GIS-based screening approach can be used to evaluate risks early in the design process

- Wildfire-risks to restoration projects include debris flows, wood loading, sediment loading, and runoff

Thank you

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