

# Pre Wildfire Decision Support

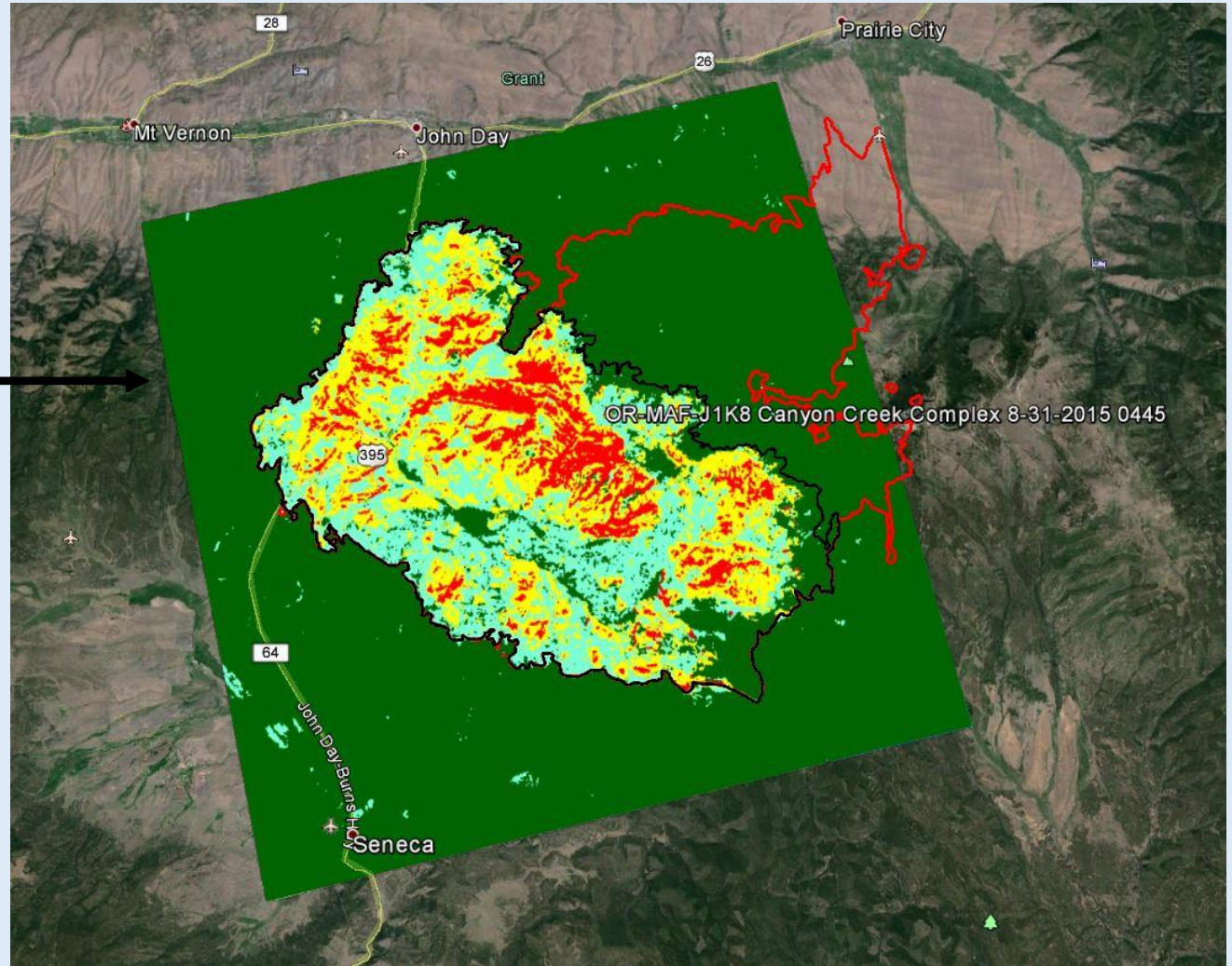
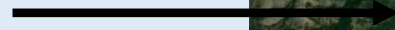
## Identifying At-Risk Infrastructure & Aquatic/Riparian Habitats

(Malheur National Forest, Eastern Oregon)



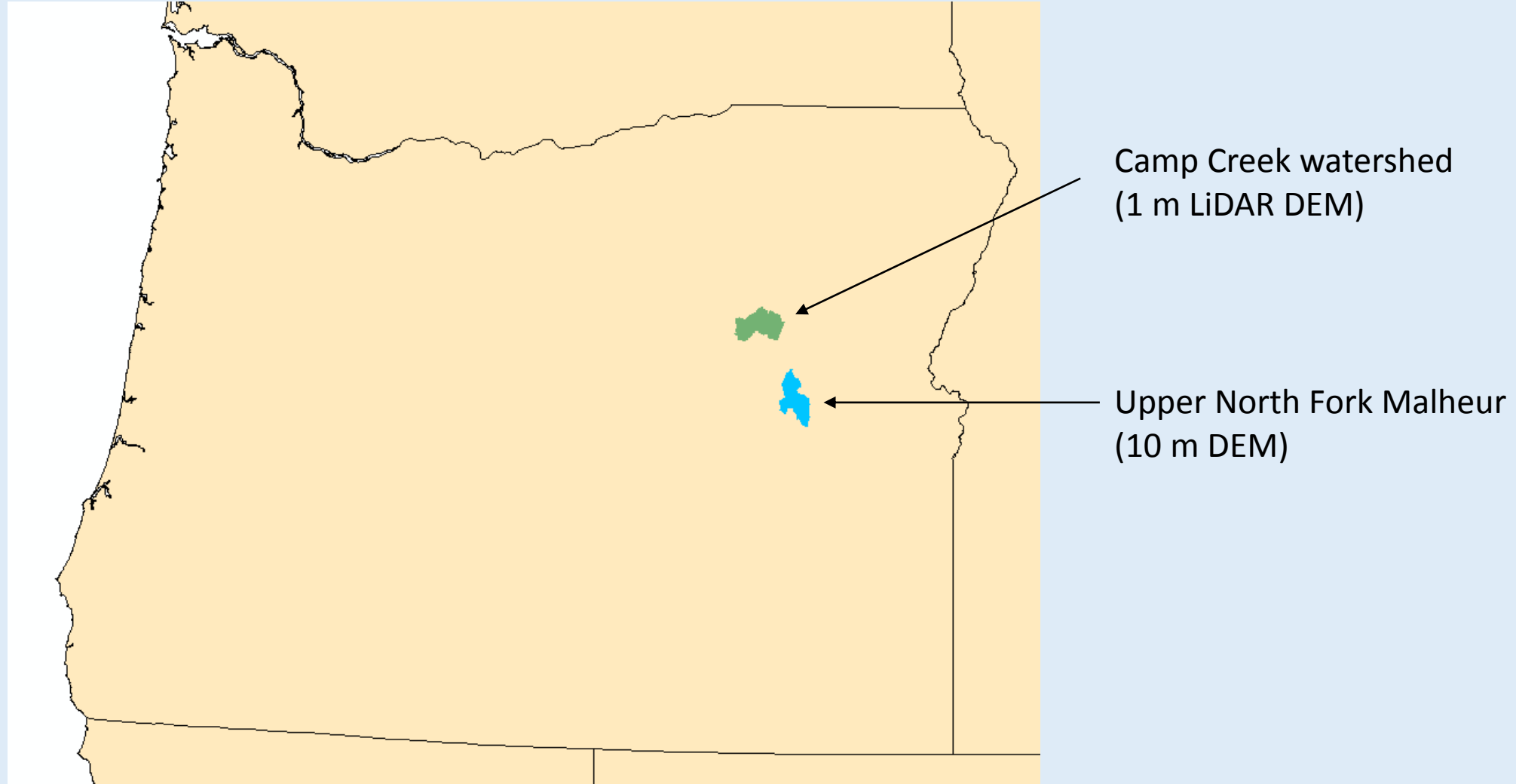
For the Post fire (BAER) analysis in the Canyon Creek Complex Fire, Eastern Oregon (9/2015), go to:  
[http://http://www.netmaptools.org/Pages/Canyonlakecreekfire\\_Netmap.pdf](http://http://www.netmaptools.org/Pages/Canyonlakecreekfire_Netmap.pdf)

Canyon Creek  
BAER-NetMap  
analysis area  
(colored)



*Continue with pre fire analysis, next slide.....*

## Pre fire analysis, pilot areas (preliminary)



# Decision Support, Data Uses

Pre Fire Management Activities	Data layers	Purpose
<b>Forest Restoration</b> (fuels reduction, thinning including in riparian zones, prescribed burns)	<ul style="list-style-type: none"> <li>-Fire severity and fire probability</li> <li>-Post fire surface erosion</li> <li>-Post fire landslide/gully erosion</li> <li>-Flash floods</li> <li>-Fish habitats</li> <li>-Thermal refugia (impacts to)</li> </ul>	<ul style="list-style-type: none"> <li>-Reduce potential for post fire erosion/floods and sediment delivery to streams (impacts on infrastructure and sensitive aquatic habitats)</li> <li>-Protect critical fish-riparian habitats (key habitats, refuges)</li> </ul>
<b>Road Restoration</b> (upgrade surfacing, increase drains, improve stream crossings, storage, decommissioning)	<ul style="list-style-type: none"> <li>-Road surface erosion &amp; sediment delivery potential (fire impacts on increased sediment delivery potential)</li> <li>-Road instability potential/fire increased</li> <li>-Roads in floodplains</li> <li>-Cumulative habitat above roads crossings</li> </ul>	<ul style="list-style-type: none"> <li>-Reduce potential for post fire erosion and sediment delivery (also in non-fire conditions)</li> <li>-Reduce potential for road related landsliding/gullyng</li> <li>-Remove fish barriers</li> </ul>
Firefighting	Data layers	Purpose
Firefighting, including retardant use	<ul style="list-style-type: none"> <li>-All stream buffered (300') - avoidance</li> <li>-Perennial stream buffered only - avoidance</li> <li>-Identify high value aquatic/riparian – non avoidance</li> </ul>	<ul style="list-style-type: none"> <li>-Avoid retardant pollution in surface waters</li> <li>-Protect critical aquatic/riparian habitats</li> </ul>

# Models and Sources

**DEMs – LiDAR and 10 m**

**Synthetic River Networks (stream layers) NetMap ([www.terrainworks.com](http://www.terrainworks.com))**

**Fire severity and probability (Flammap)**

**Post fire surface erosion (WEPP – Disturbed)**

**Post fire gully potential (Parker et al. 2010)**

**Post fire landsliding/gullying (Miller and Burnett 2007, 2008, NetMap)**

**Post fire road surface erosion and sediment delivery (GRAIP-Lite w/ modified sediment delivery)**

**Flash floods (NWS model)**

**Bull Trout Habitat (NorWest and US Forest Service stream layer)**

**Salmon habitat (Intrinsic Potential Chinook and steelhead, Burnett et al. 2007)**

**Shade/thermal loading/thermal refugia (NetMap and Groom et al. 2011)**

**Road – stability (NetMap)**

**Cumulative habitat length above roads (NetMap)**

**Refer to NetMap's online technical help manuals for additional information**

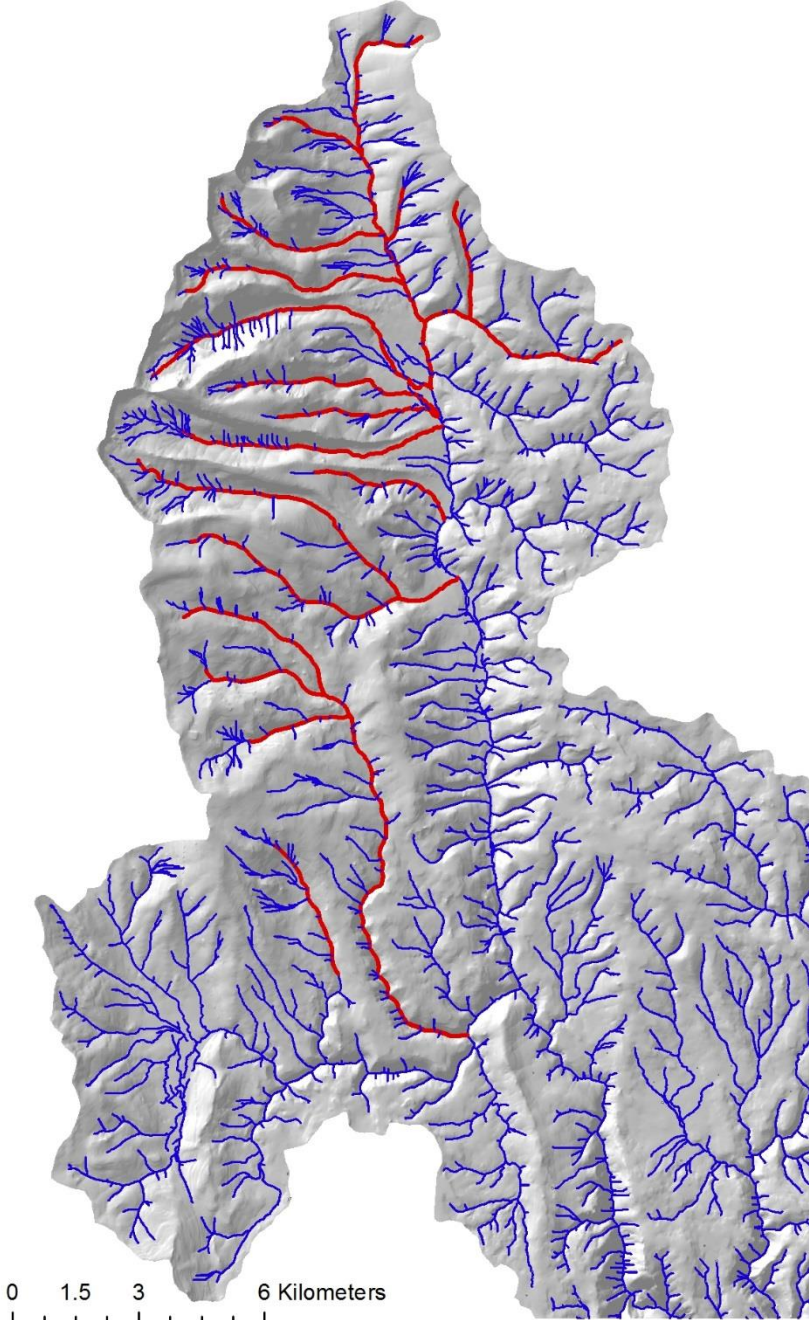
# Data Deliverable: Fish Habitat



Bull Trout (*Salvelinus confluentus*)

Use habitat intrinsic potential models  
in NetMap

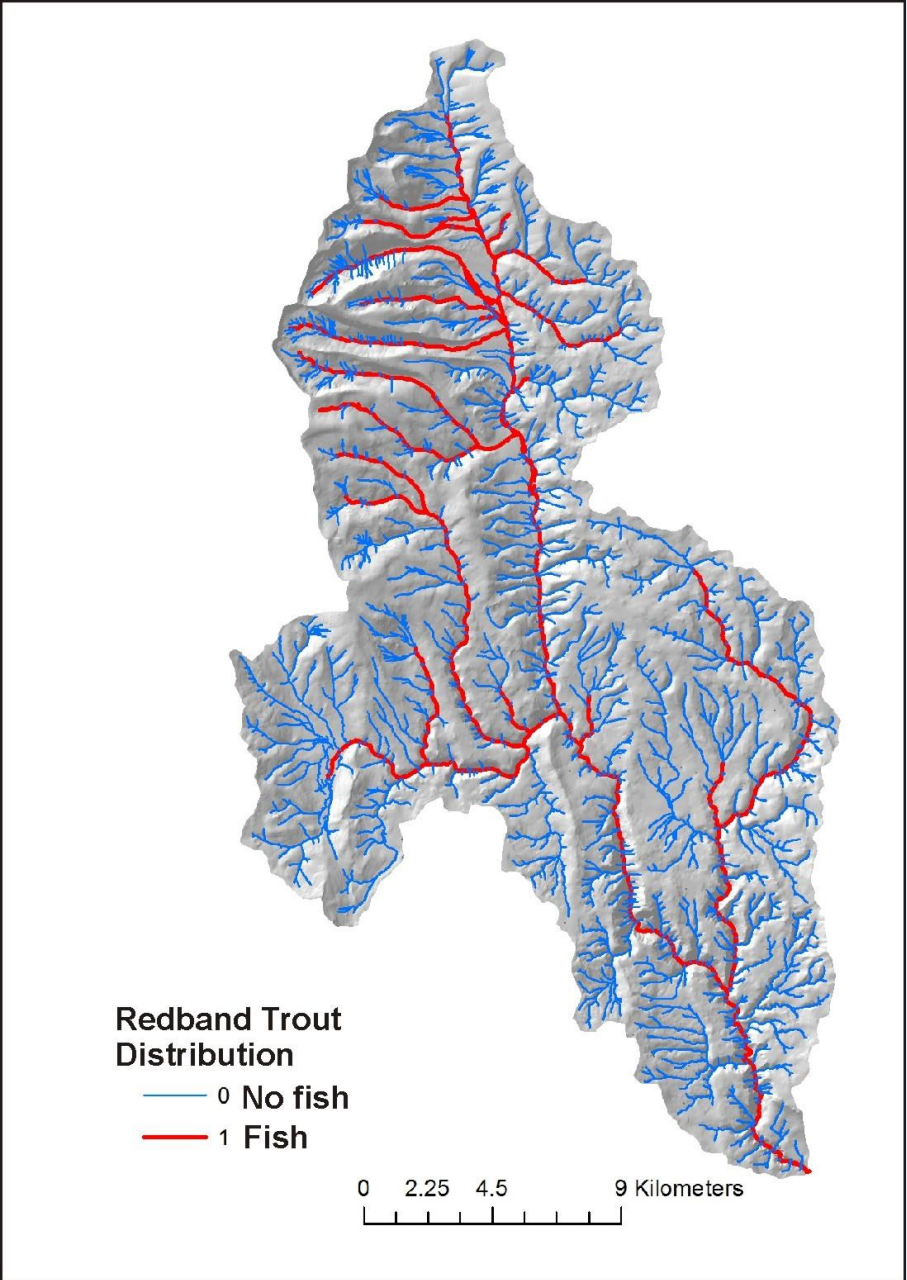
Legend  
reach\_unfm  
Fish  
— 1  
No Fish  
— 0



# Fish Habitat: Redband Trout (subspecies of *Oncorhynchus mykiss*)

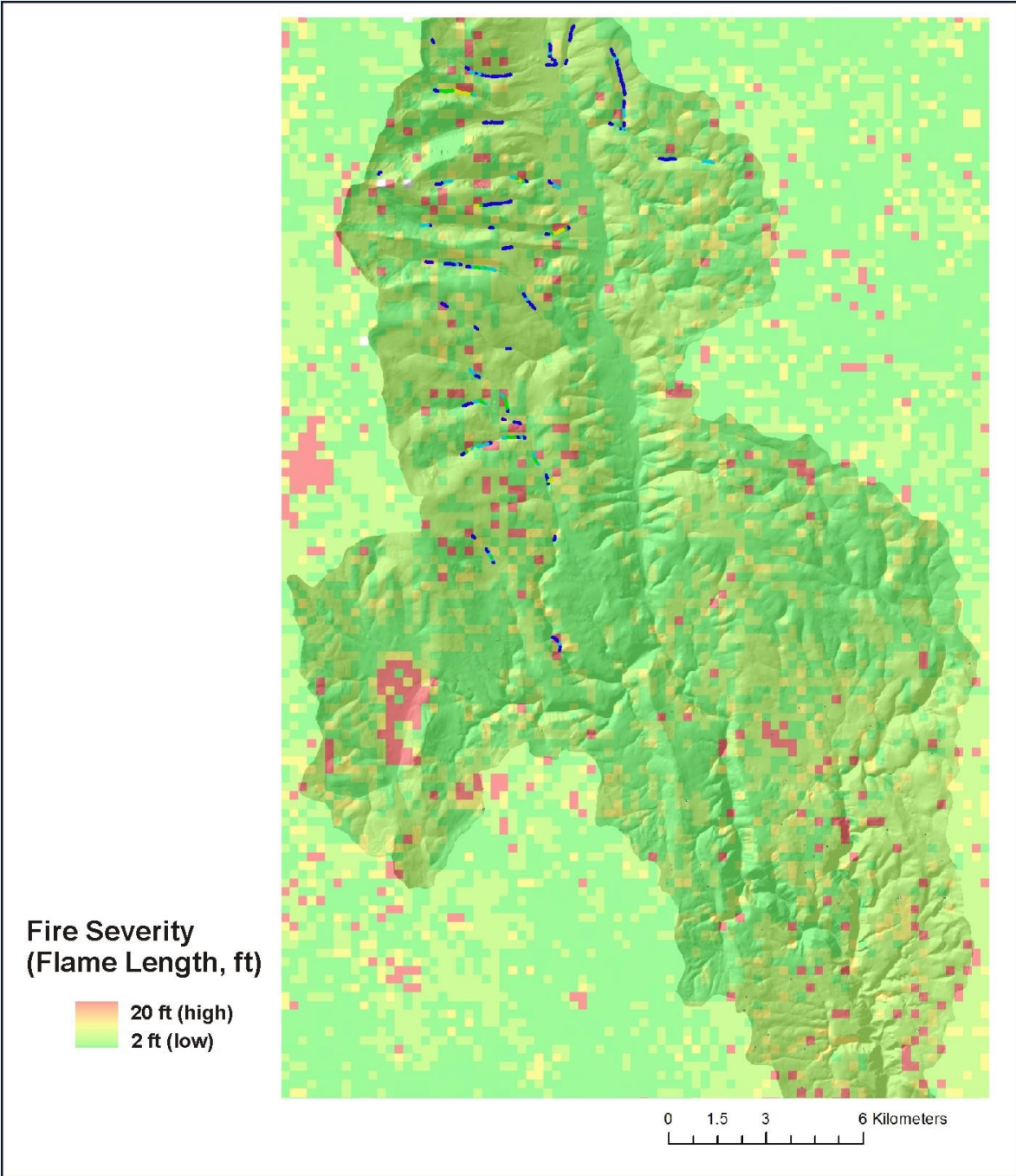


Use habitat intrinsic potential models  
in NetMap



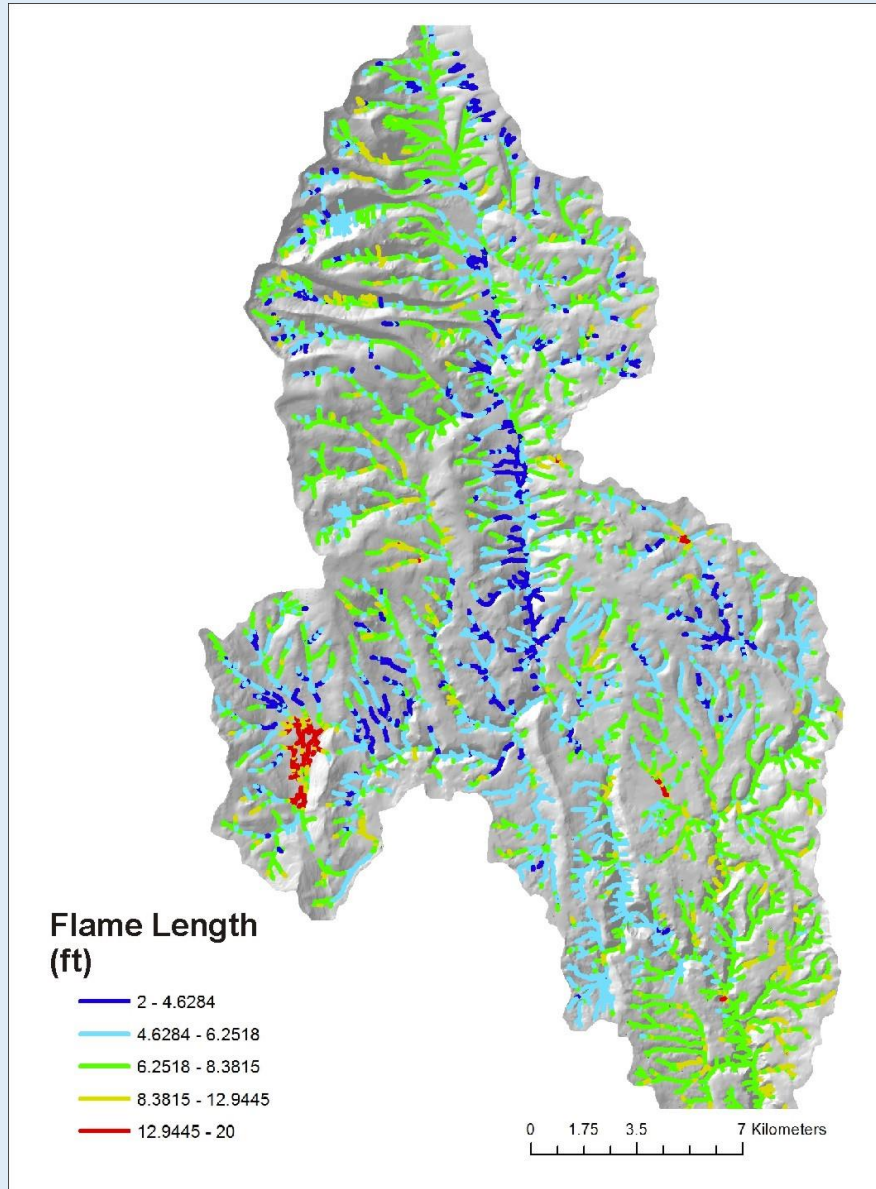
# Data Deliverables

## Fire Severity (hillside, Flammap)

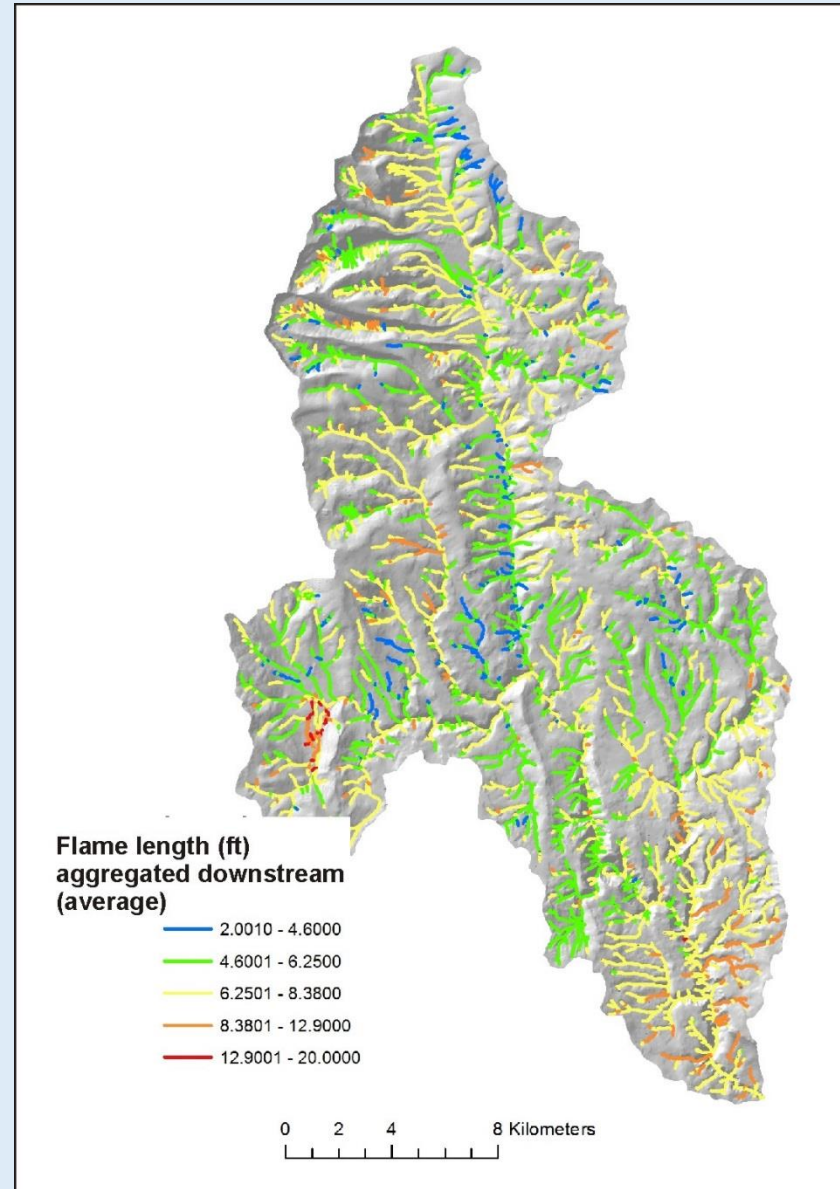




## Fire Severity (channel, fish eye)



## Fire Severity, Aggregated Downstream (tributary scale patterns)



**Why are hillslope attributes reported to channels, via drainage wings?**

**This facilitates comparing hillslope related stressors (fire severity, erosion, roads etc.) to fish habitats, a channel attribute.**

# Fire Probability

Fire Probability  
(Recurrence, years)



0 1.5 3 6 Kilometers

## Fire Cascade Impacts on Aquatic Ecosystems



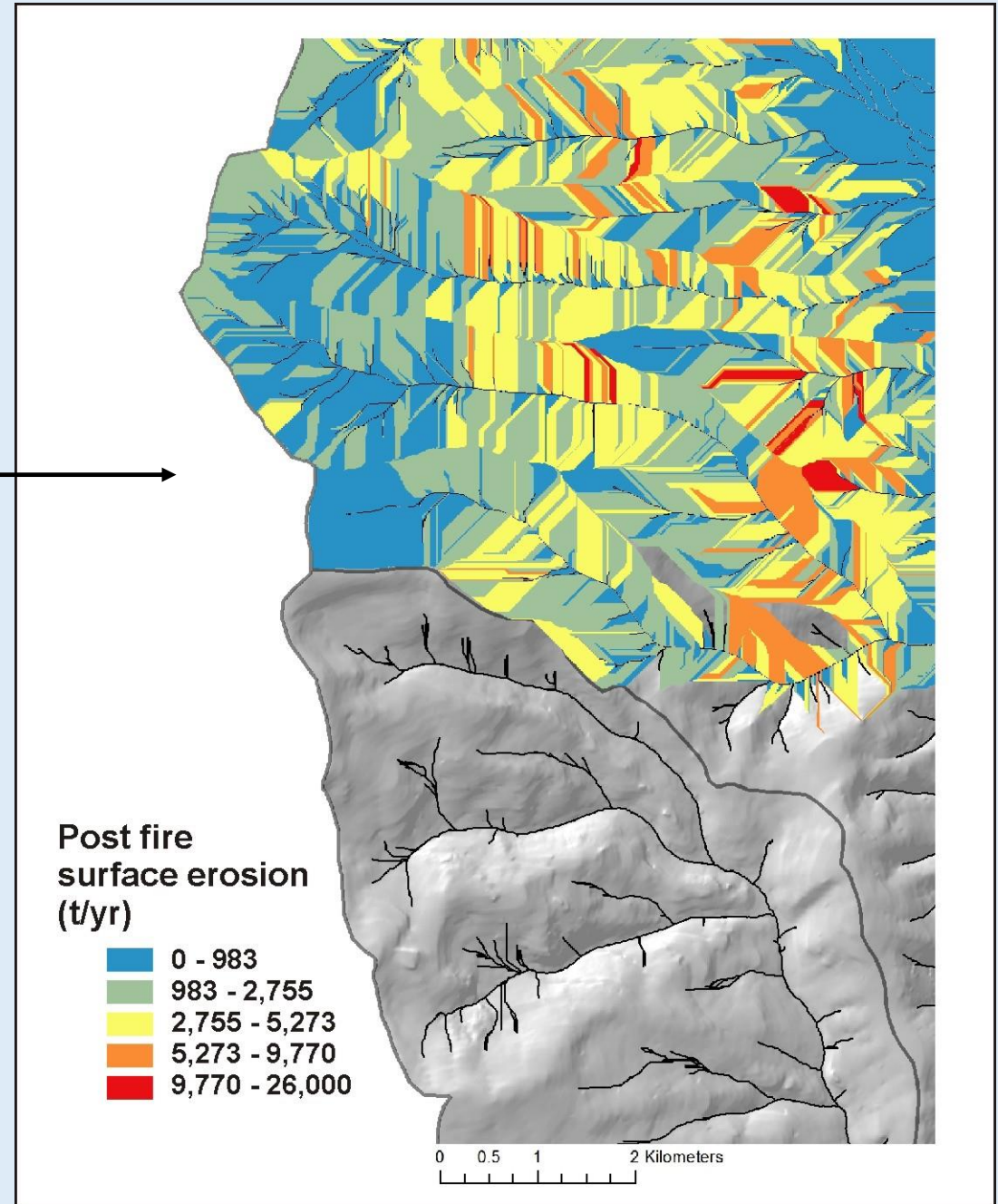
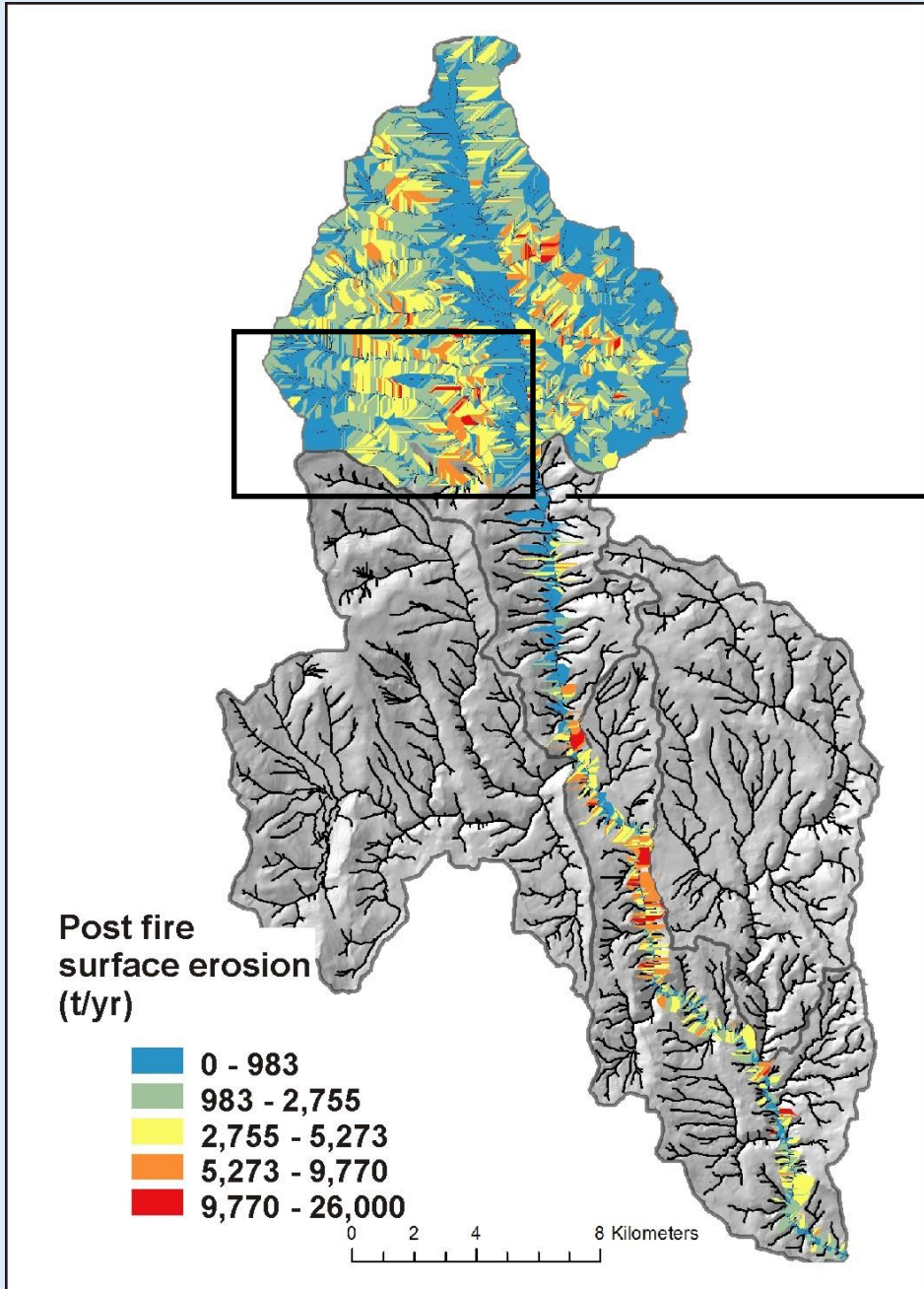
**Fisheries/  
Water Quality Impacts**

**Sedimentation**

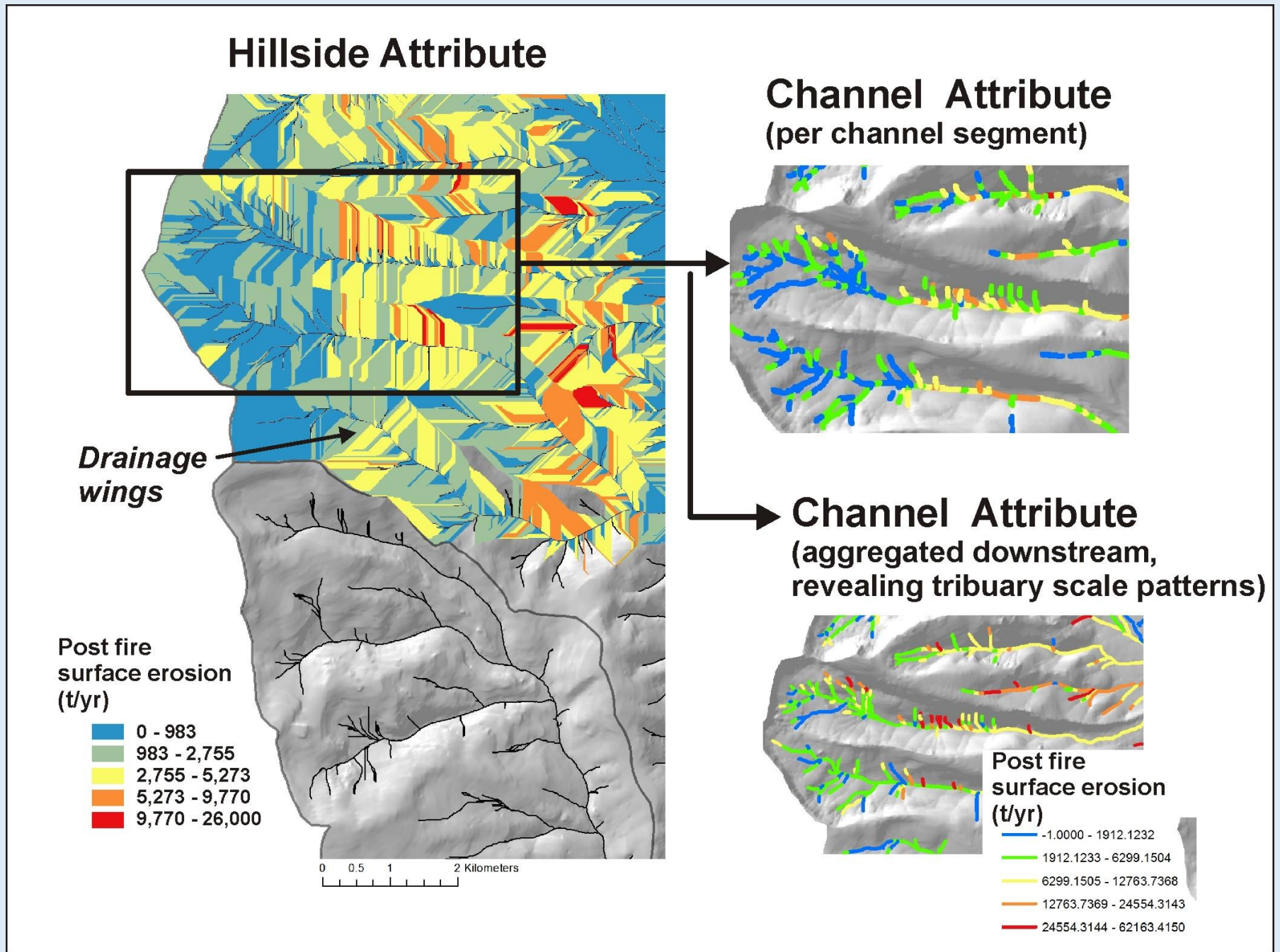
**Post Fire Erosion**



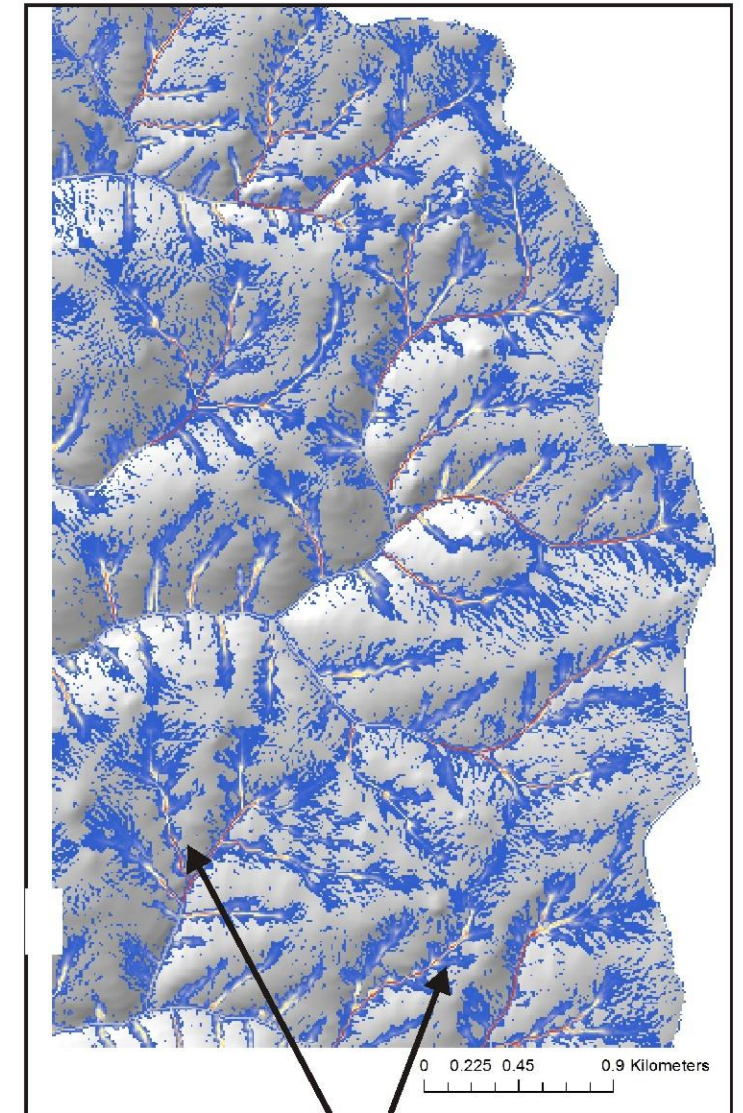
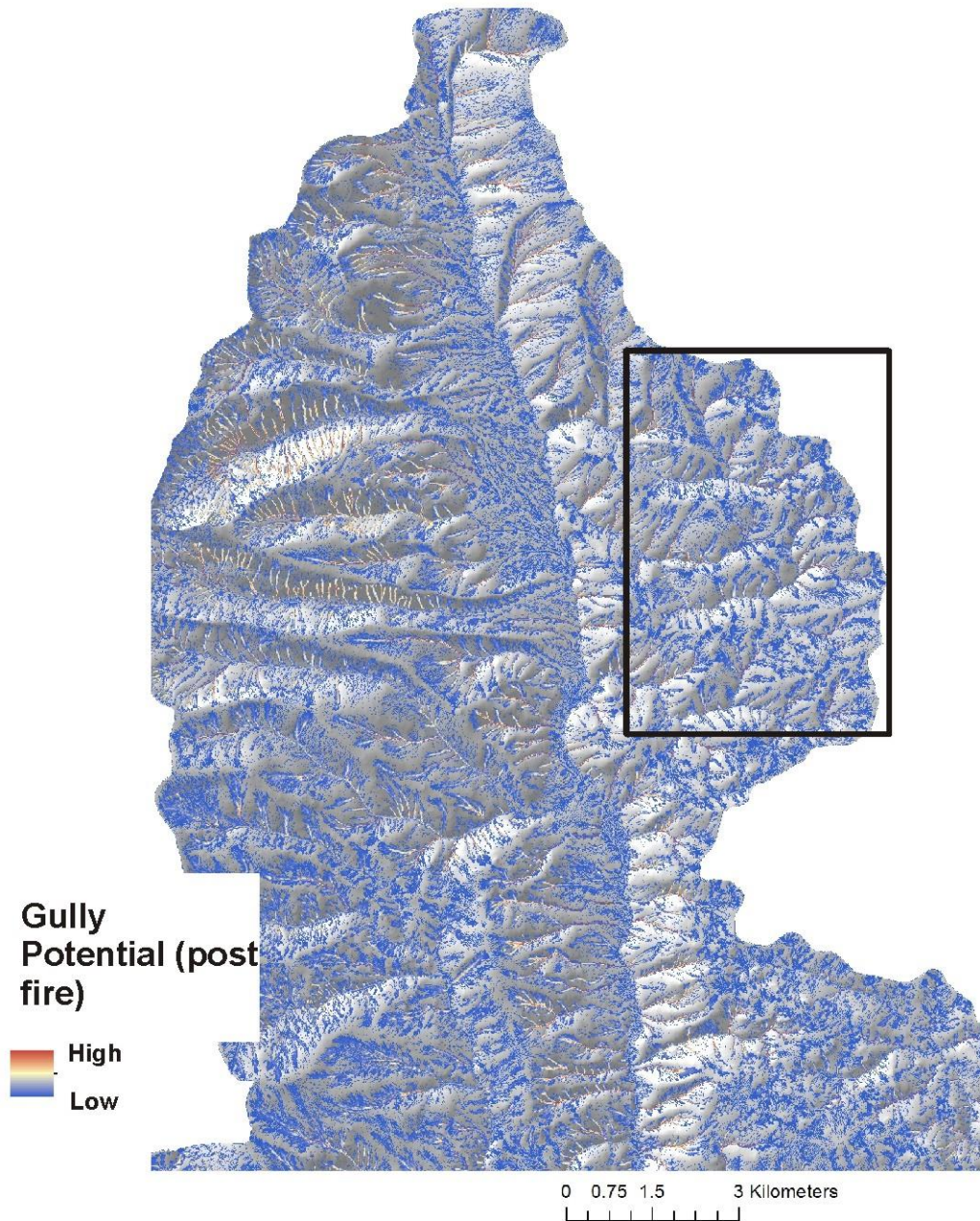
# Post Fire Surface Erosion (WEPP, disturbed)



An example about how a hillside attribute (post fire erosion) is transferred to individual channel segments, and aggregated downstream

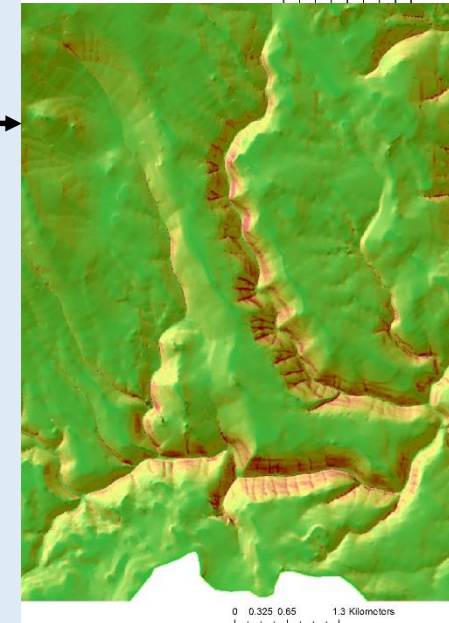
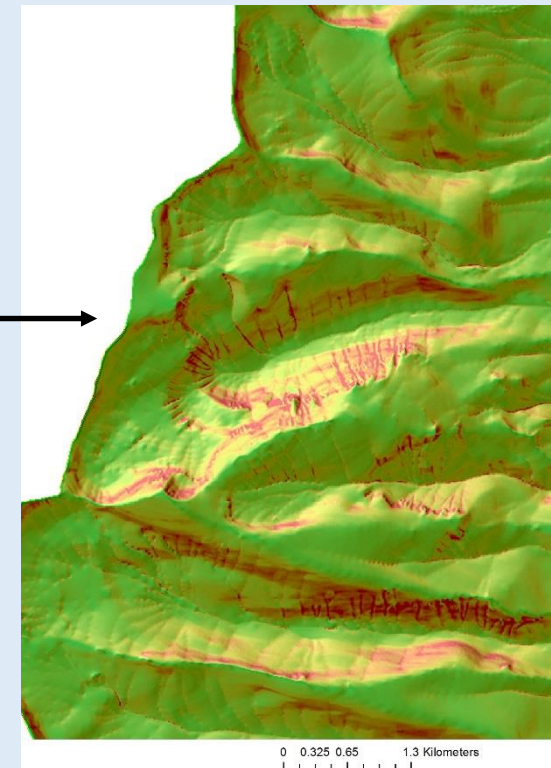
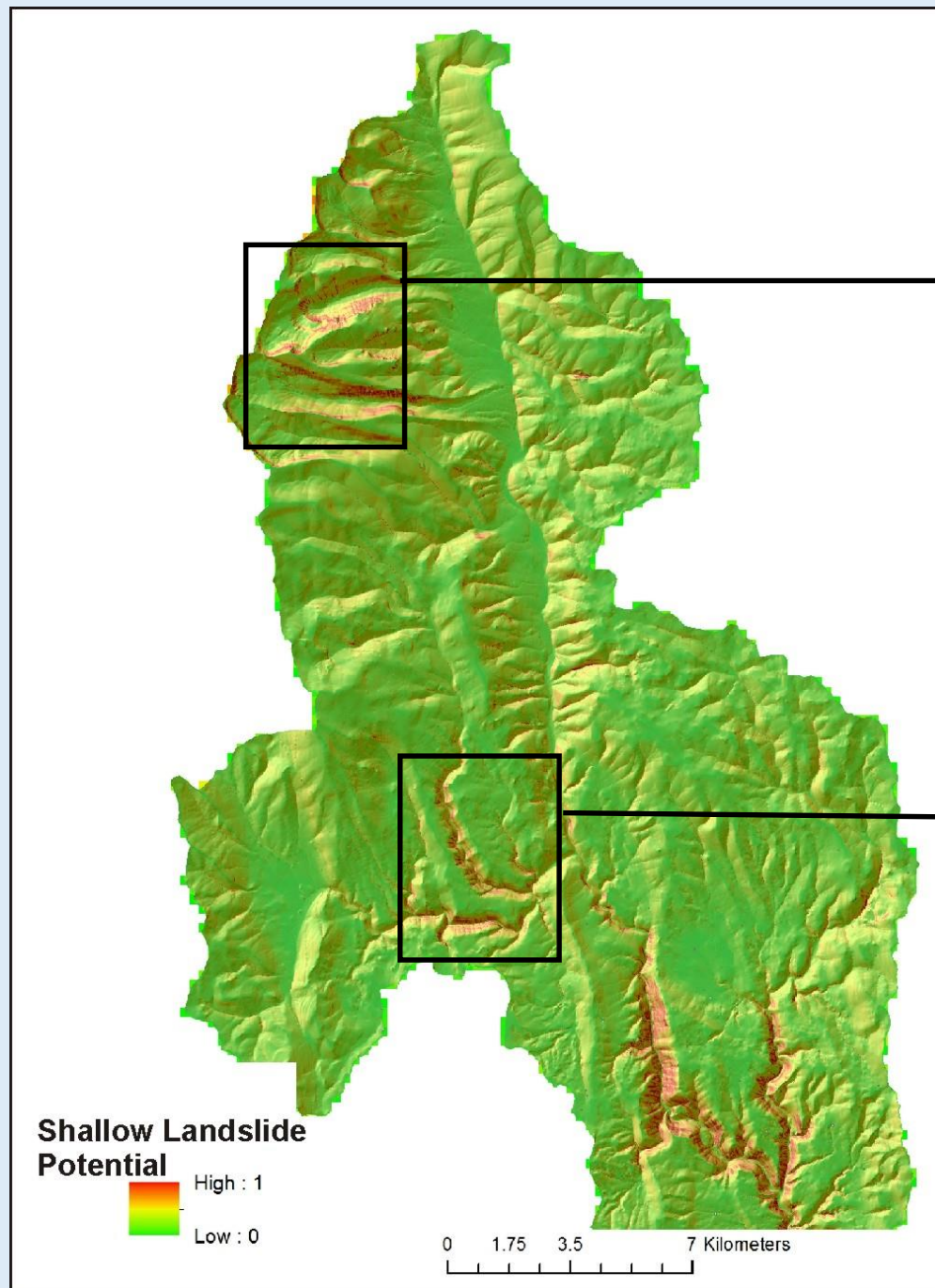


# Post Fire Gully Potential

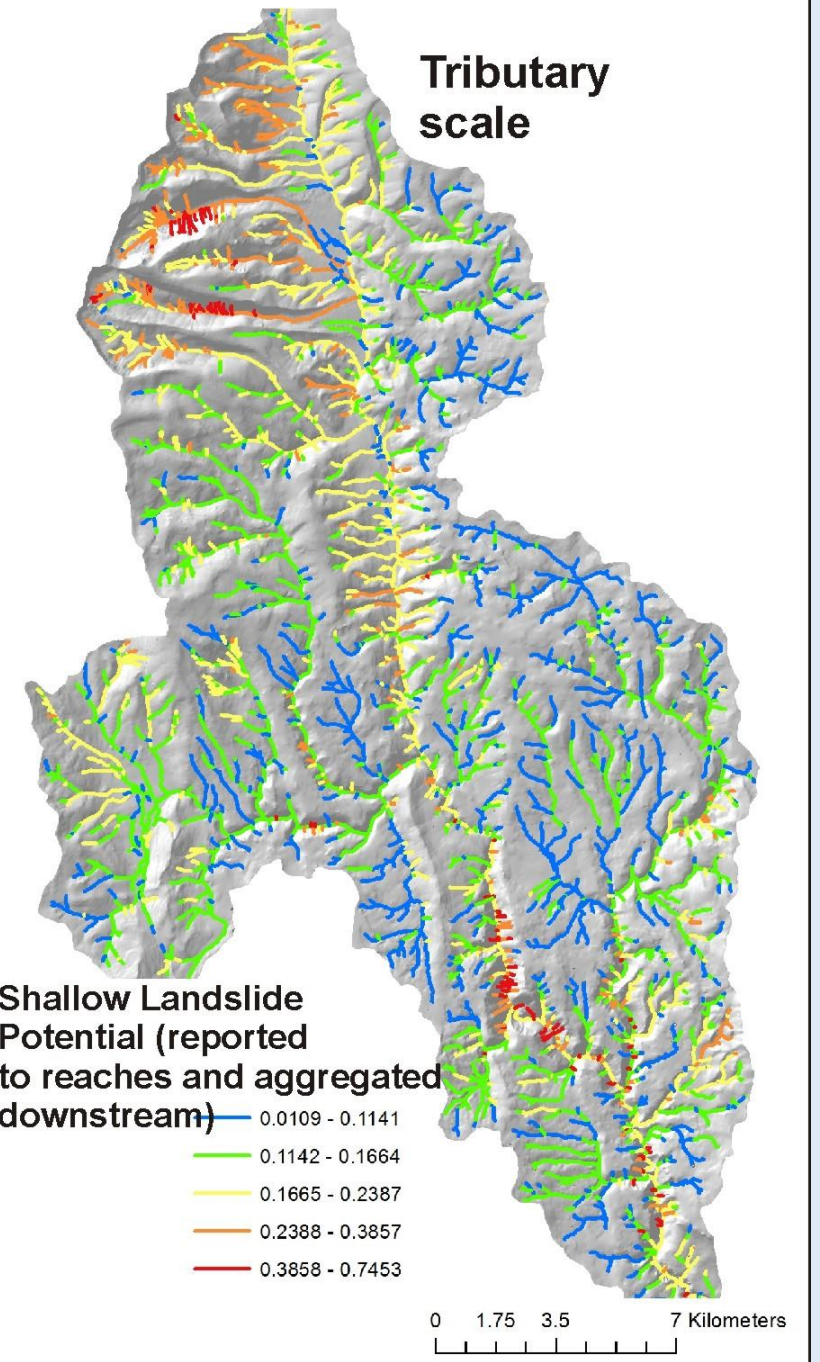
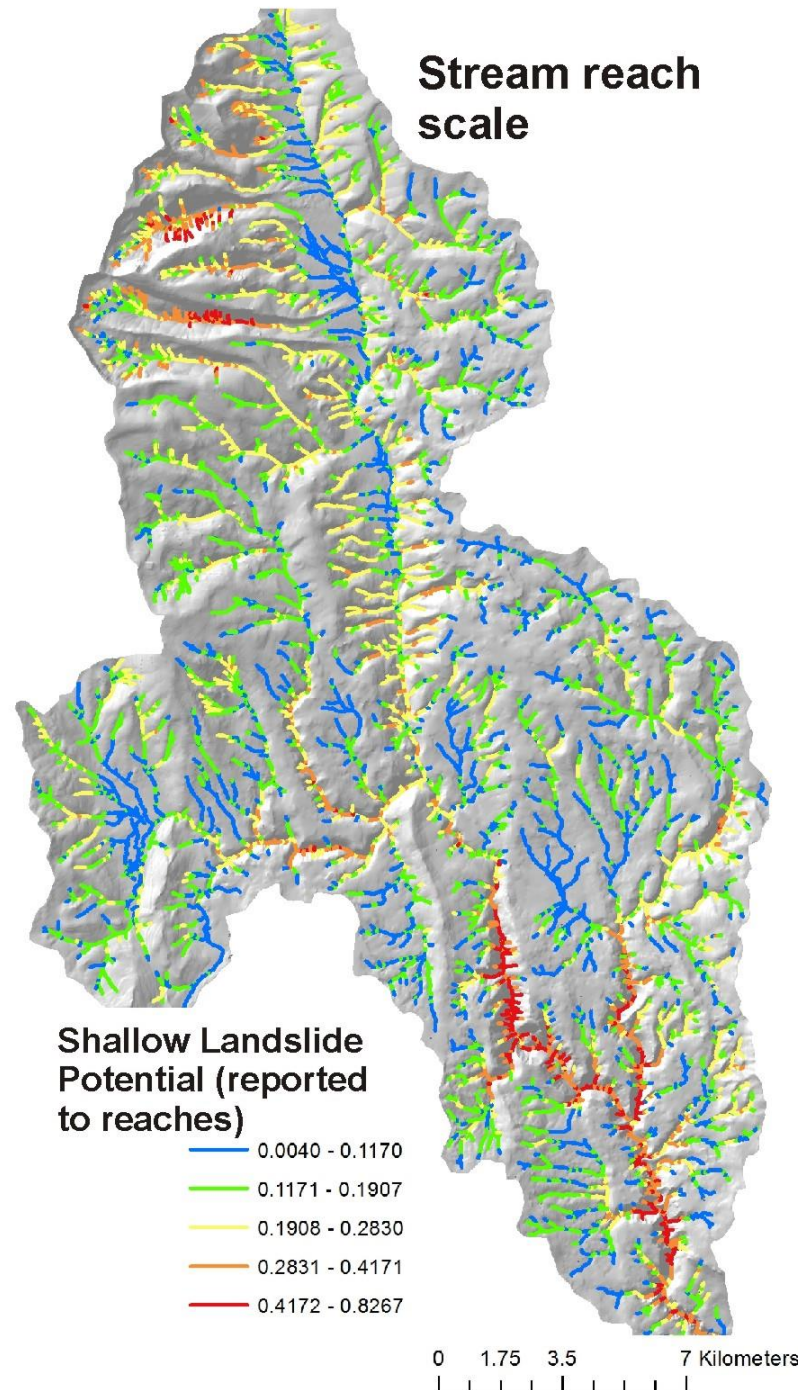


High gully erosion potential

# Shallow Landslide- Debris Flow Potential



Shallow landslide potential reported to channel segments and aggregated downstream





# FLASH FLOOD Potential



A dimensionless index developed by the National Weather Service. The Flash Flood Potential Index (FFPI) consists of four factors:

- 1) hillslope gradient
- 2) soils (percent silt, clay and sand)
- 3) vegetation density (forest, shrubs, grasses)
- 4) fire impacts on soils and vegetation.

See NetMap's online technical help manual for additional details.

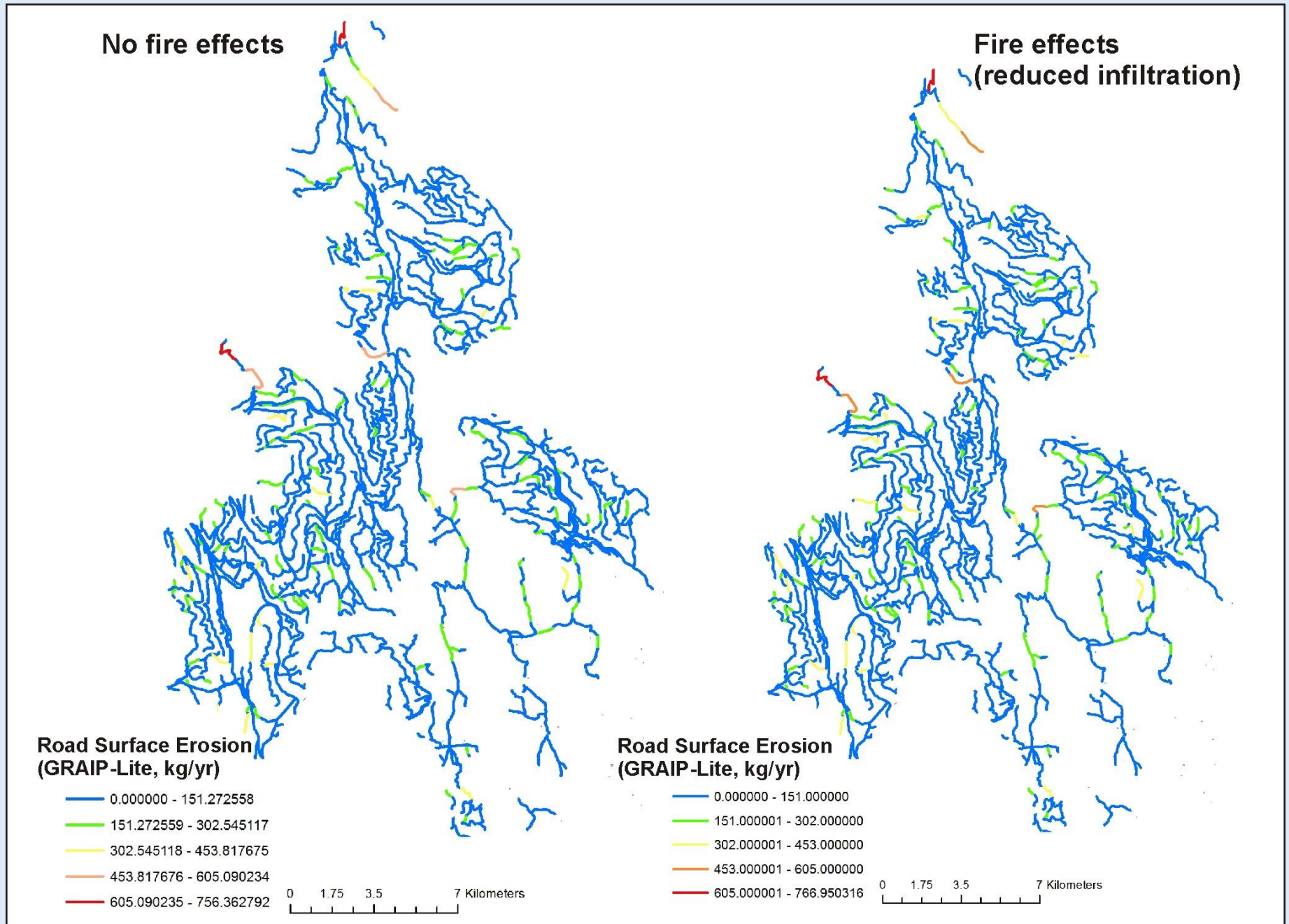
## Road Surface Erosion and Sediment Delivery to Streams, Post Fire



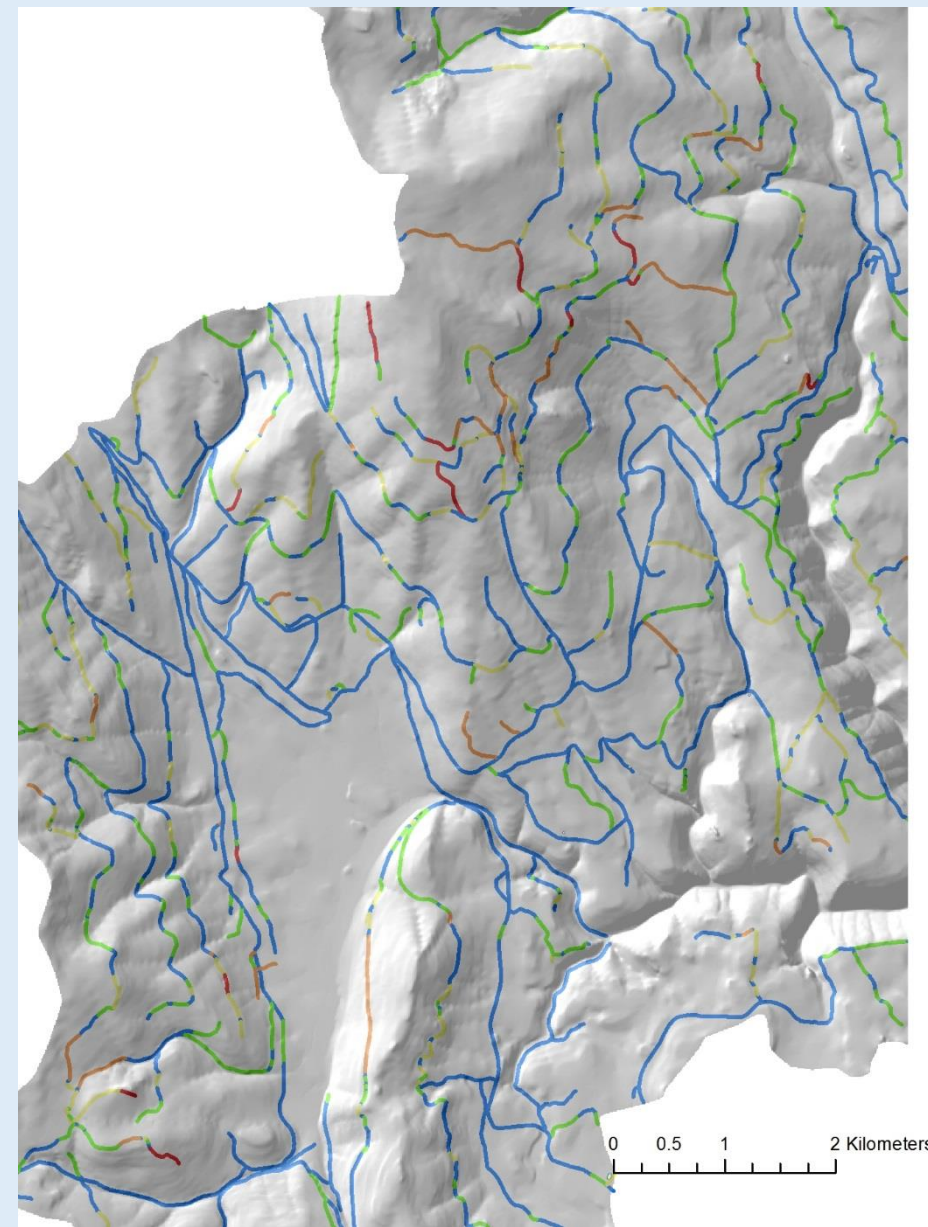
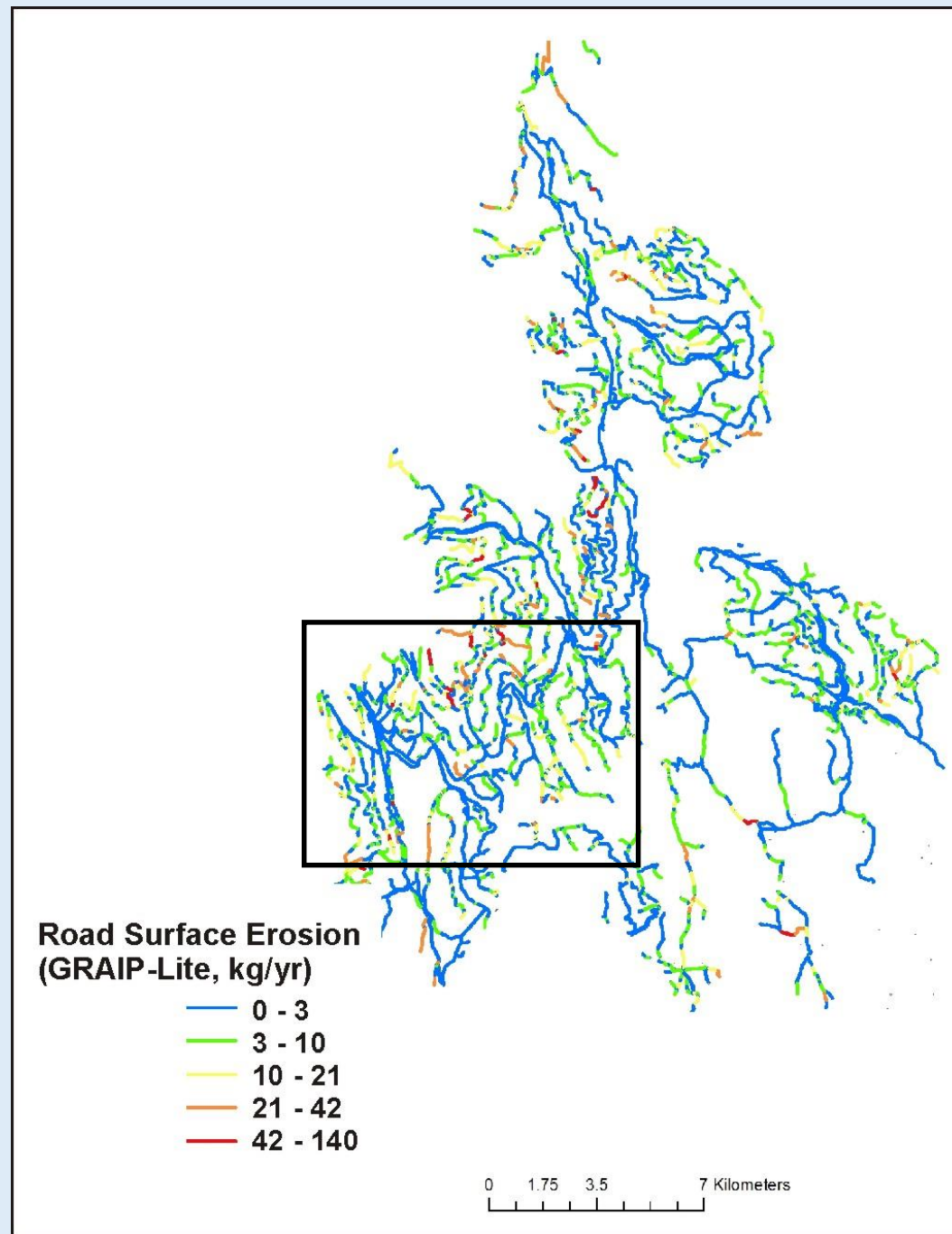
# Road erosion results, pre and post fire

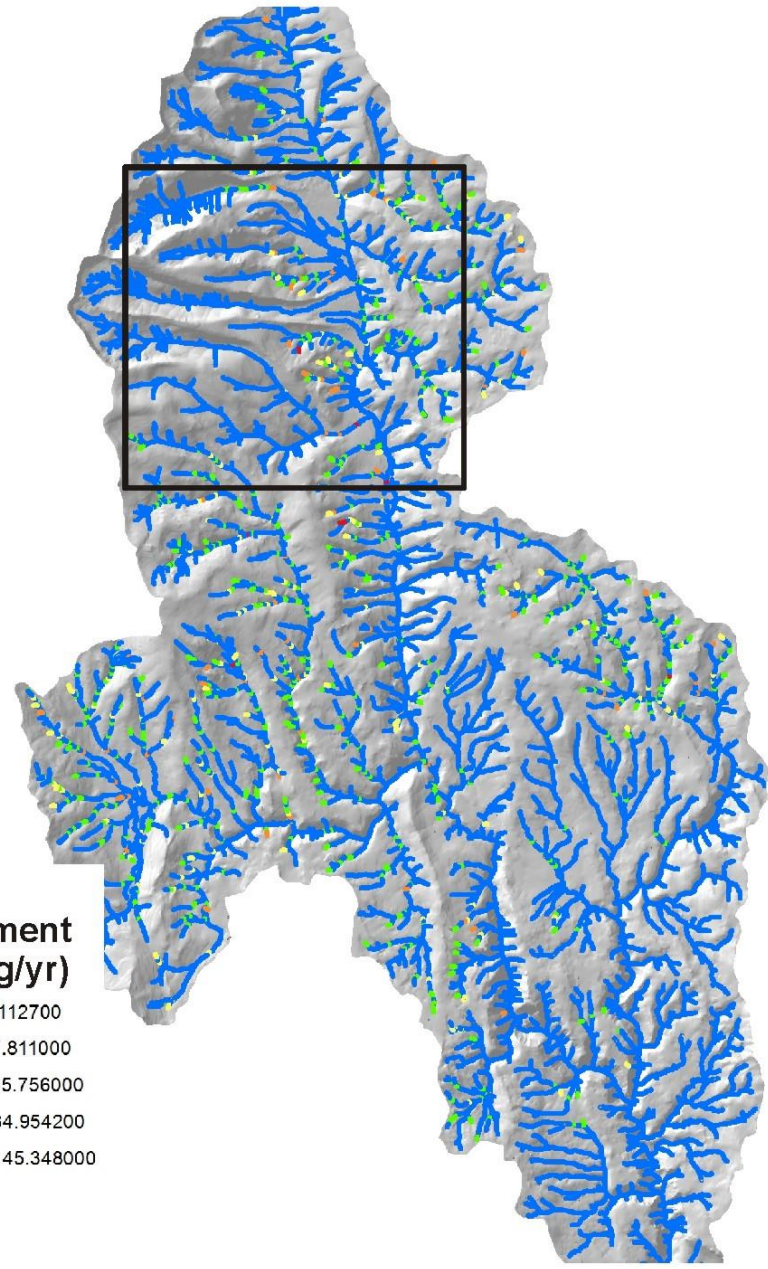
It is difficult to see the changes in these maps because of the broad legend categories.

See following slide for the difference between no fire and fire.



Road erosion  
difference map,  
where fire should  
have the largest effect  
of increasing sediment  
delivery



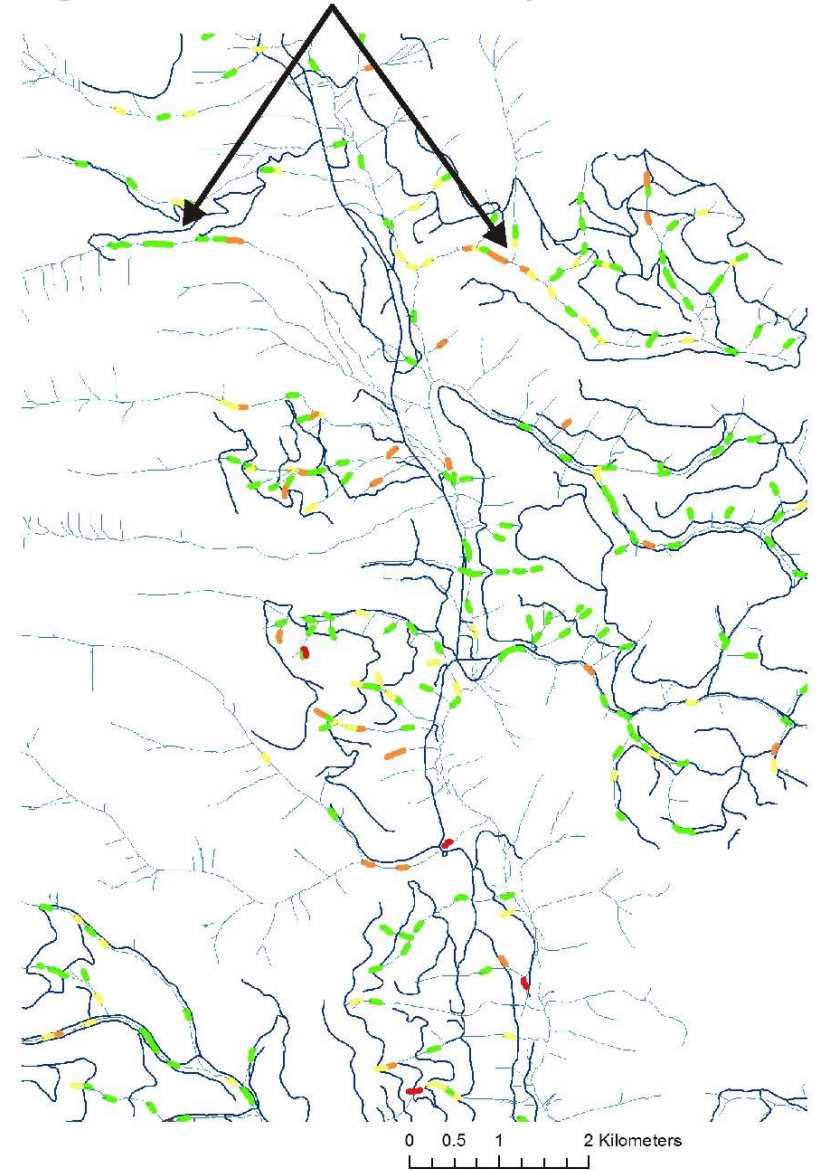


**Road Sediment Delivery (kg/yr)**

- 0.000000 - 5.112700
- 5.112701 - 17.811000
- 17.811001 - 35.756000
- 35.756001 - 84.954200
- 84.954201 - 145.348000



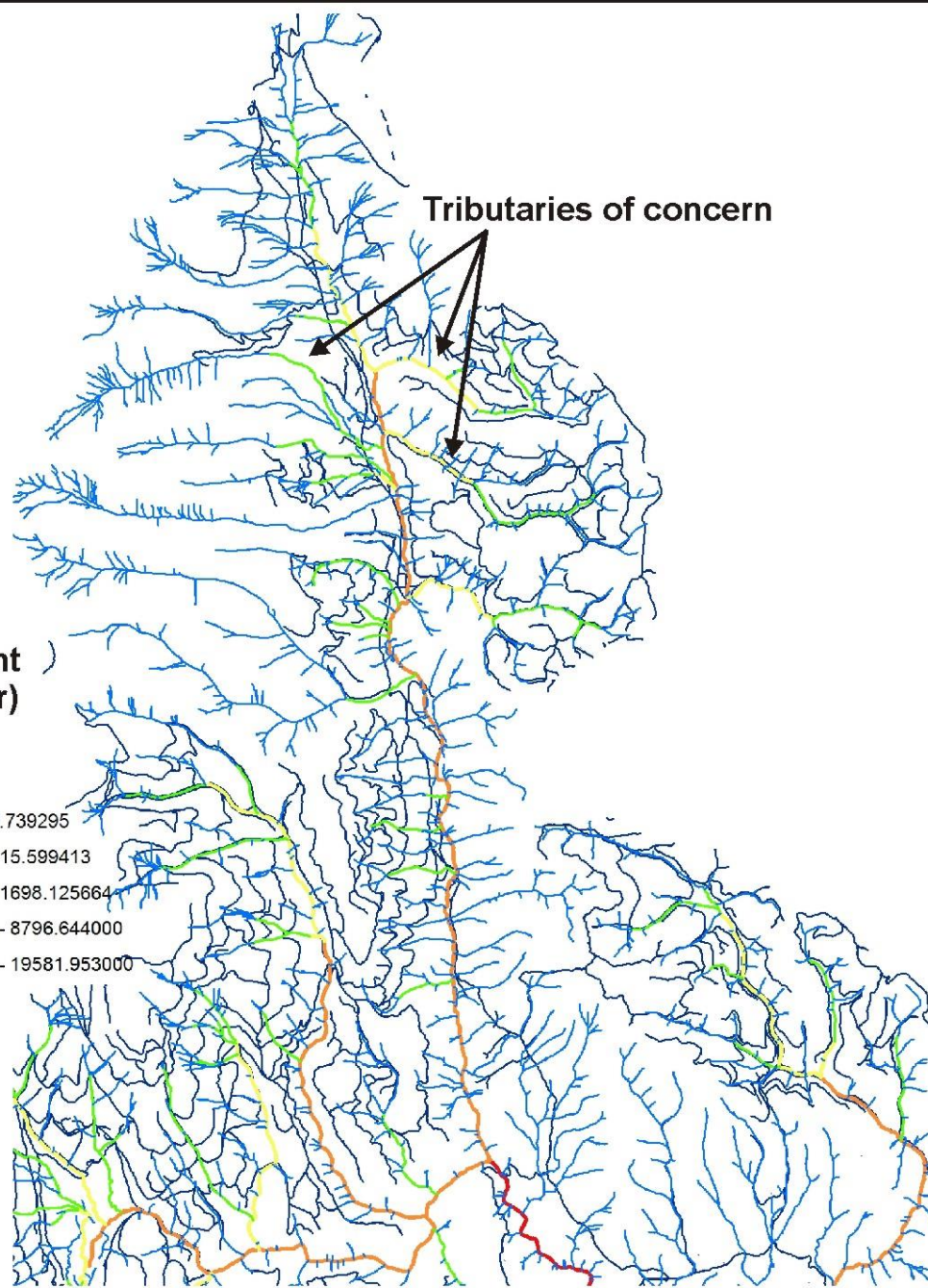
**Stream reaches predicted to receive higher road related sediment, post fire**



**Road Sediment Delivery (kg/yr) (aggregated downstream)**

- 0.000000 - 96.739295
- 96.739296 - 415.599413
- 415.599414 - 1698.125664
- 1698.125665 - 8796.644000
- 8796.644001 - 19581.953000

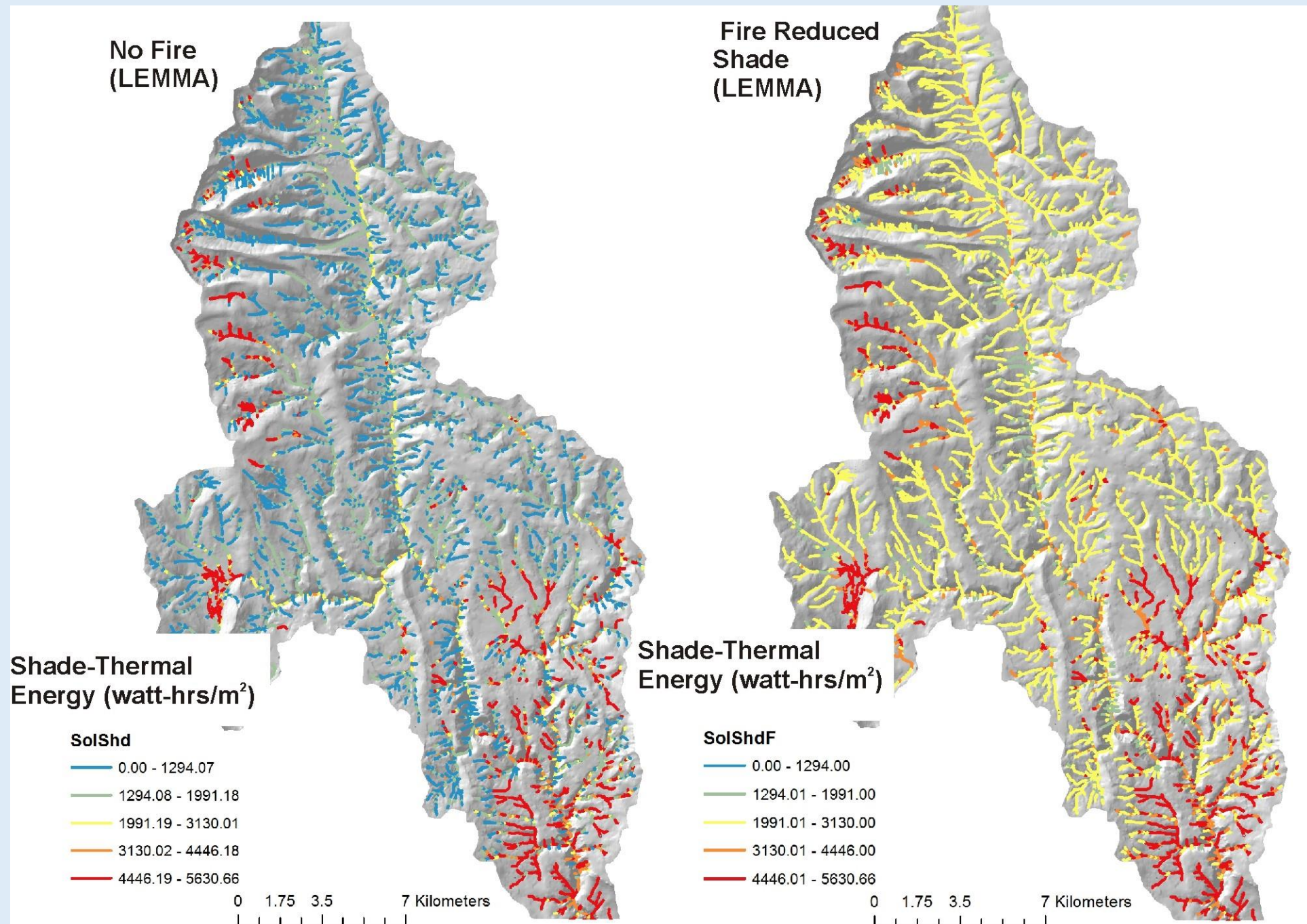
**Tributaries of concern**



# Riparian Zones: Impacts from Fire, Loss of Shade, Increases in Thermal Loading and Loss of Cool Water Refugia



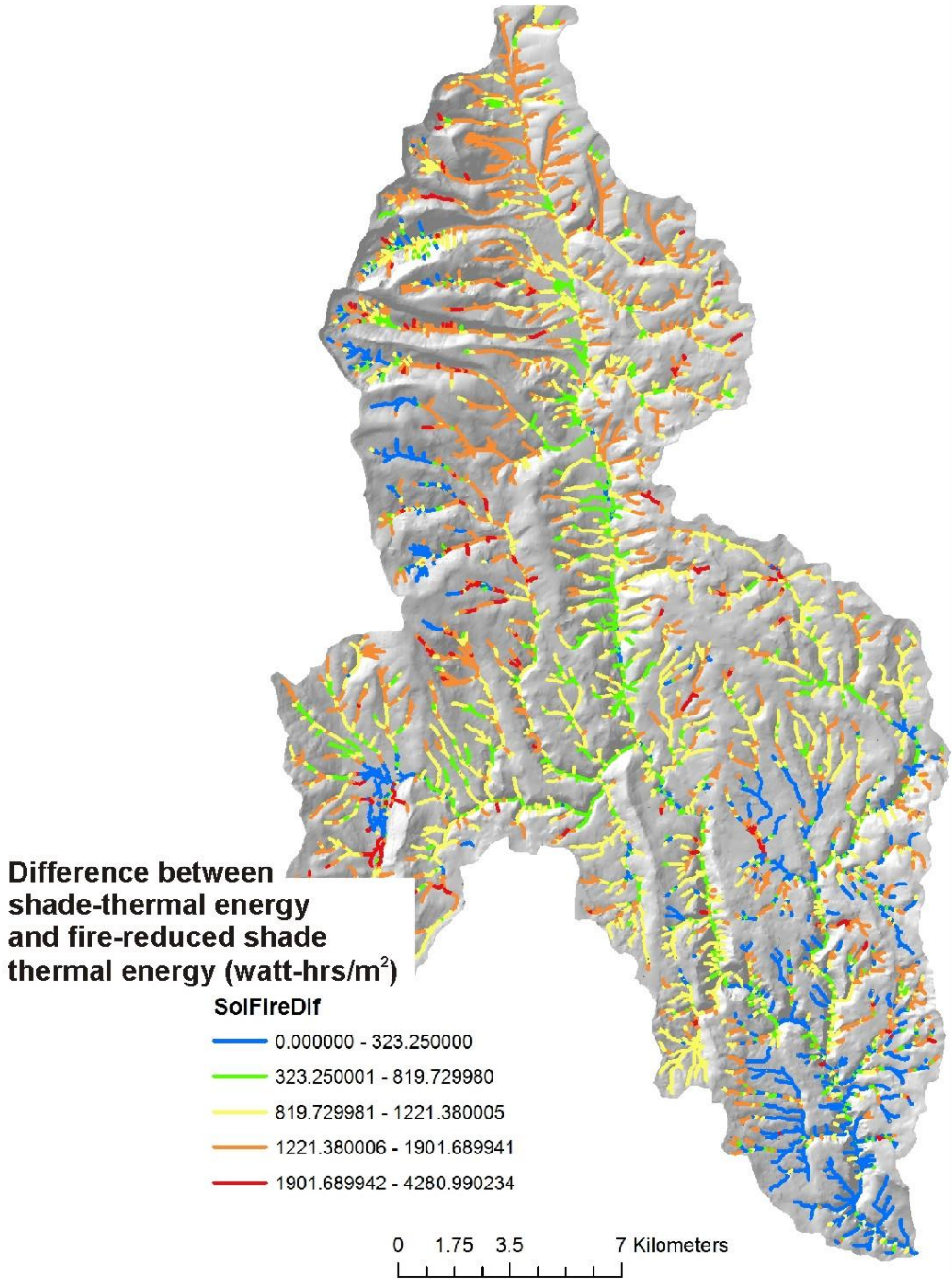
# Riparian – Current Shade/ Thermal Energy





**Difference between current shade-thermal energy and fire reduced shade thermal energy.**

**Shows reaches where the greatest impacts to shade and increases in thermal energy are predicted to occur**



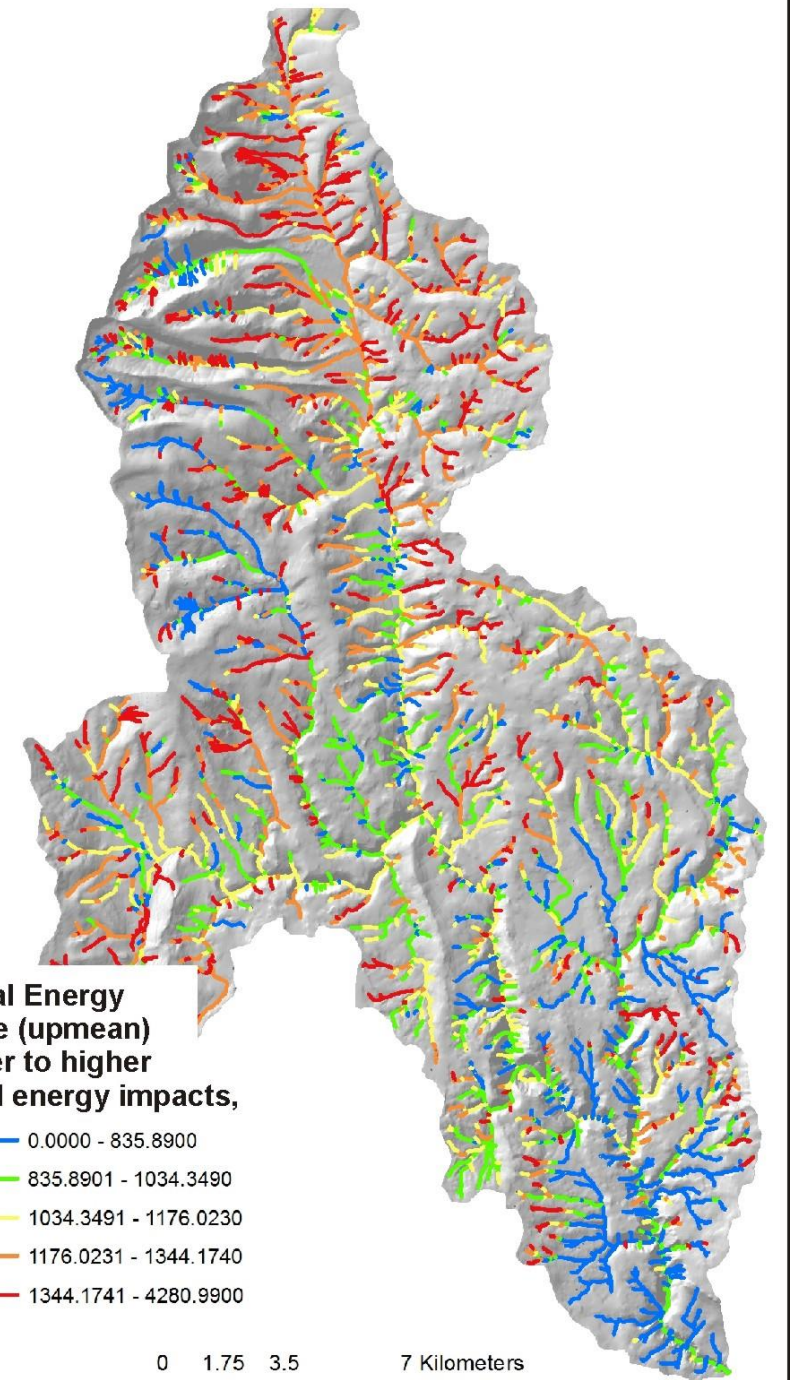
**Difference between current shade-thermal energy and fire reduced shade thermal energy, but aggregated downstream (running average).**

**Shows multi-reach or tributary scale impacts to shade and increases in thermal energy, e.g., stream segments and tributaries where thermal refugia will be reduced.**

**Shade-Thermal Energy  
Fire Difference (upmean)  
(Areas of lower to higher  
shade-thermal energy impacts,  
post fire)**

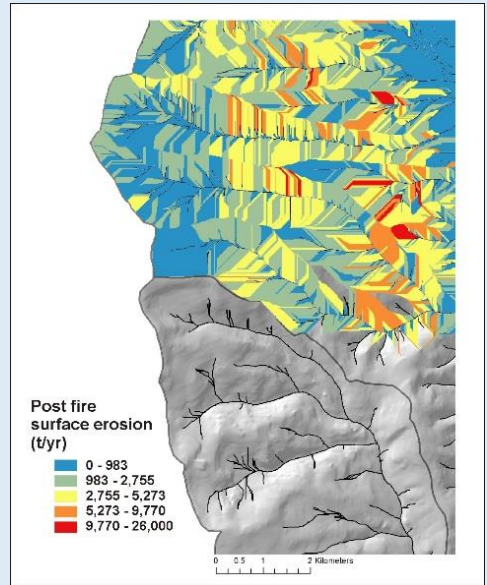


0 1.75 3.5 7 Kilometers



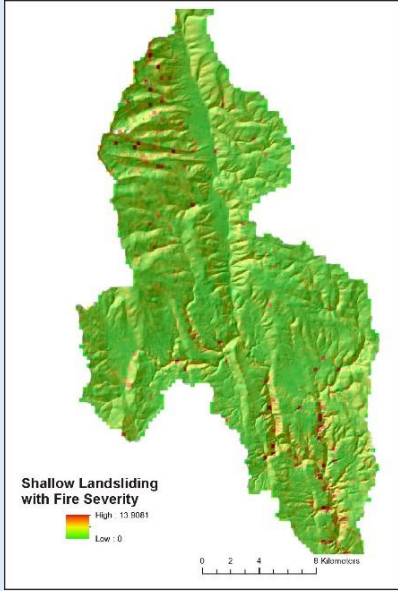
# Decision Space: Spatially Explicit Maps (visual - qualitative)

Surface erosion potential



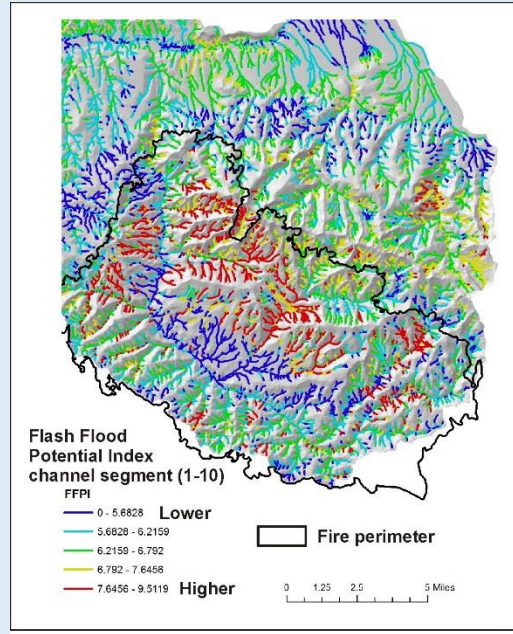
+

Landslide potential

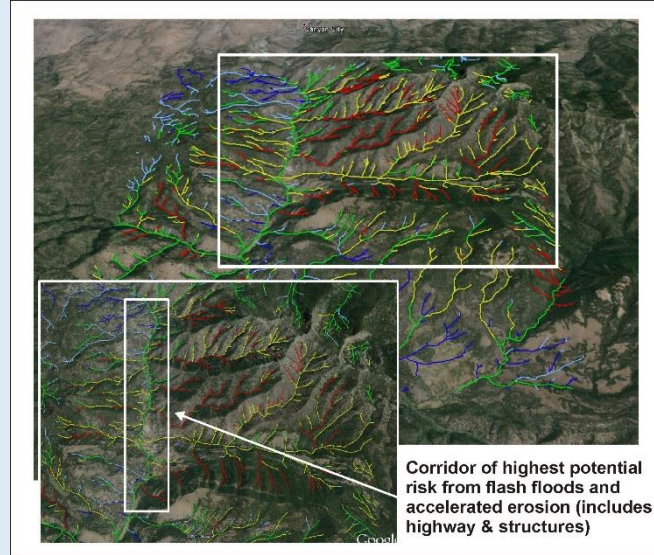
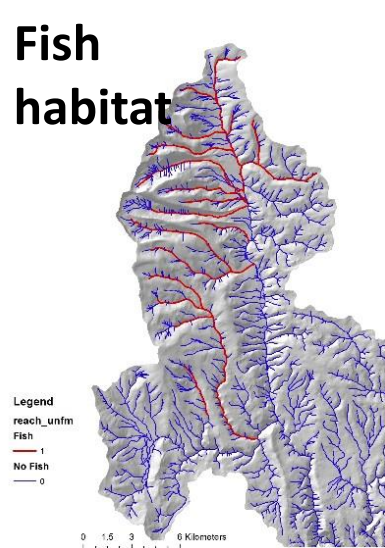


+

Flash flood potential



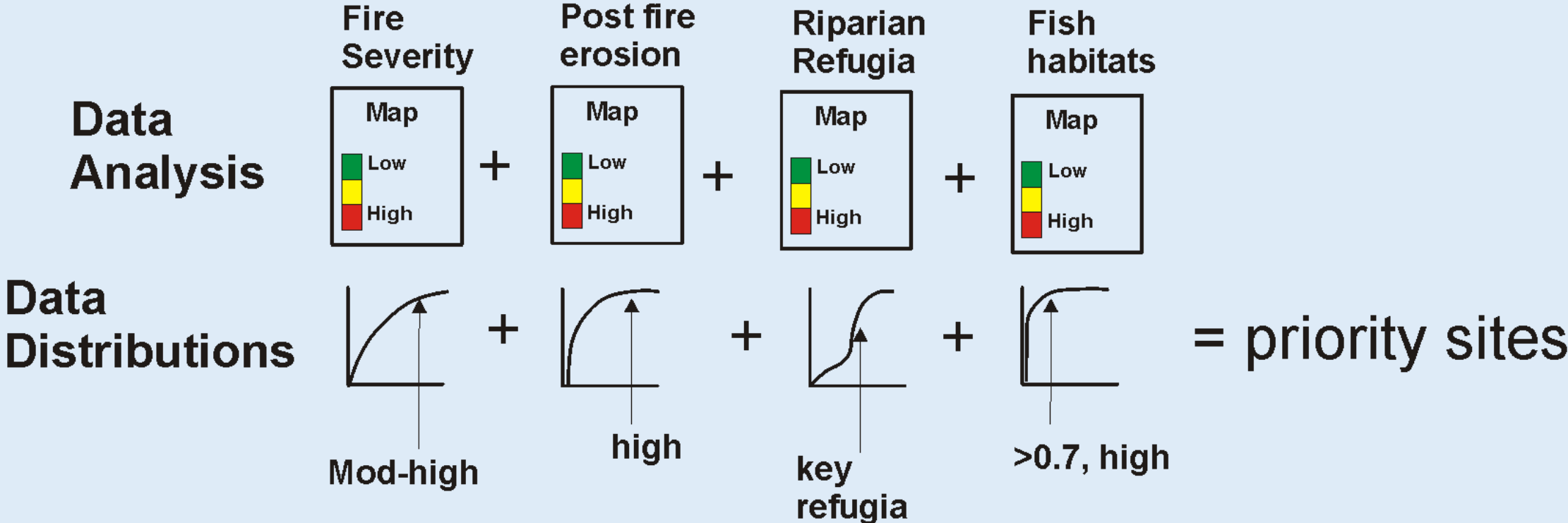
+ locations of aquatic habitats, or infrastructure (homes, highways, energy)



= priority sites for protection (pre fire management, firefighting)

# Decision Space: Spatially Explicit Quantitative (using Quick Fire Tool)

## Search for critical fire - fish interactions

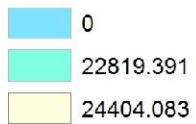


Important Areas of Overlap



Bull Trout Habitat Length (m)

Lower



Higher



Post Fire Surface Erosion (t/yr)

Lower



Higher



## Presentation Complete



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