Road Analysis in NetMap (www.terrainworks.com)

Roads drainage diversion

Roads erosion/ sediment delivery

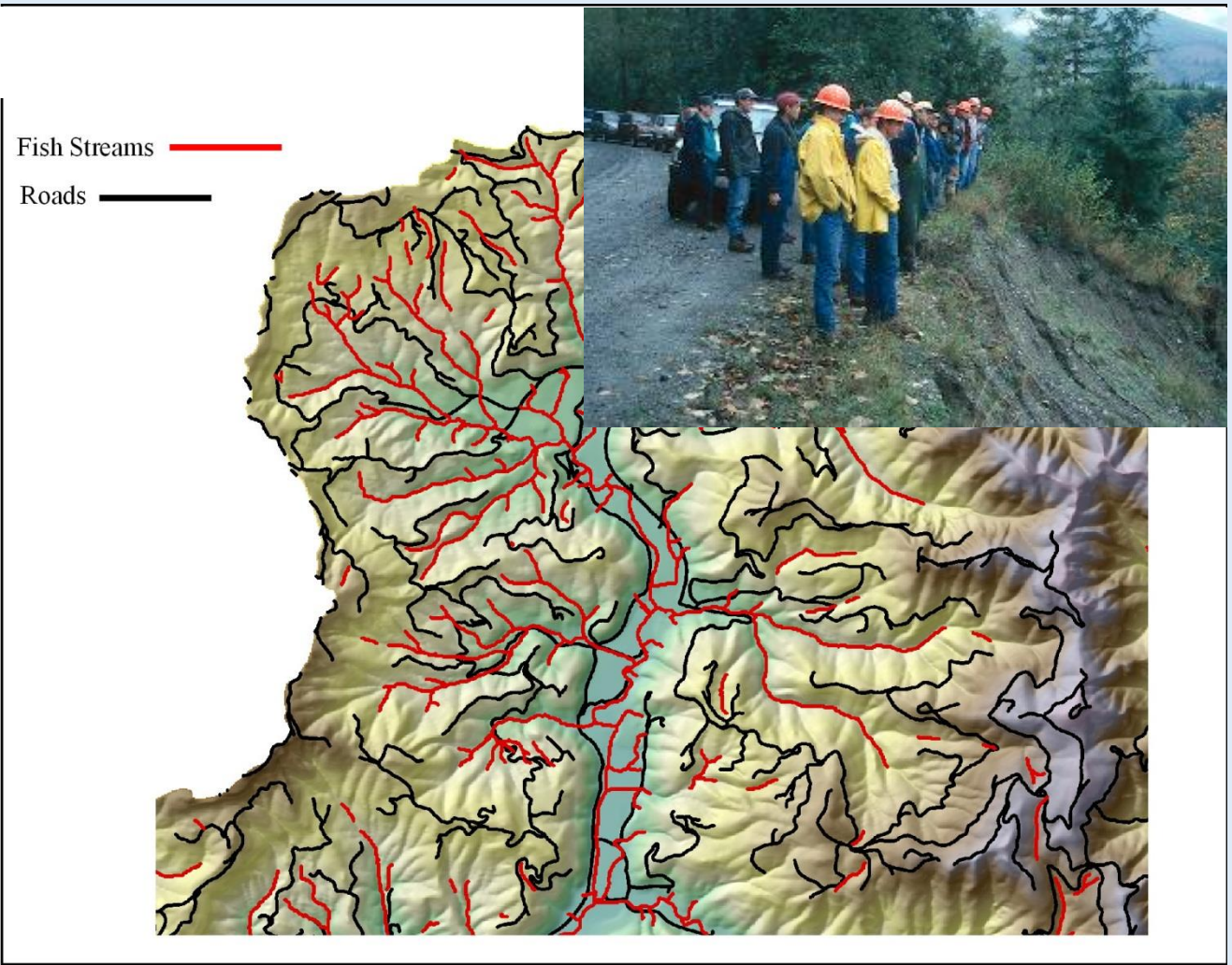
Road failure

Roads in floodplains

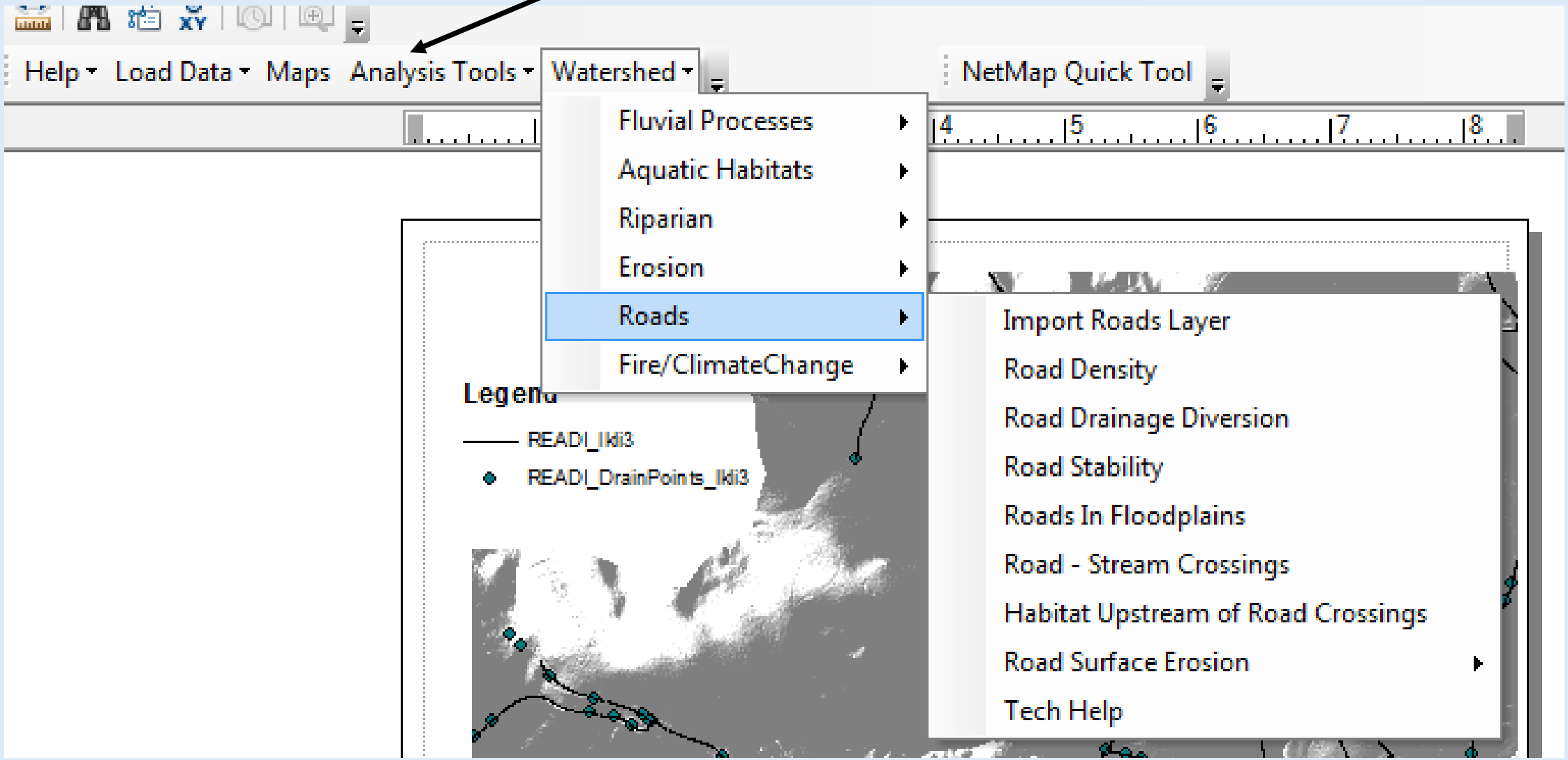
Habitat length above crossings

and their use in post wildfire environments

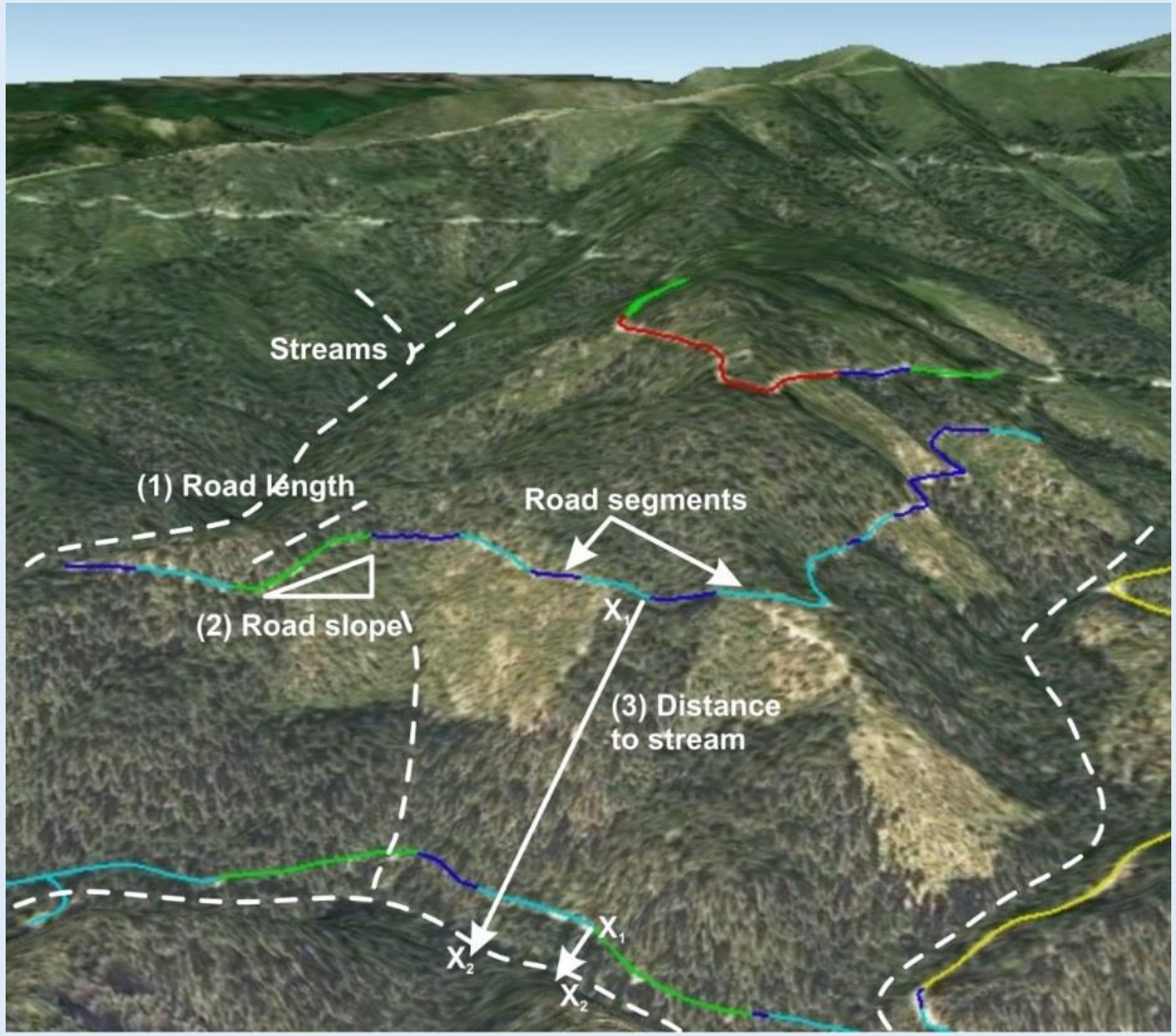
Of the hundreds to thousands of road segments and road-stream crossings, how does one prioritize actions?



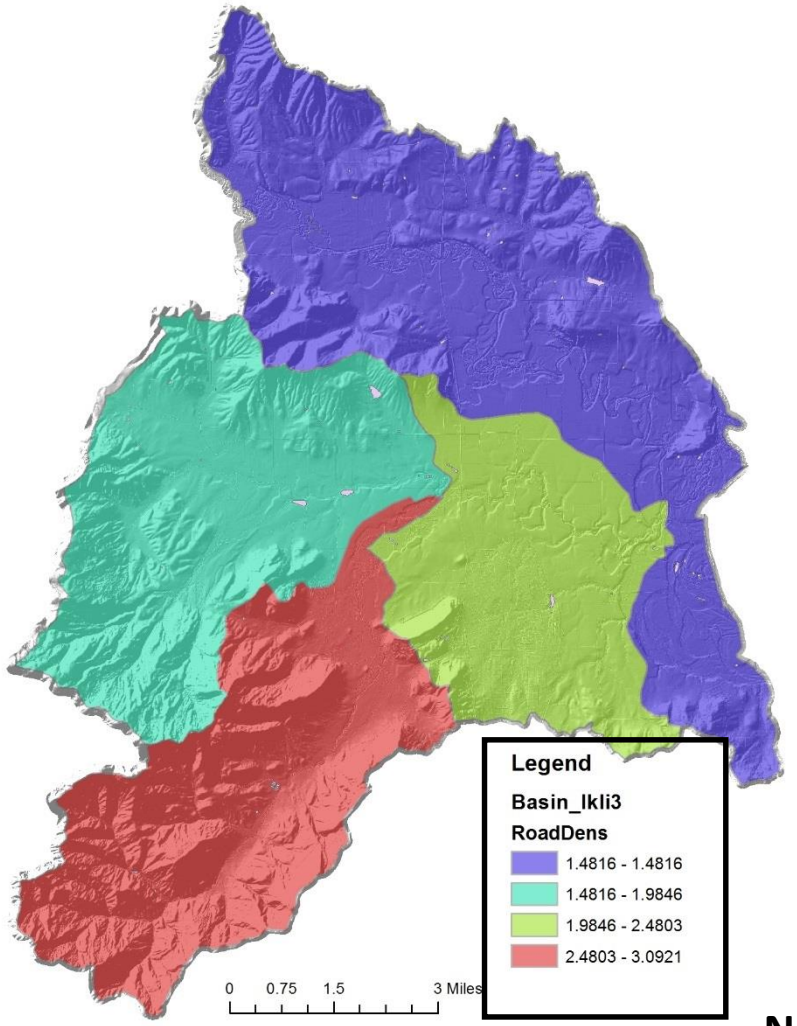
NetMap tool bar in ArcMap 10.x



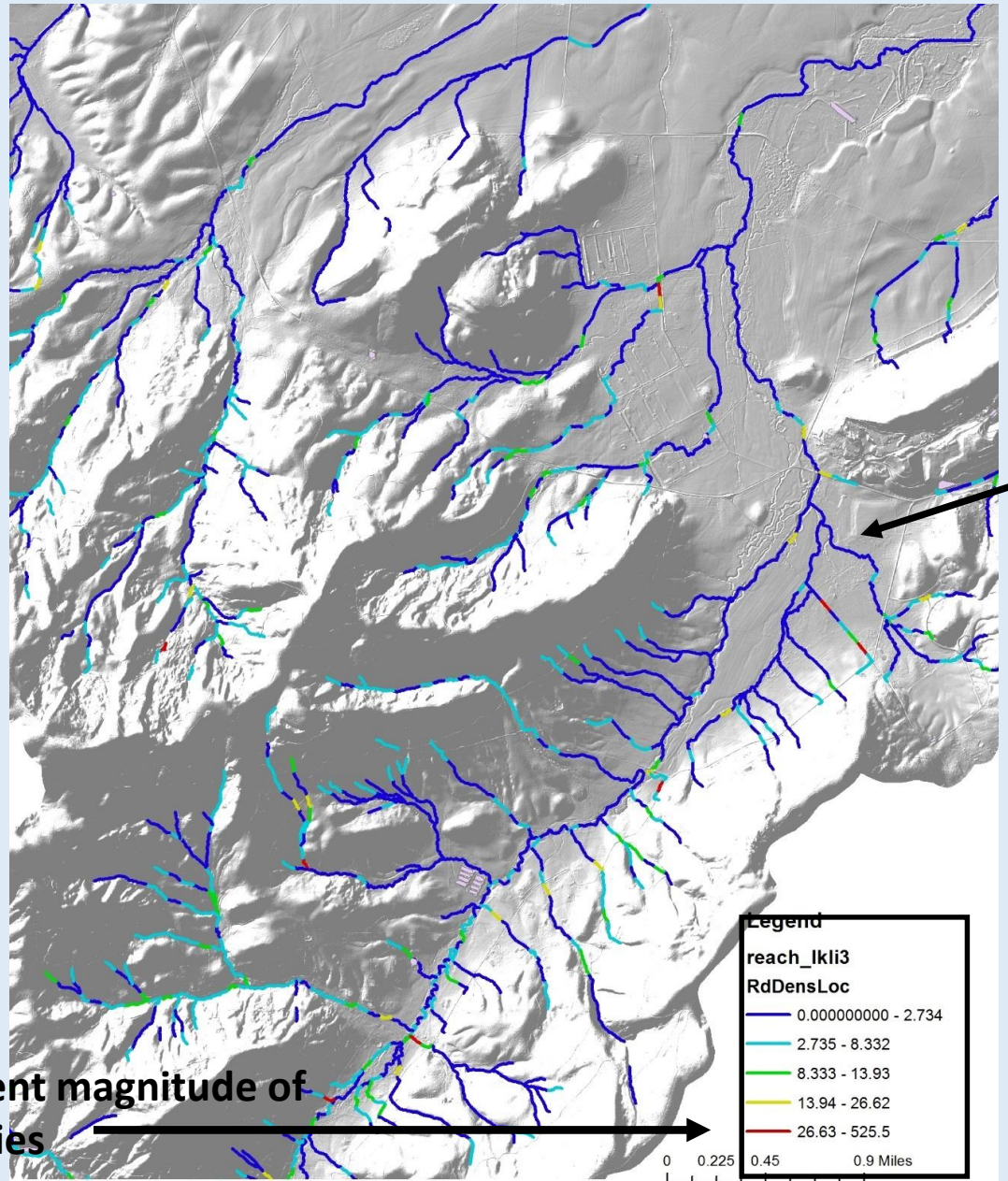
Road layer is draped onto the DEM



Road Density at the subbasin scale (km/km²)



Road Density at the stream reach local contributing area scale (km/km²)

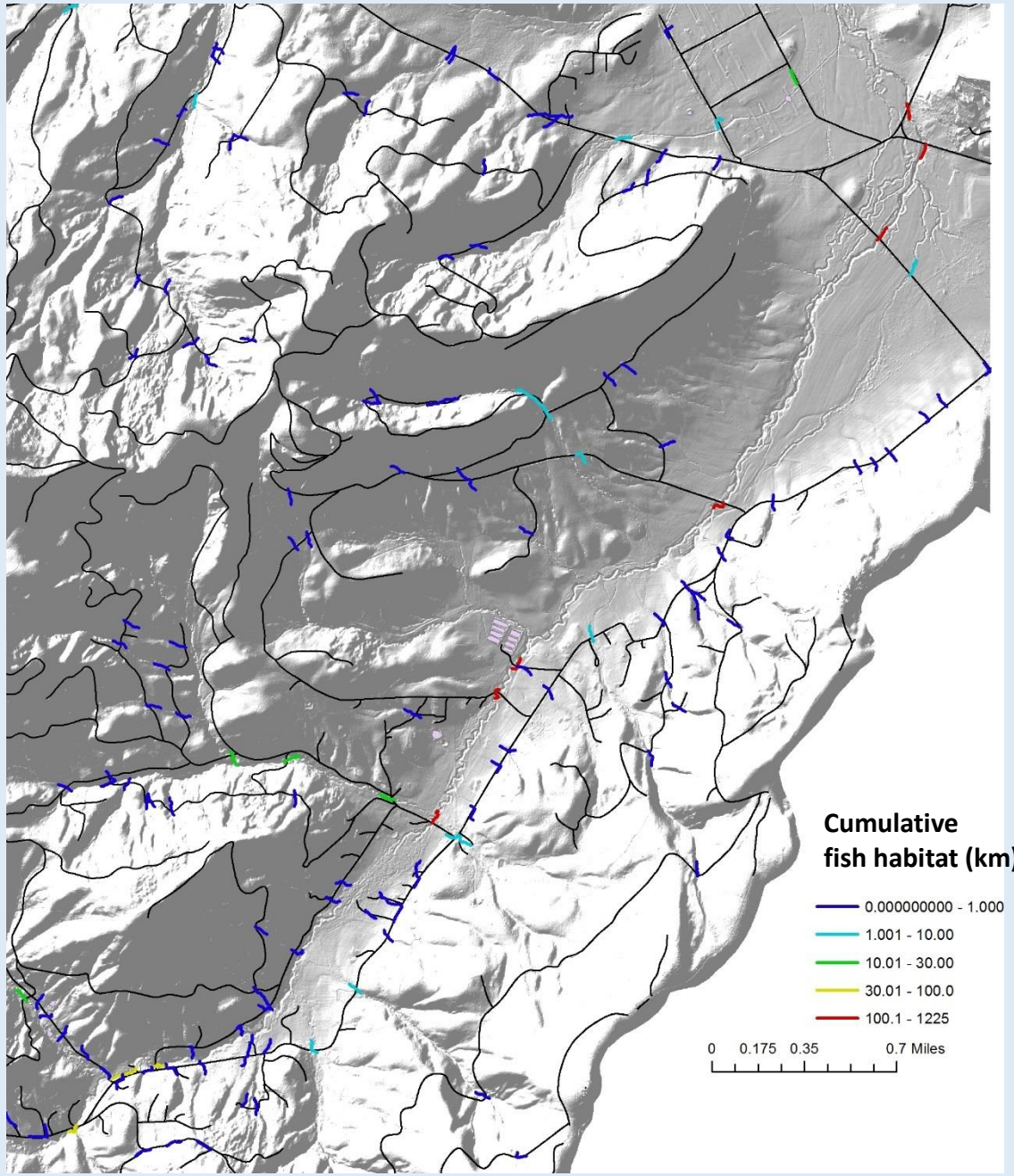


Stream reaches (synthetic river network)

Note different magnitude of road densities

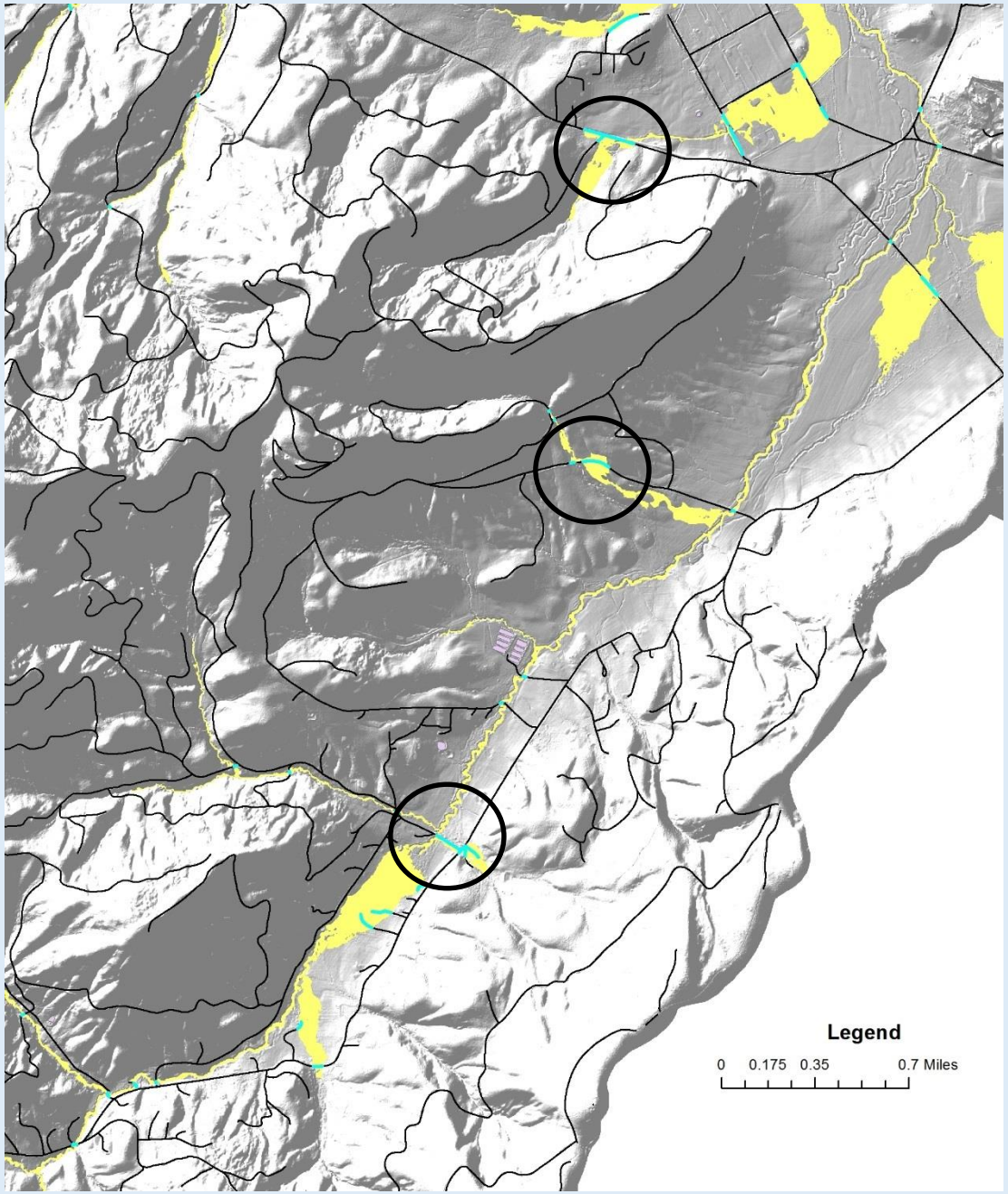
Much more spatially specific and detailed

Quickly calculate cumulative habitat length above crossings across entire watersheds (can add quality)

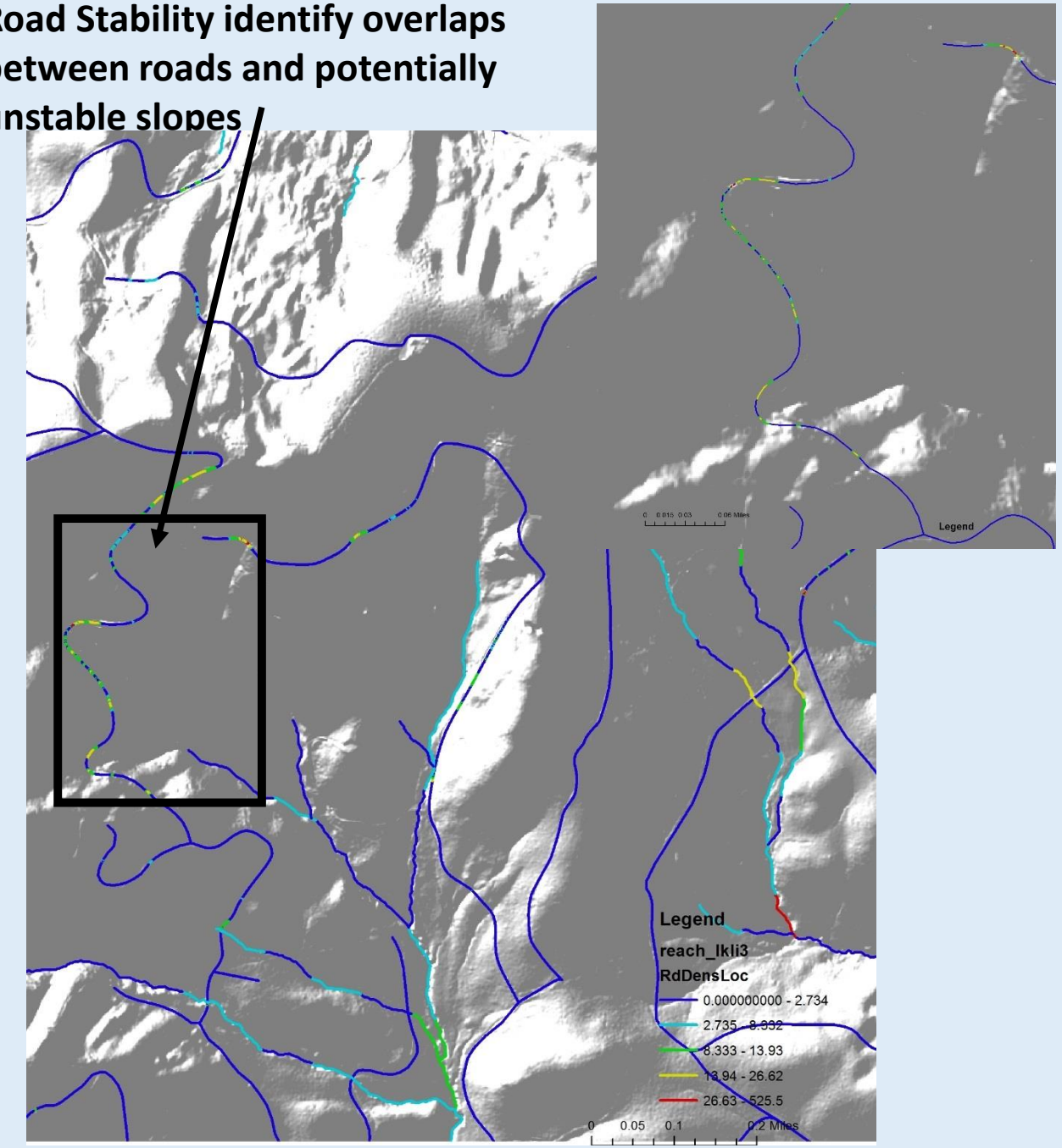


Roads in Floodplains: quickly identify intersections between roads and mapped floodplains

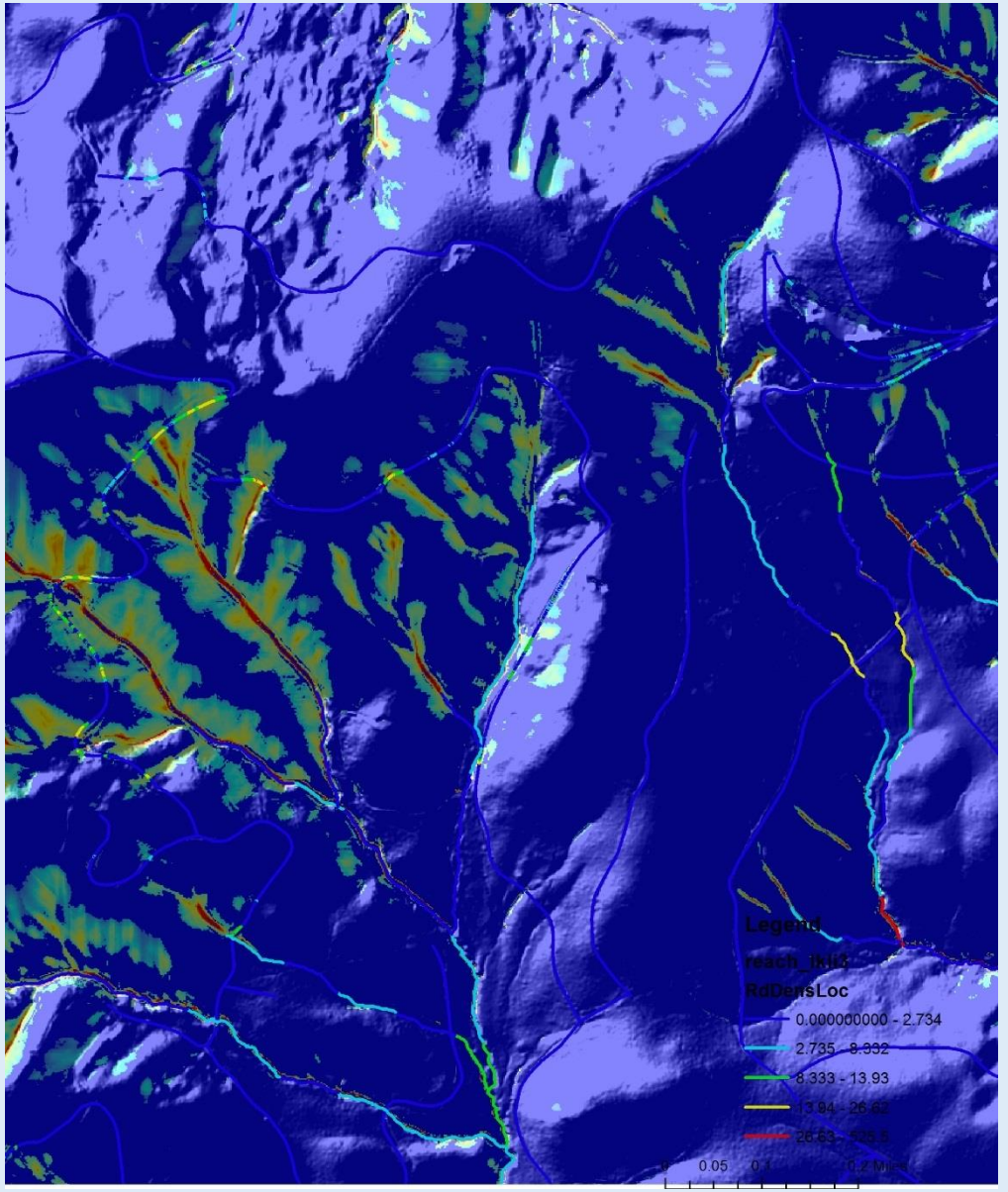
(in NetMap, floodplains can be mapped at a range of elevations above the channel, including in terms of bankfull depths. See NetMap's Floodplain Tool.



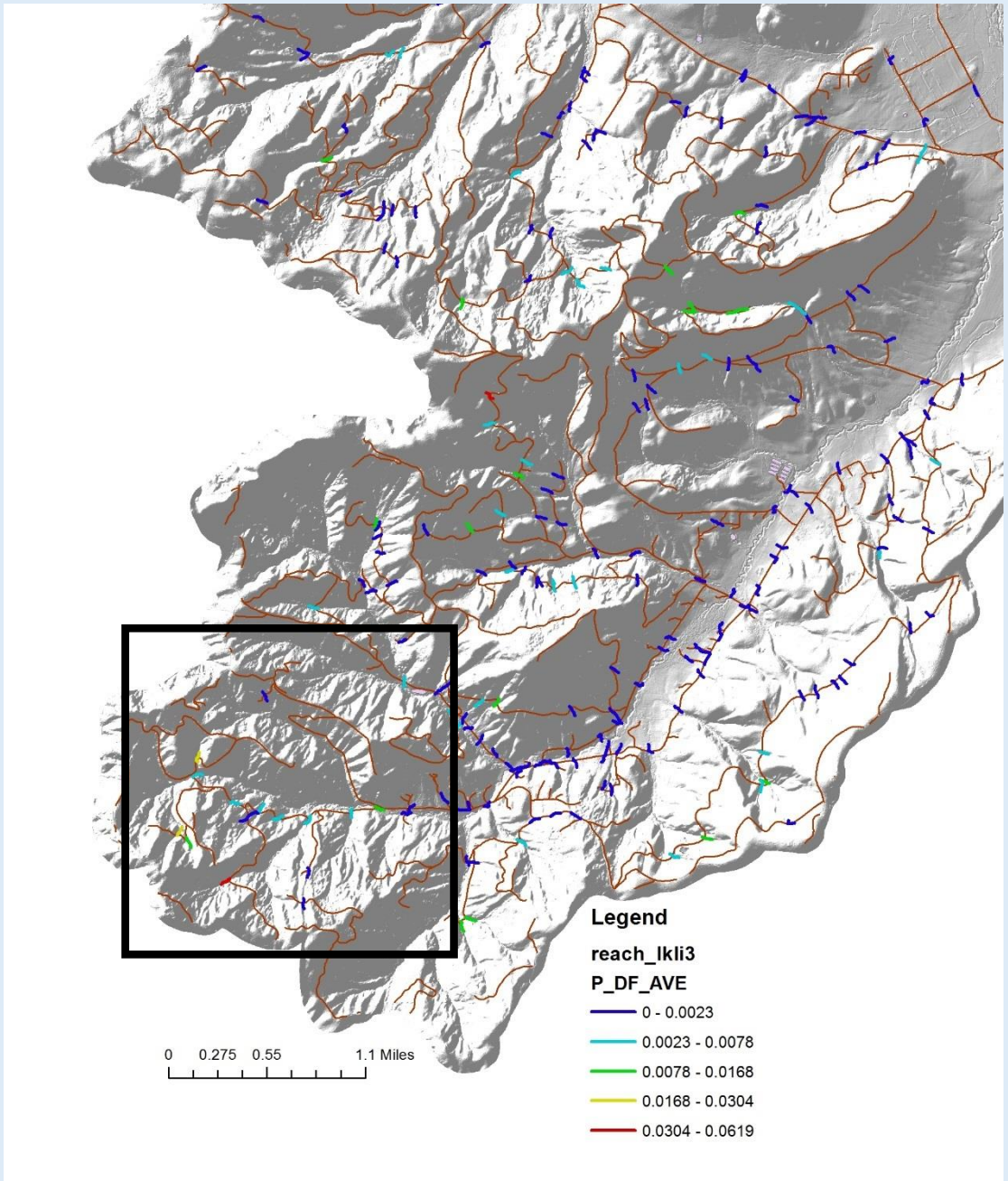
Road Stability identify overlaps between roads and potentially unstable slopes

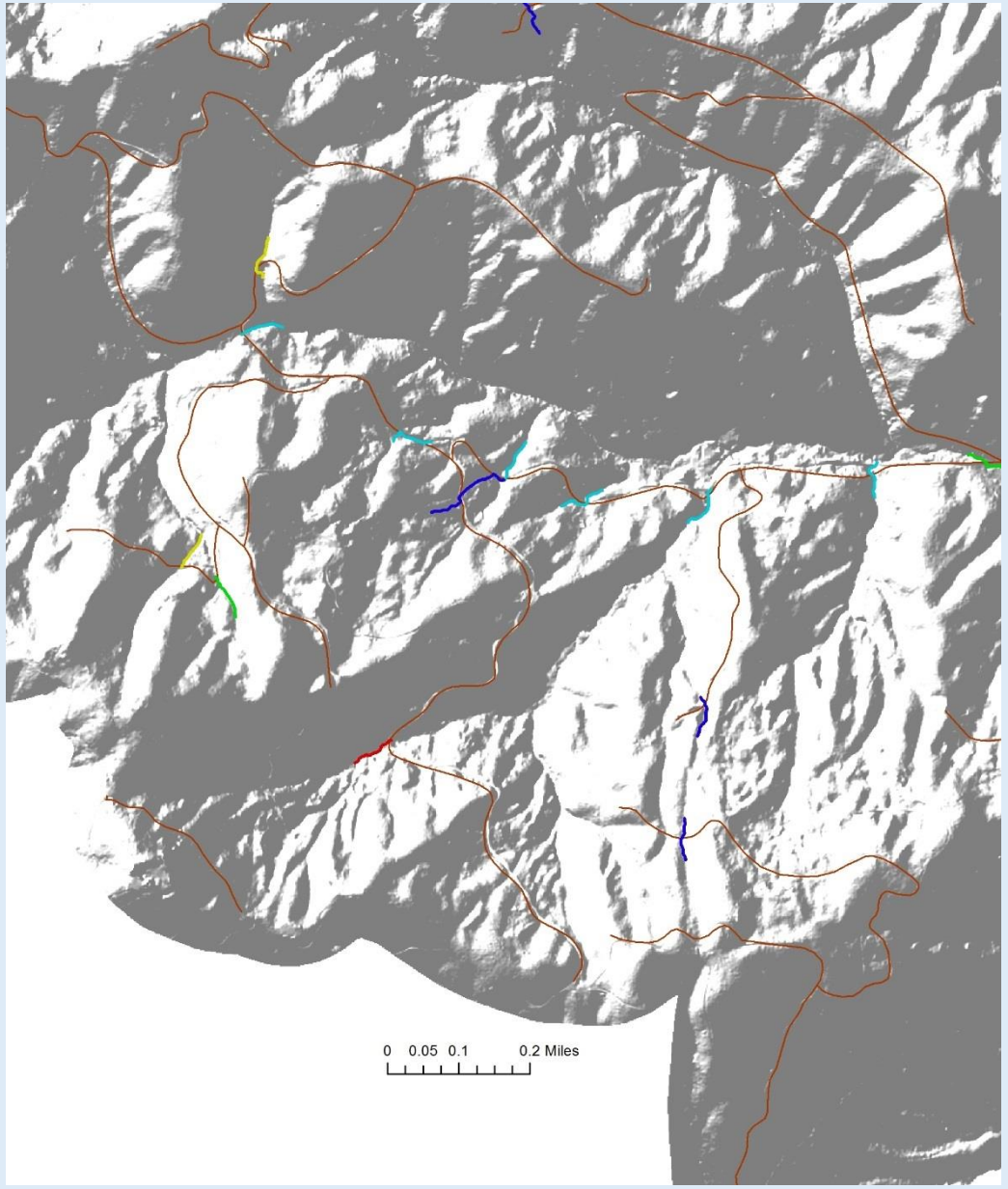


NetMap contains slope stability models including for shallow failures, debris flows, flash floods and gully erosion

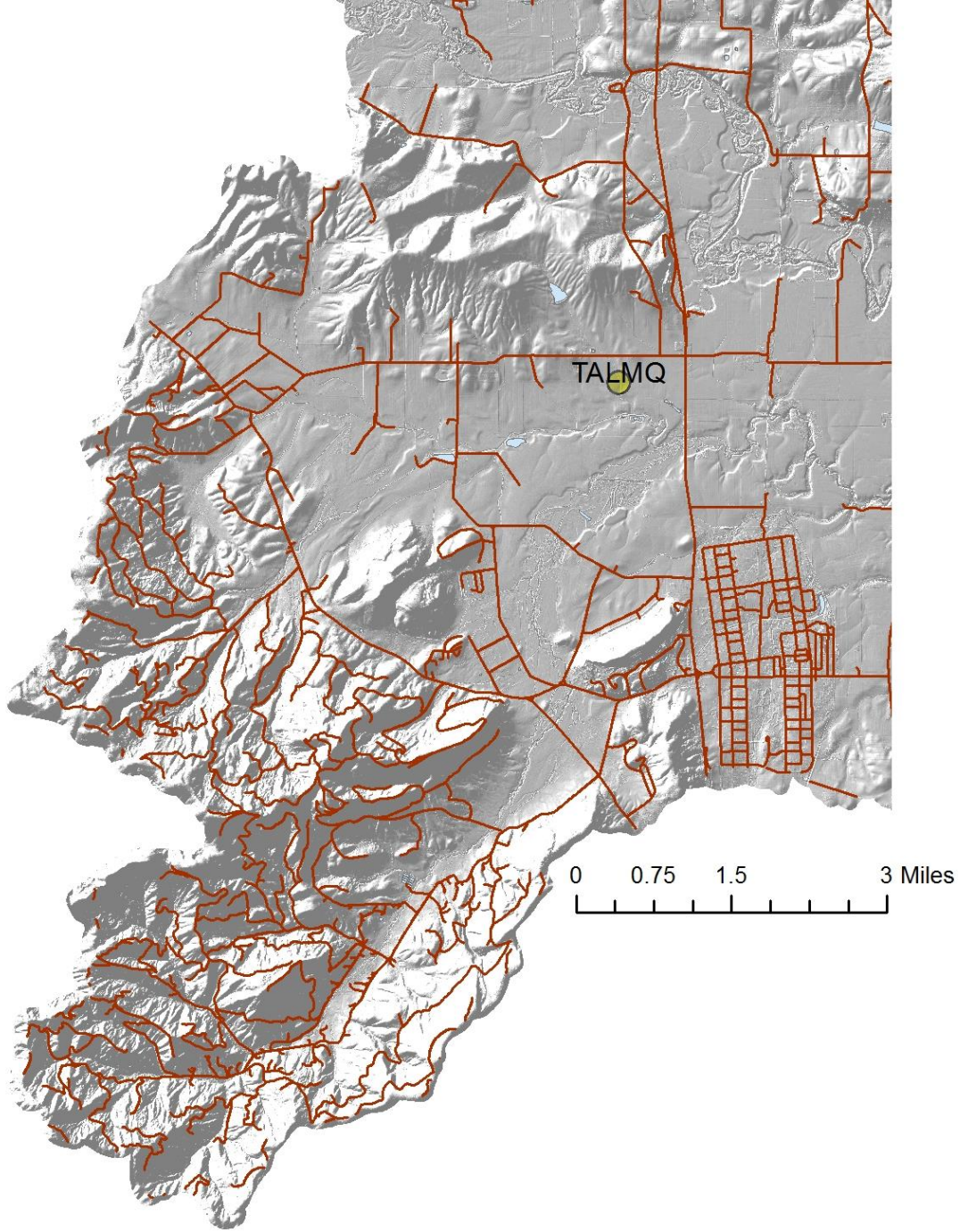


Road Debris Flow Intersections

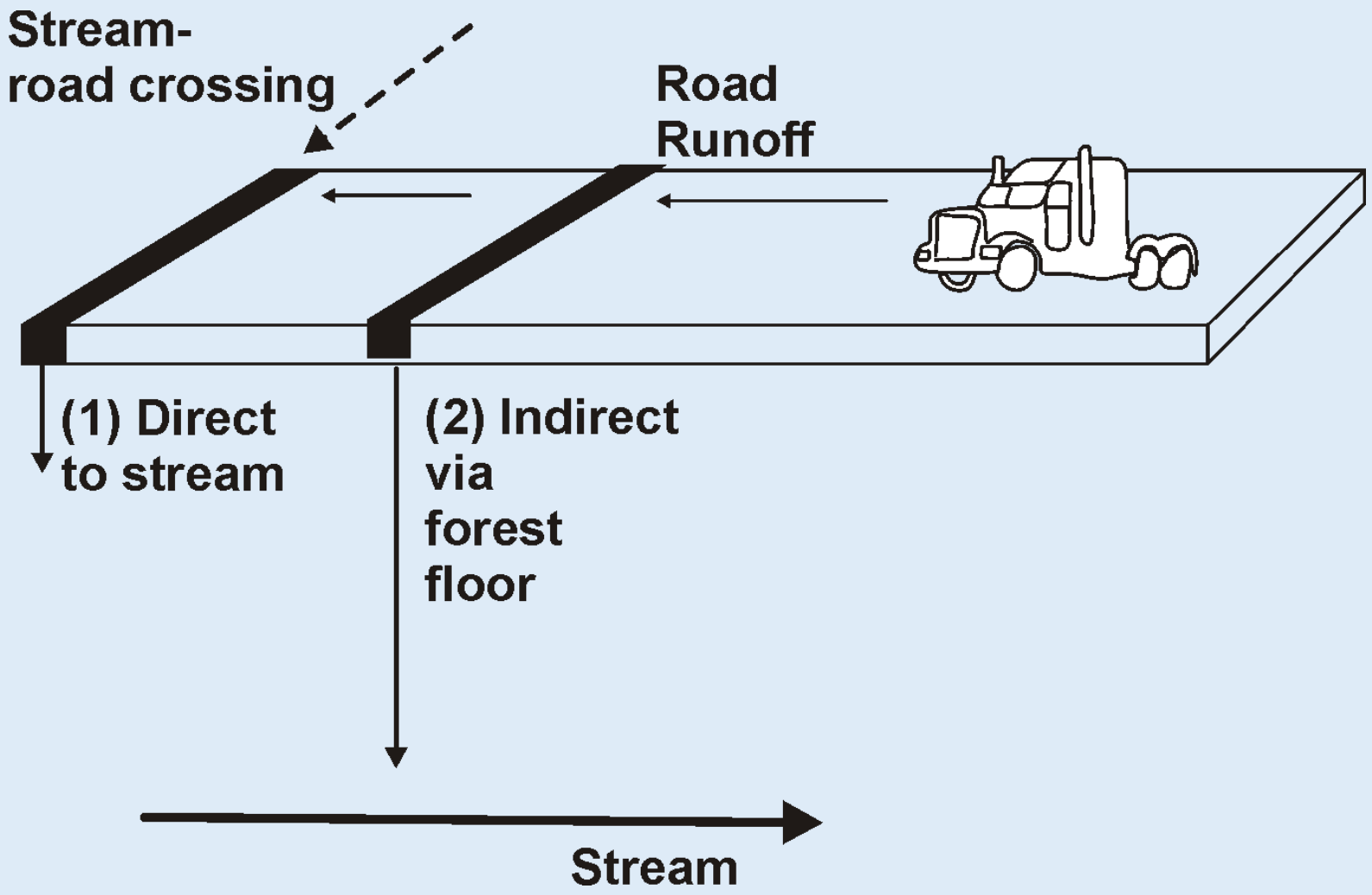




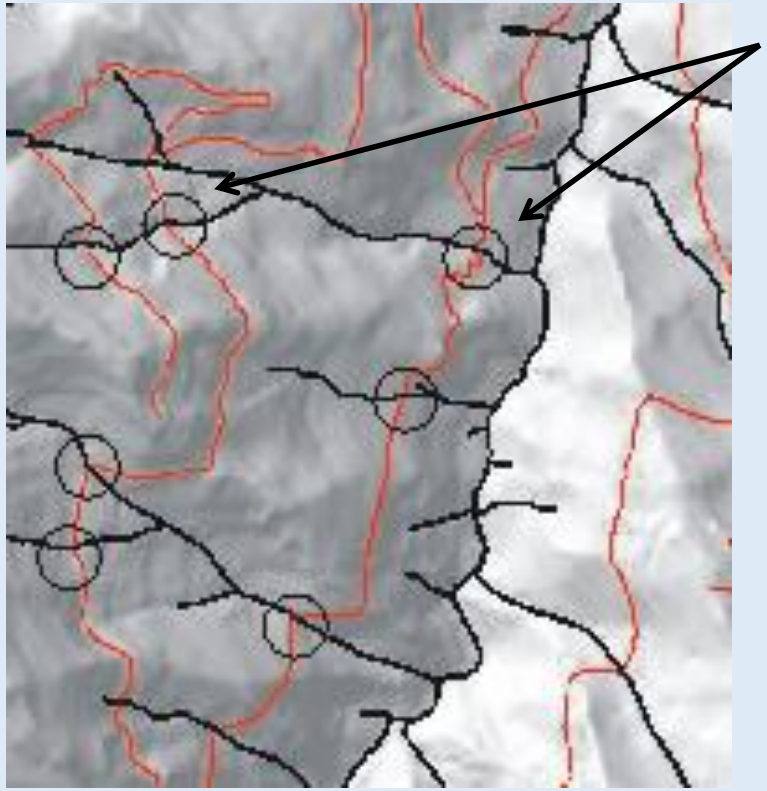
Estimate road sediment production and delivery to streams



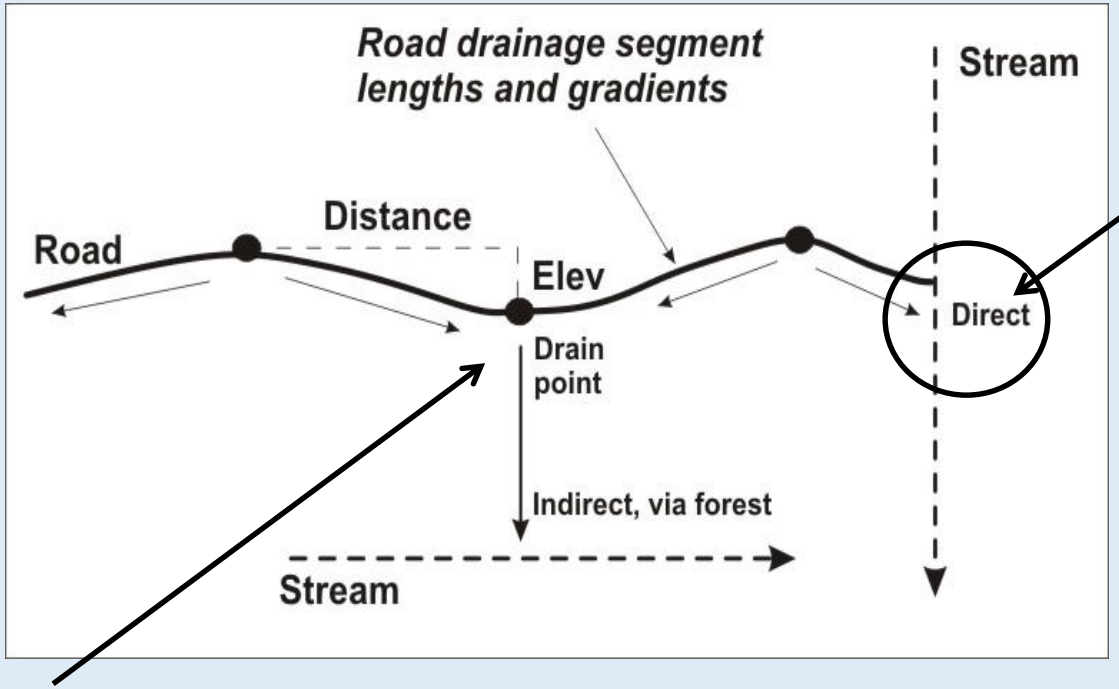
Sediment Delivery to Streams: Two types



Determining road drainage and road (hydrologically connected) segment lengths

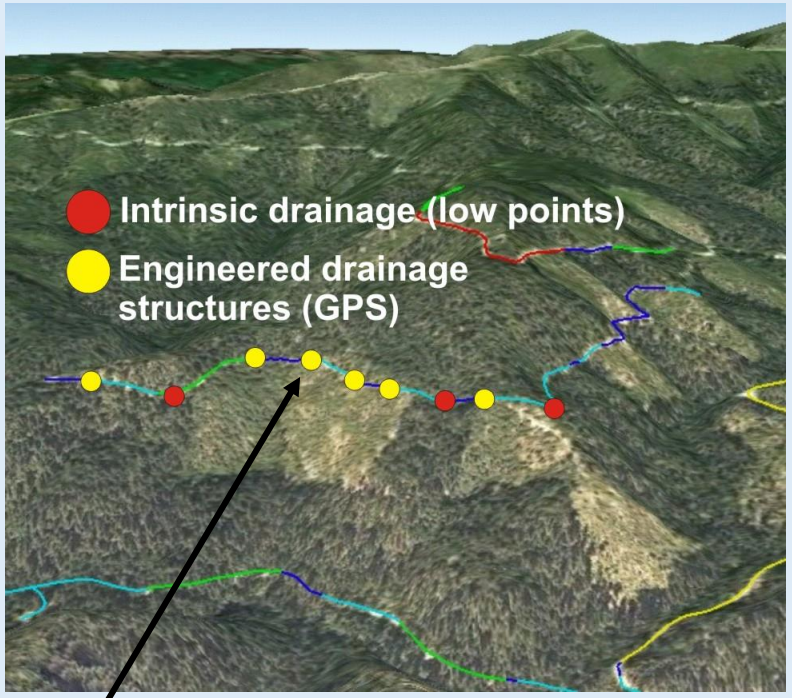


First type of "intrinsic" road drainage:
road – stream crossings



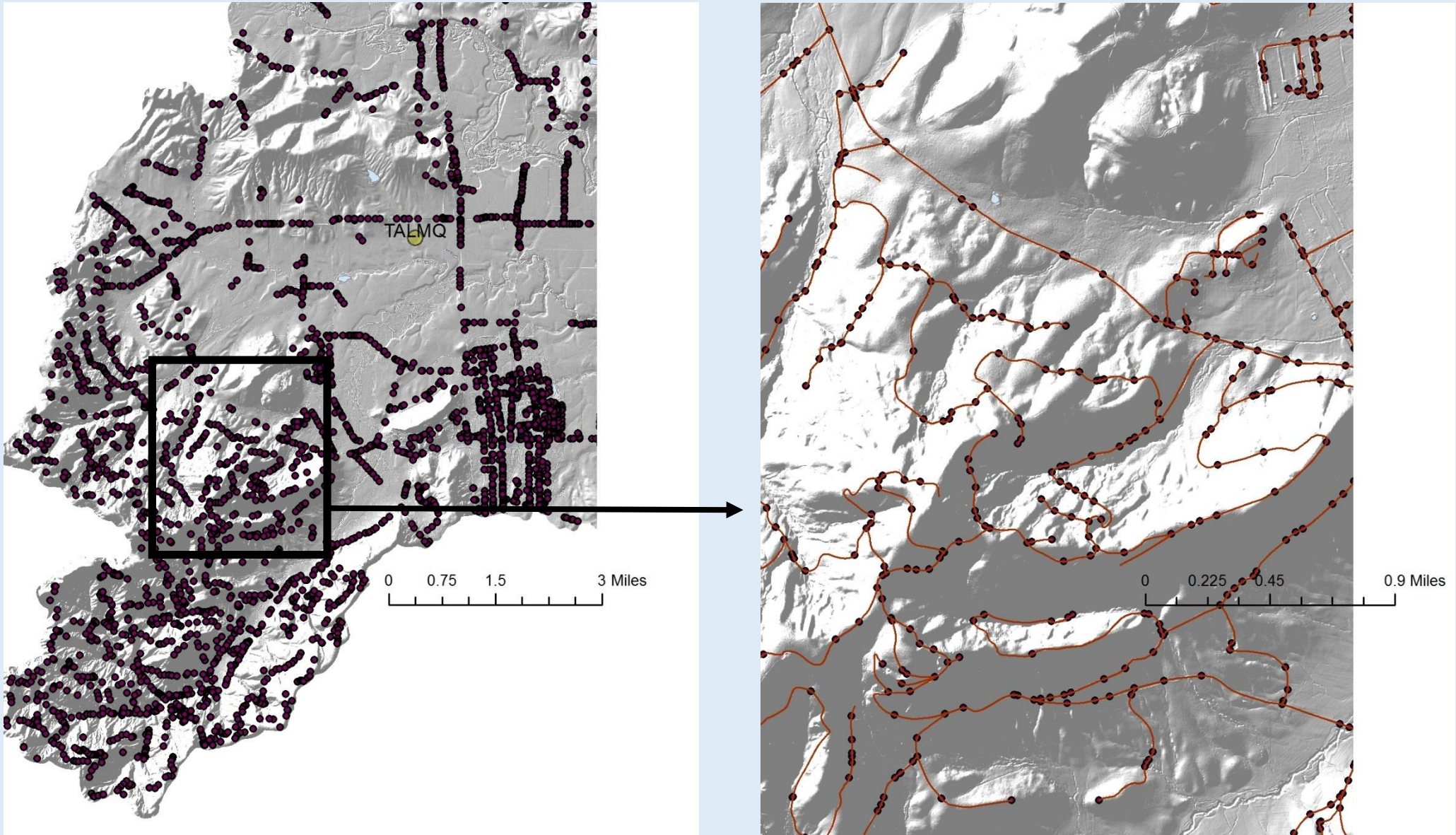
First type (direct to stream)

<u>Second type</u> of "intrinsic" road drainage: indirect to streams by topographically controlled road – drain points (may or may not have engineered structures)

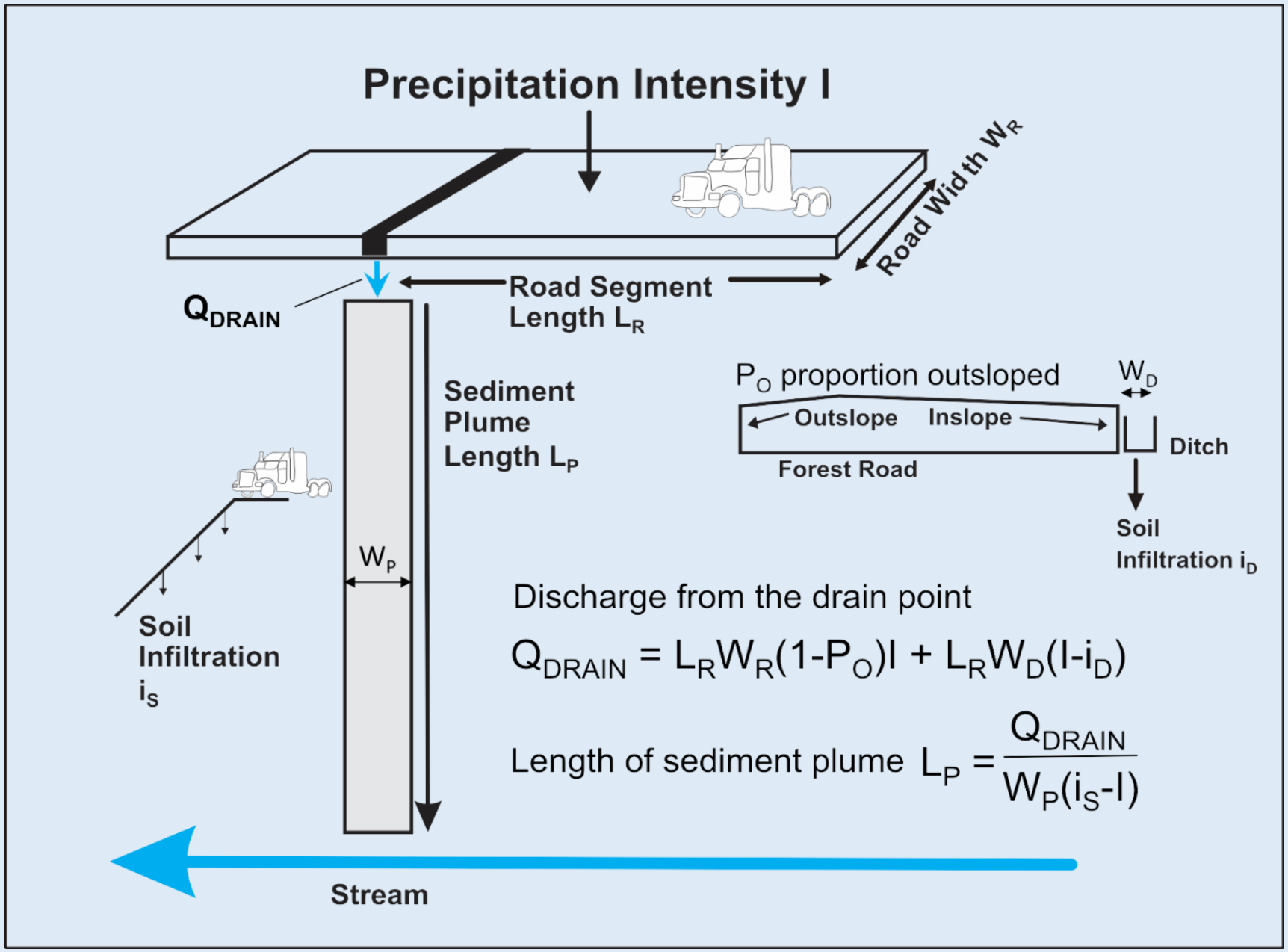


Third type of road drainage: engineered structures (GPS), optional

Existing road drainage features



Indirect runoff/sediment delivery model (in review)

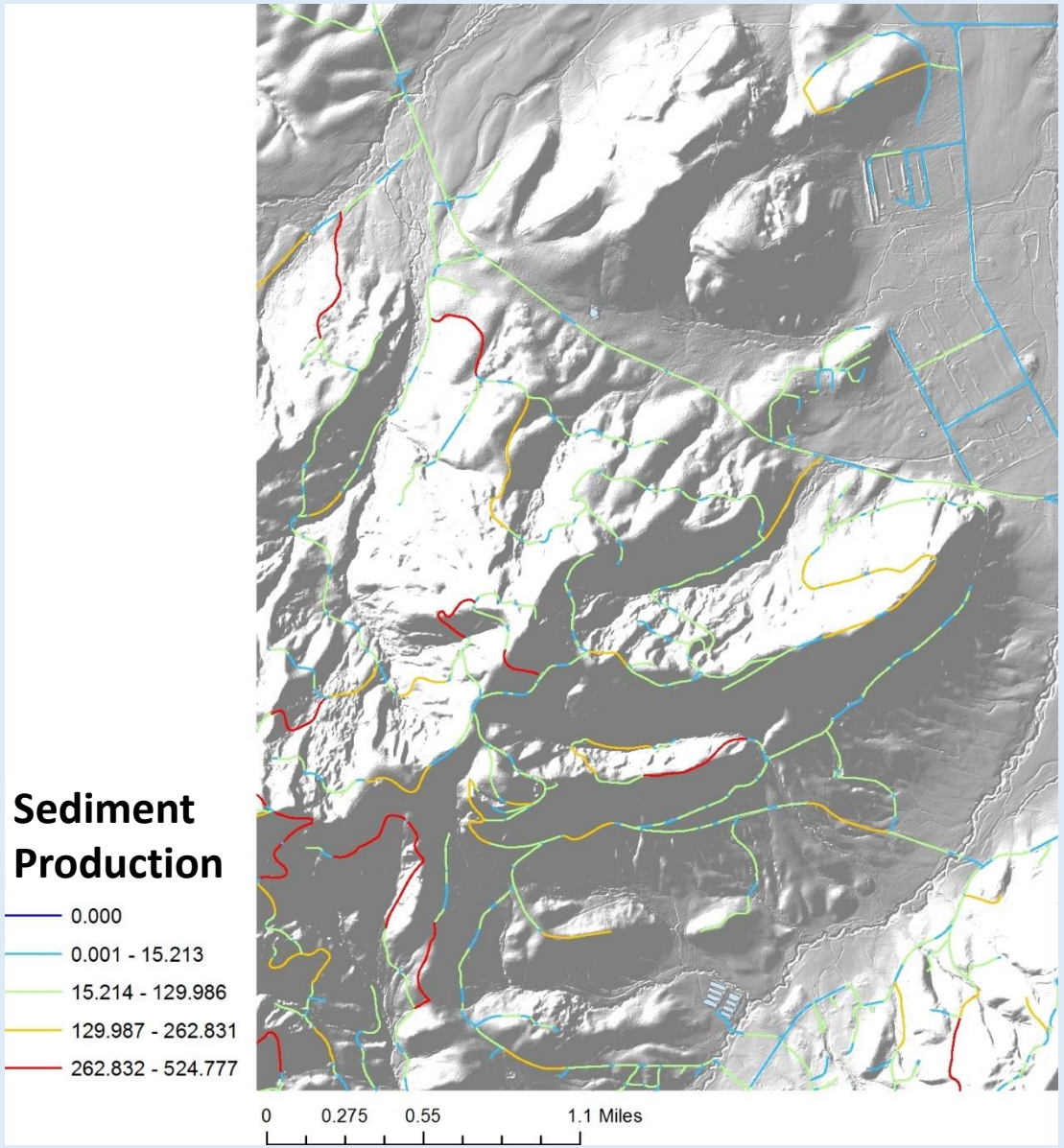


-Sediment production
-Sediment delivery to streams

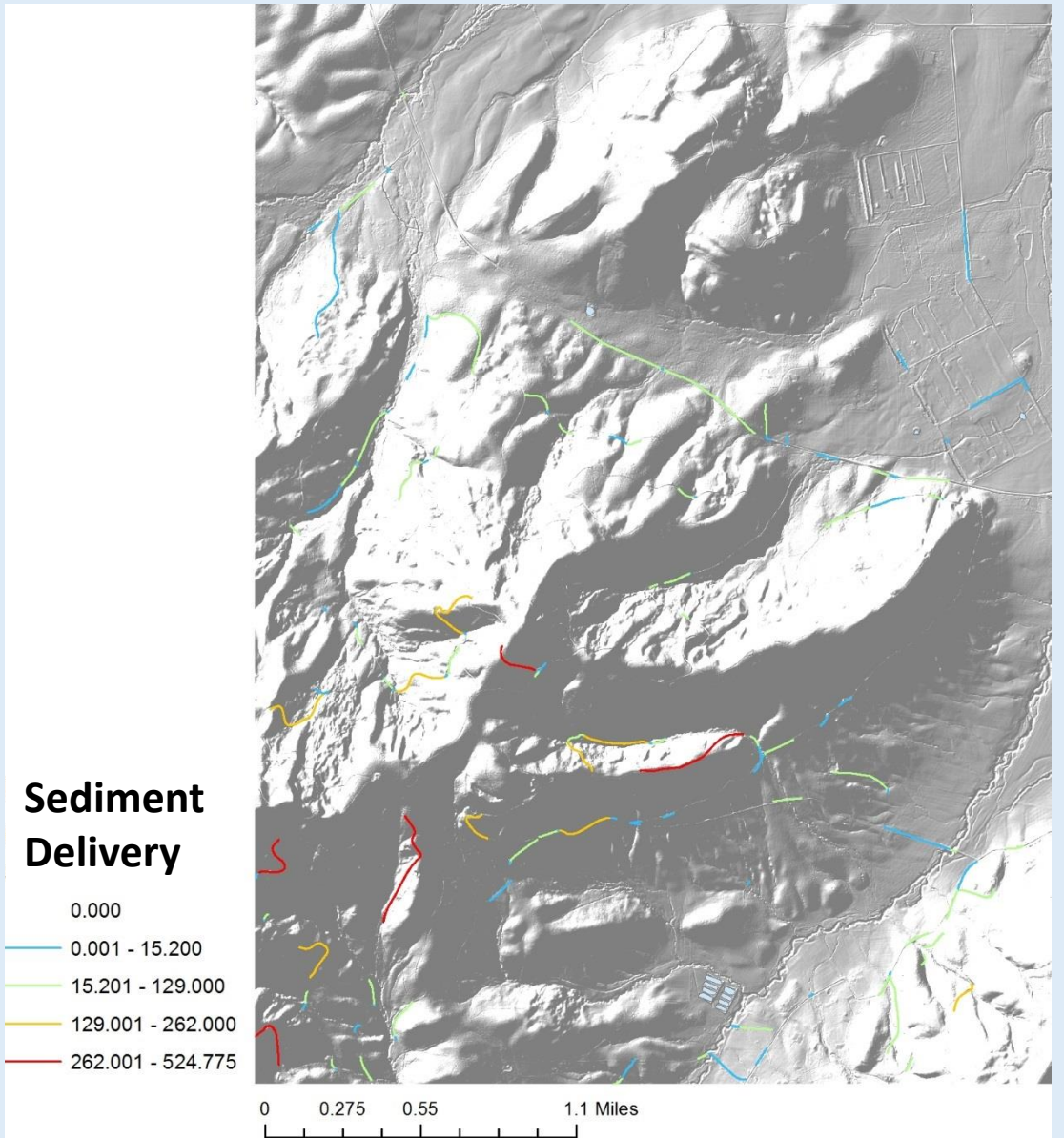
Units of
kg or tons
per year or
dimensionless

Requires design storm;
for example, annual, one-hour storm

Unpaved Road Sediment Production (dimensionless)

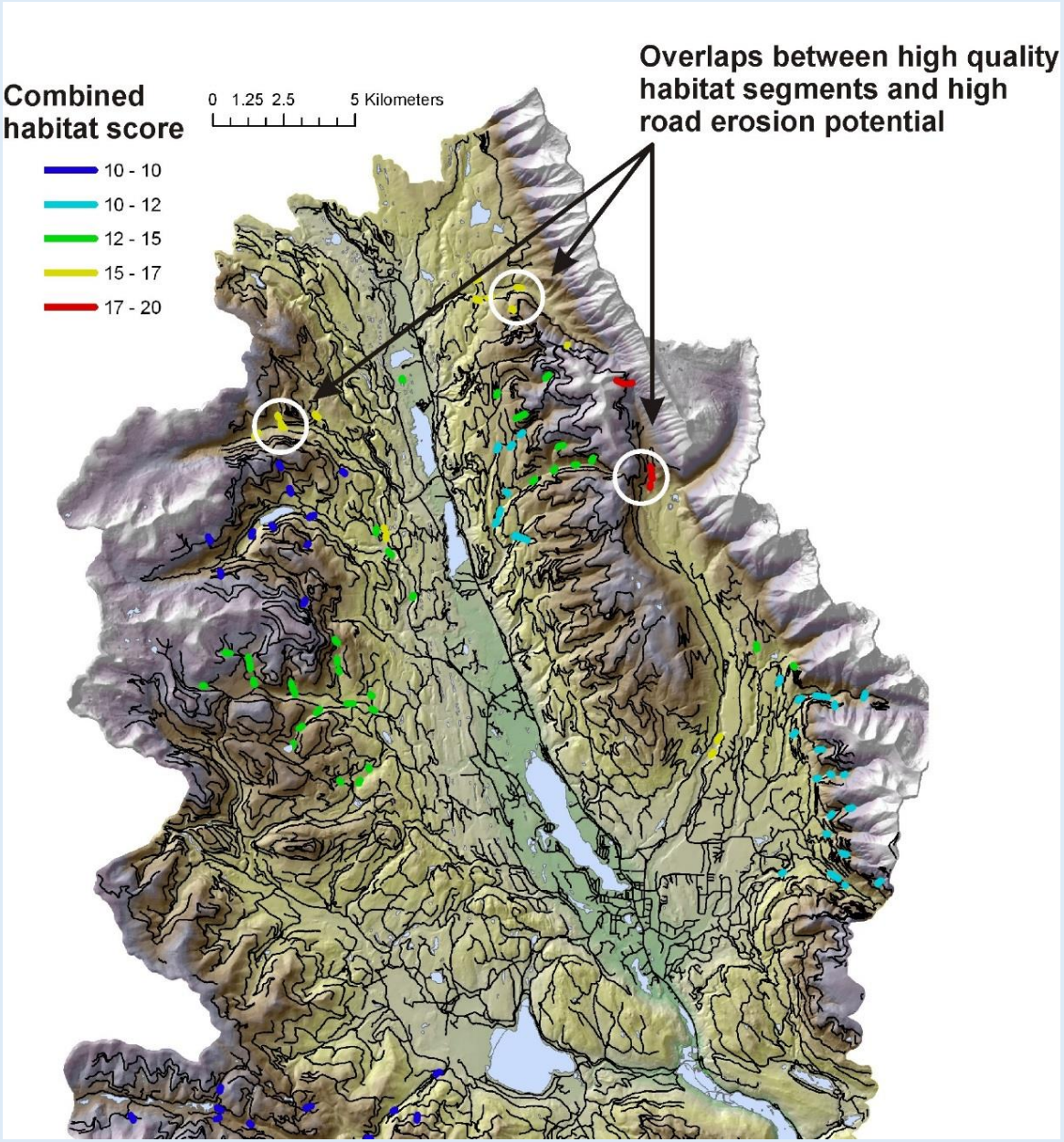


Unpaved Road Sediment Delivery to Streams

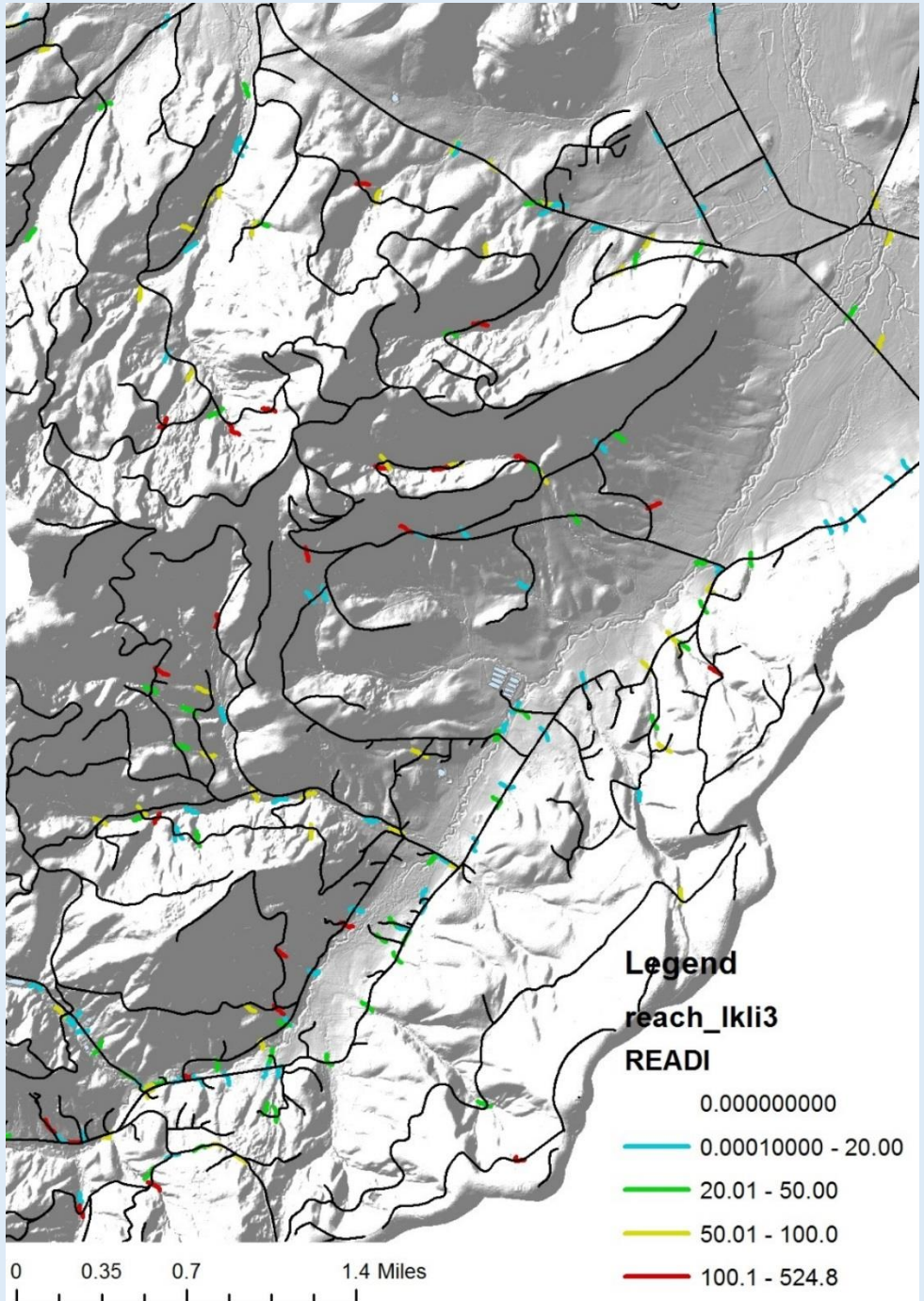


Road Surface Erosion and Sediment Delivery

Quickly search for overlaps between the top percentile of predicted road surface erosion (1%, 5%, 10%)
and top percentile of fish habitat quality

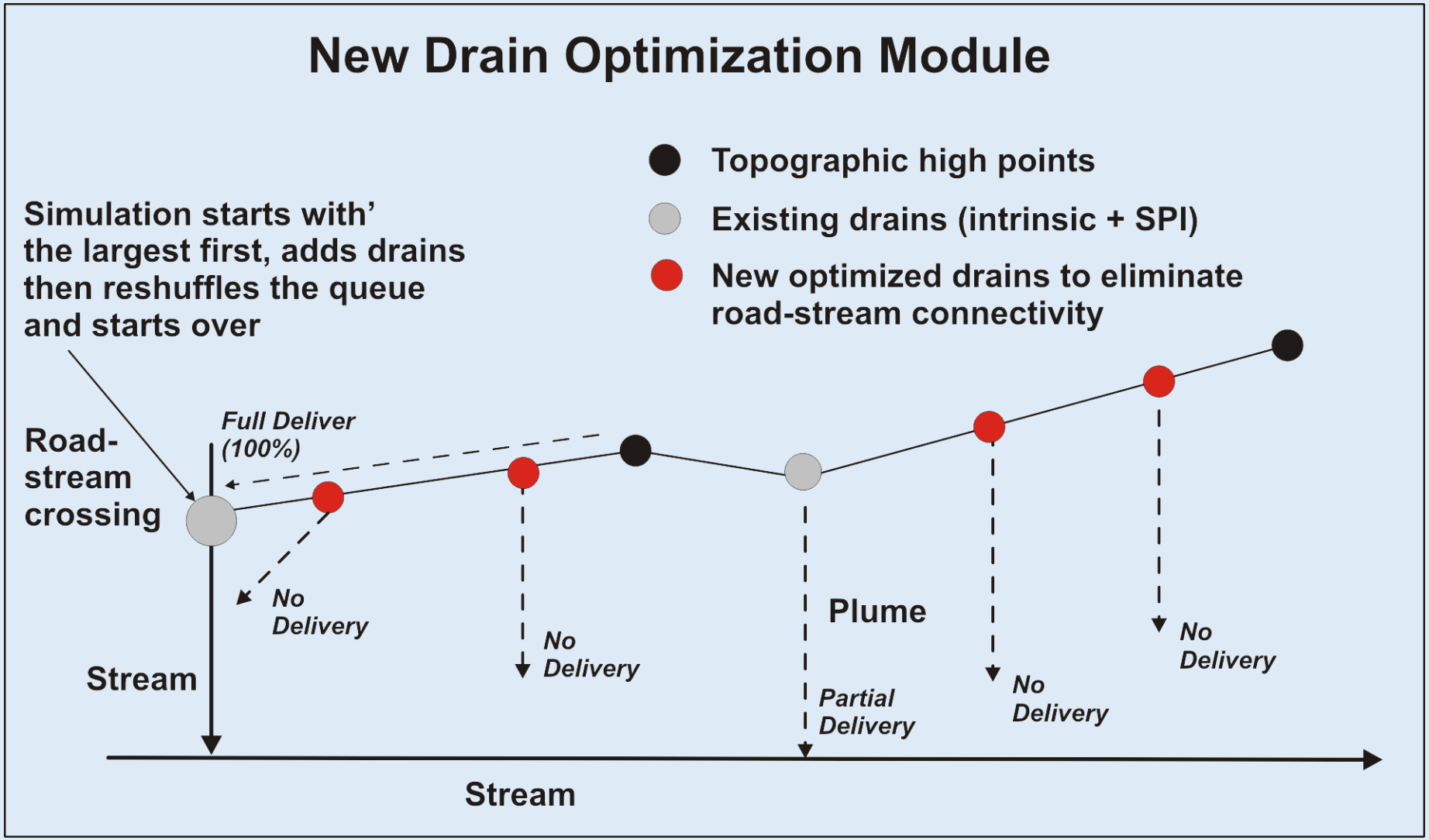


Predicted road sediment delivery, mapped to stream reaches

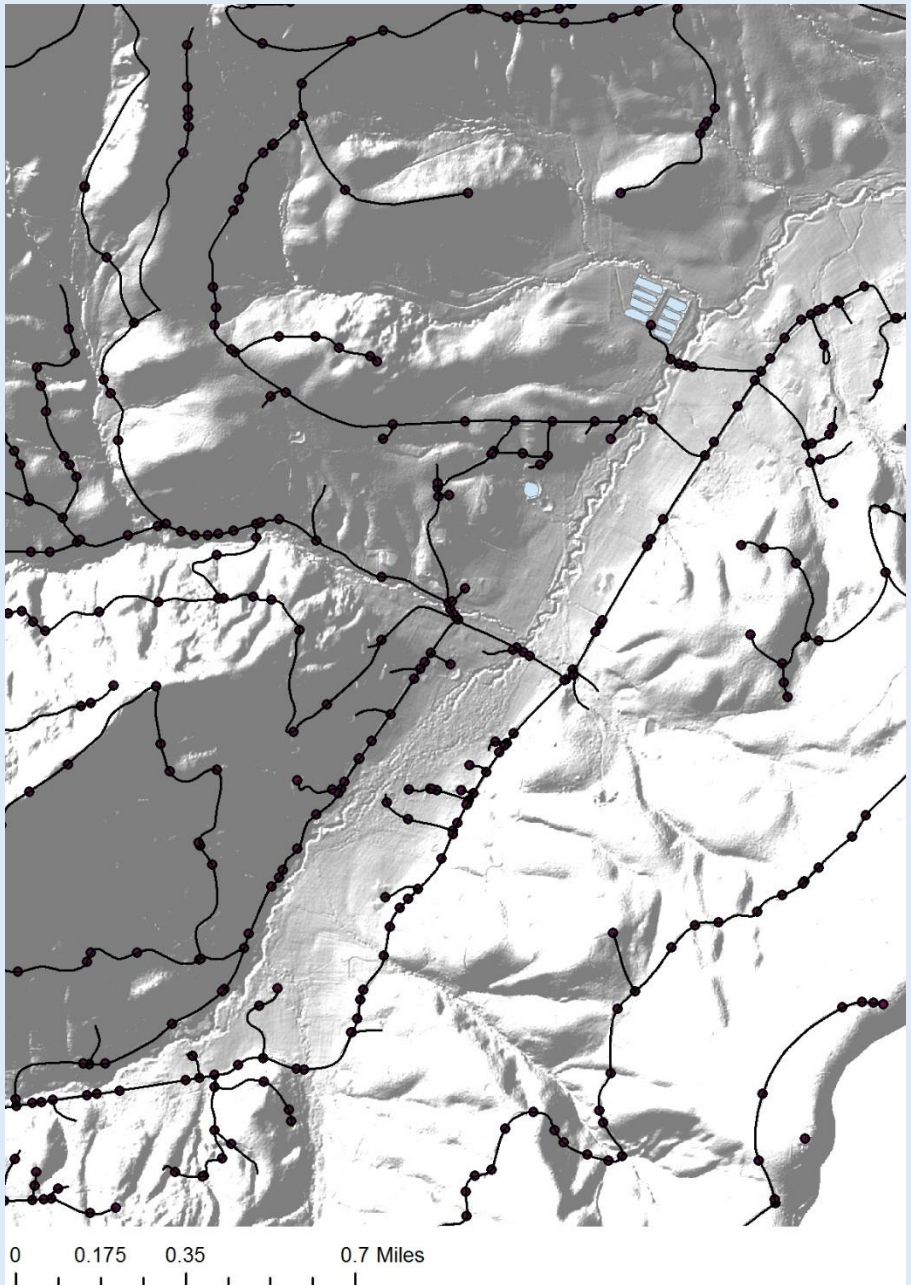


Mitigation – Restoration (optimized locations for additional drains and surfacing)

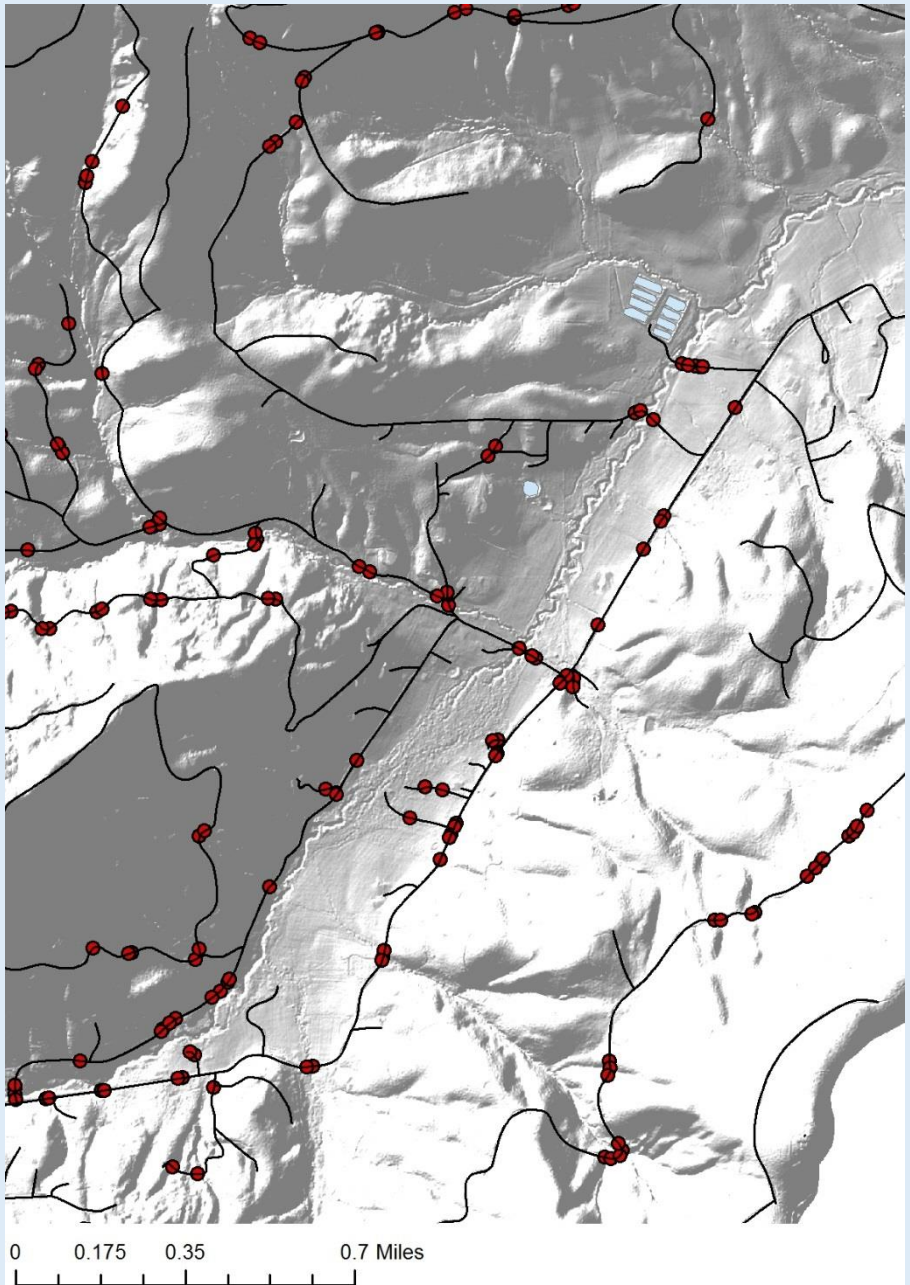
If you were going to add new drainage features to decouple roads from streams, where would you do it?



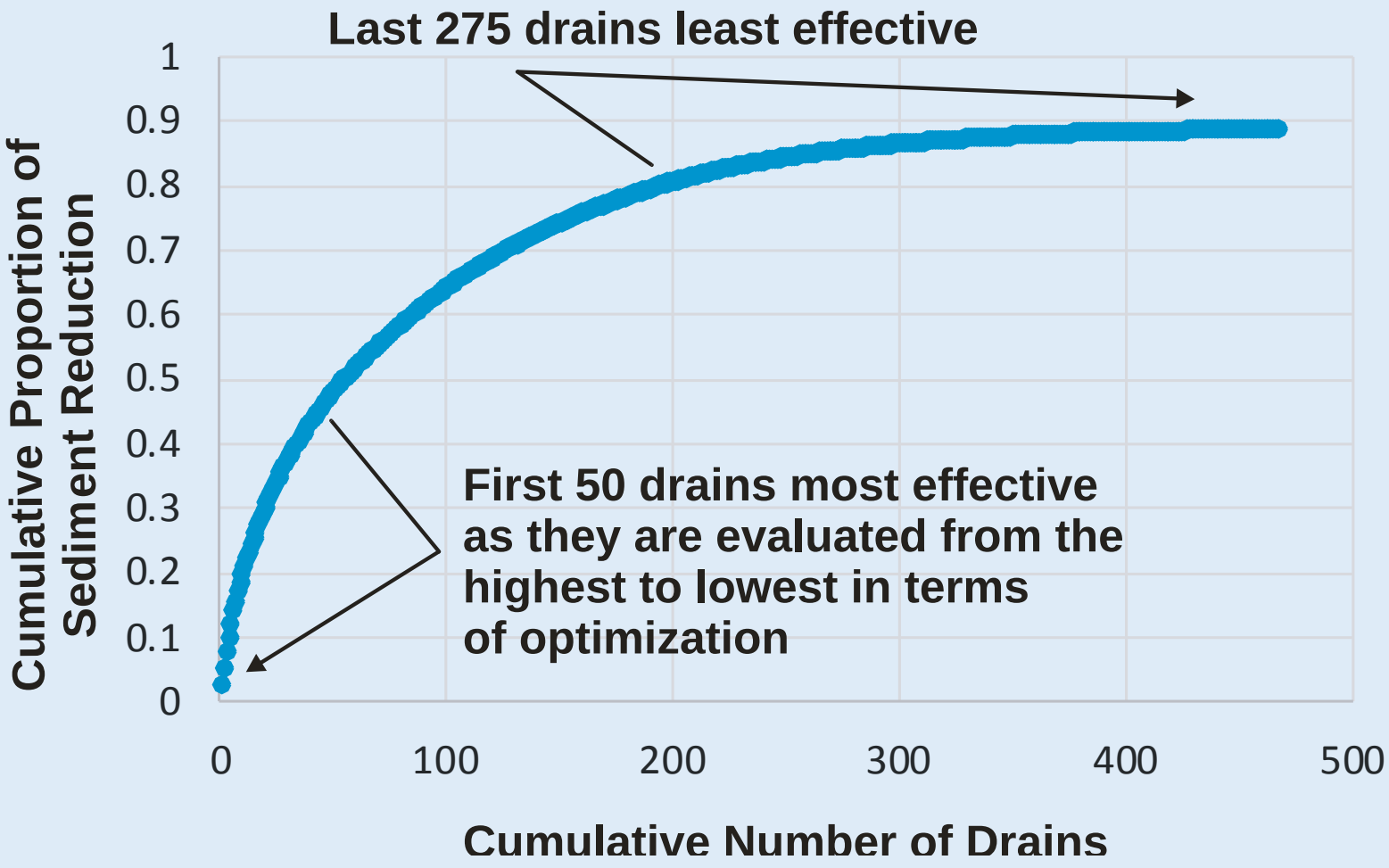
Existing road drains



Optimized locations of new drains



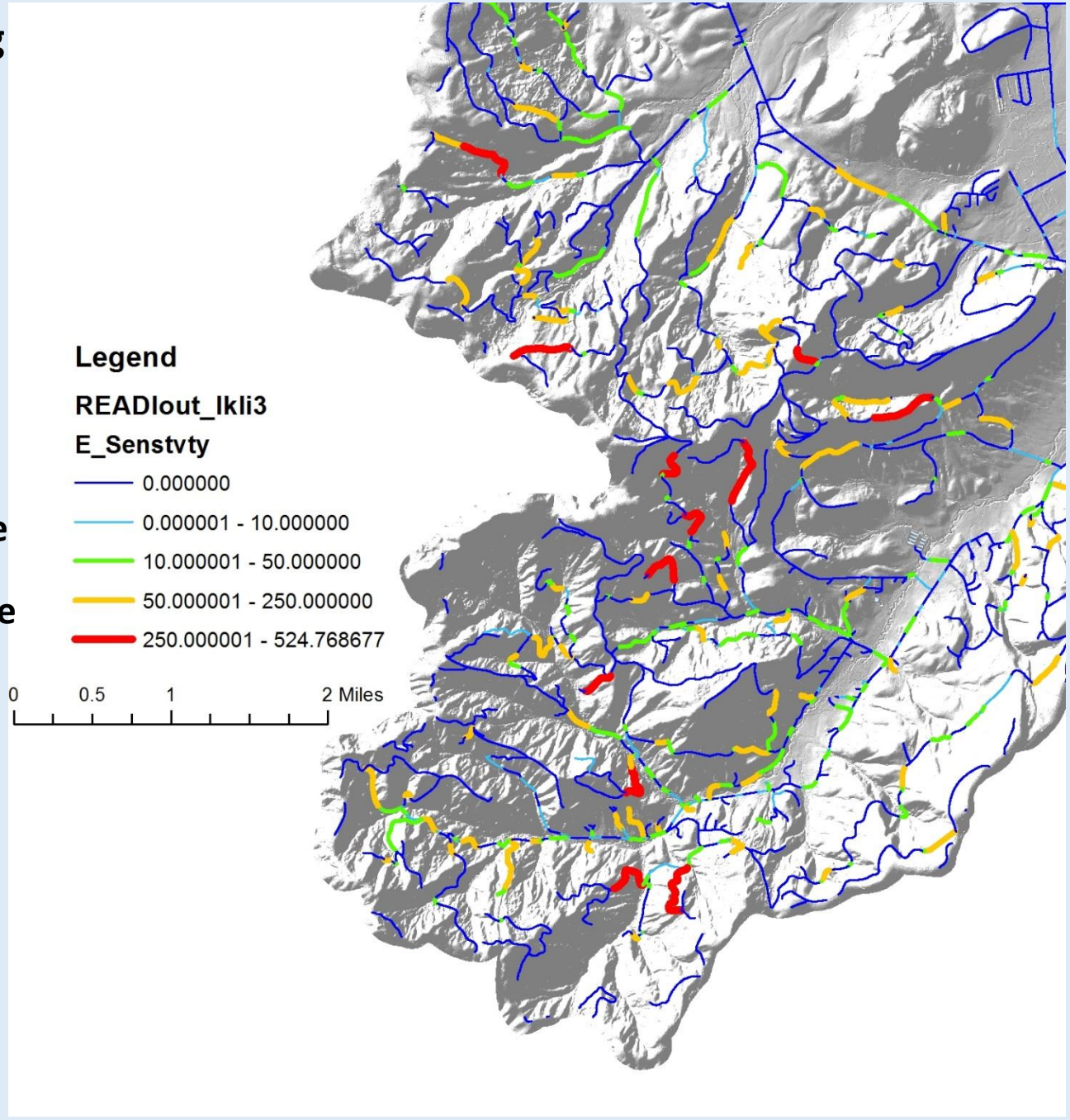
Effectiveness of added optimized drains



If you were going to improve road surfacing and or maintenance to reduce sediment production and delivery, where would you do it?

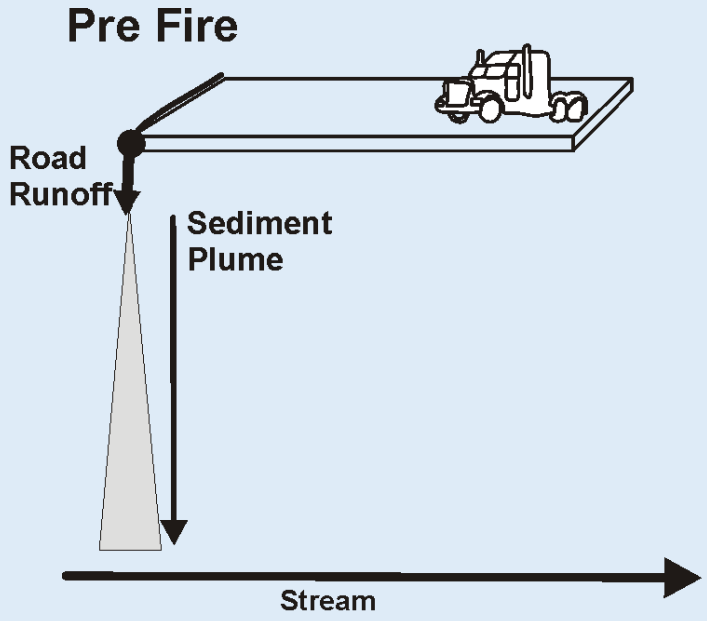
Less effective

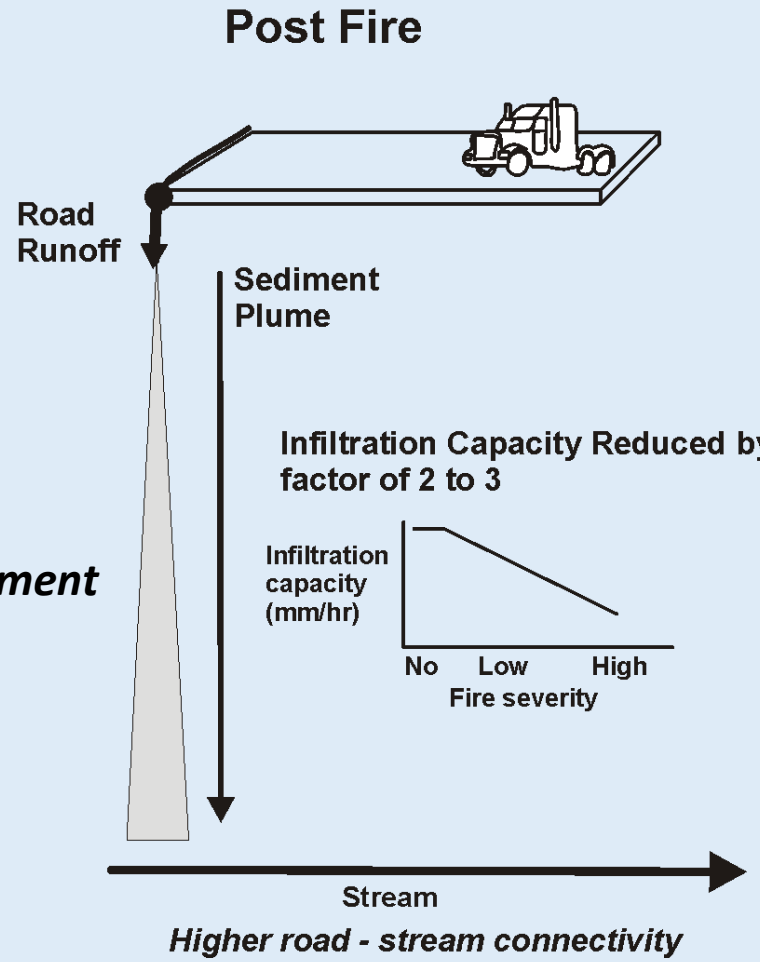
Most effective



Road Surface Erosion and Sediment Delivery to Streams, Post Fire

Fire Effects on Road Erosion and Sediment Delivery to Streams

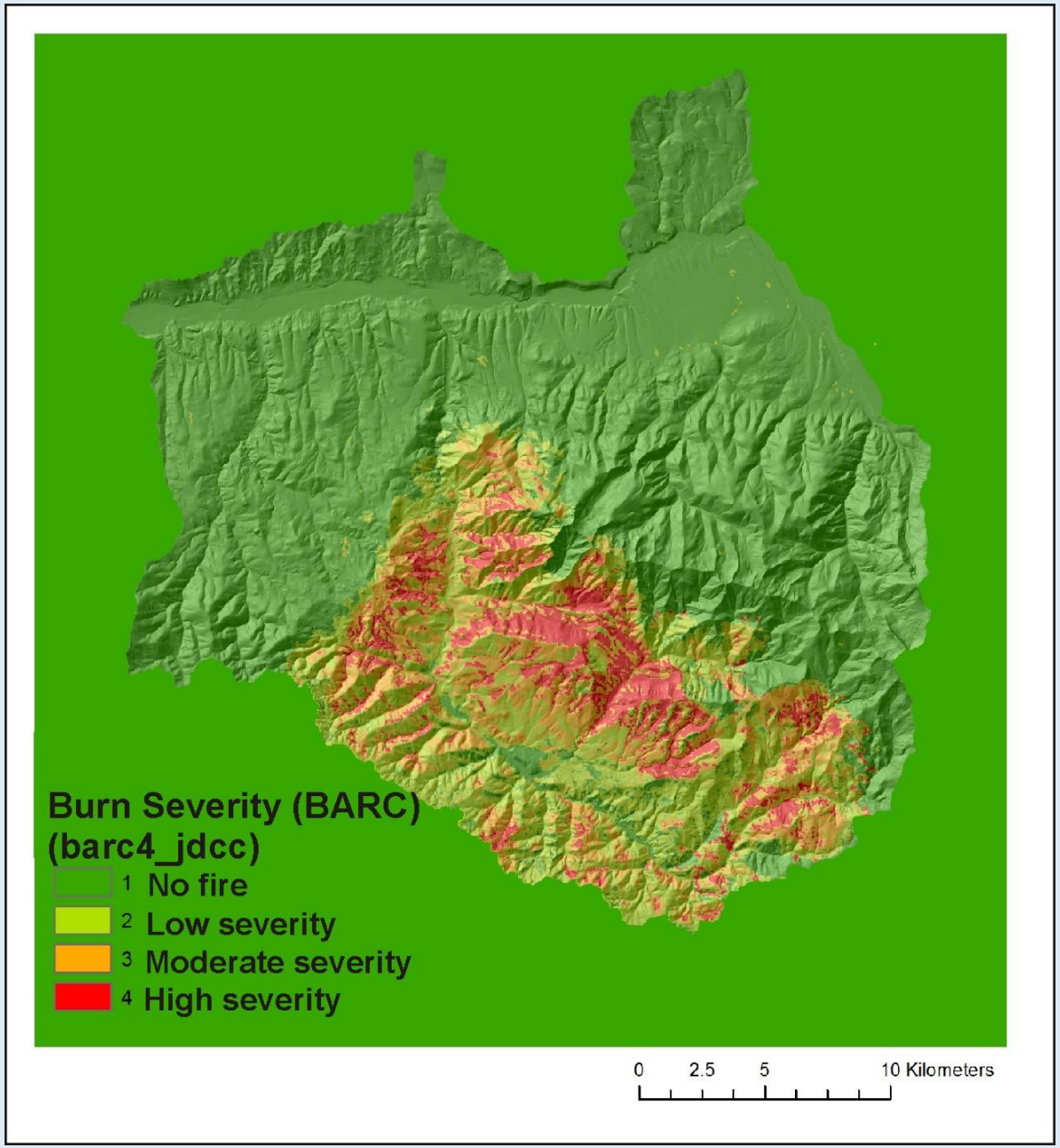




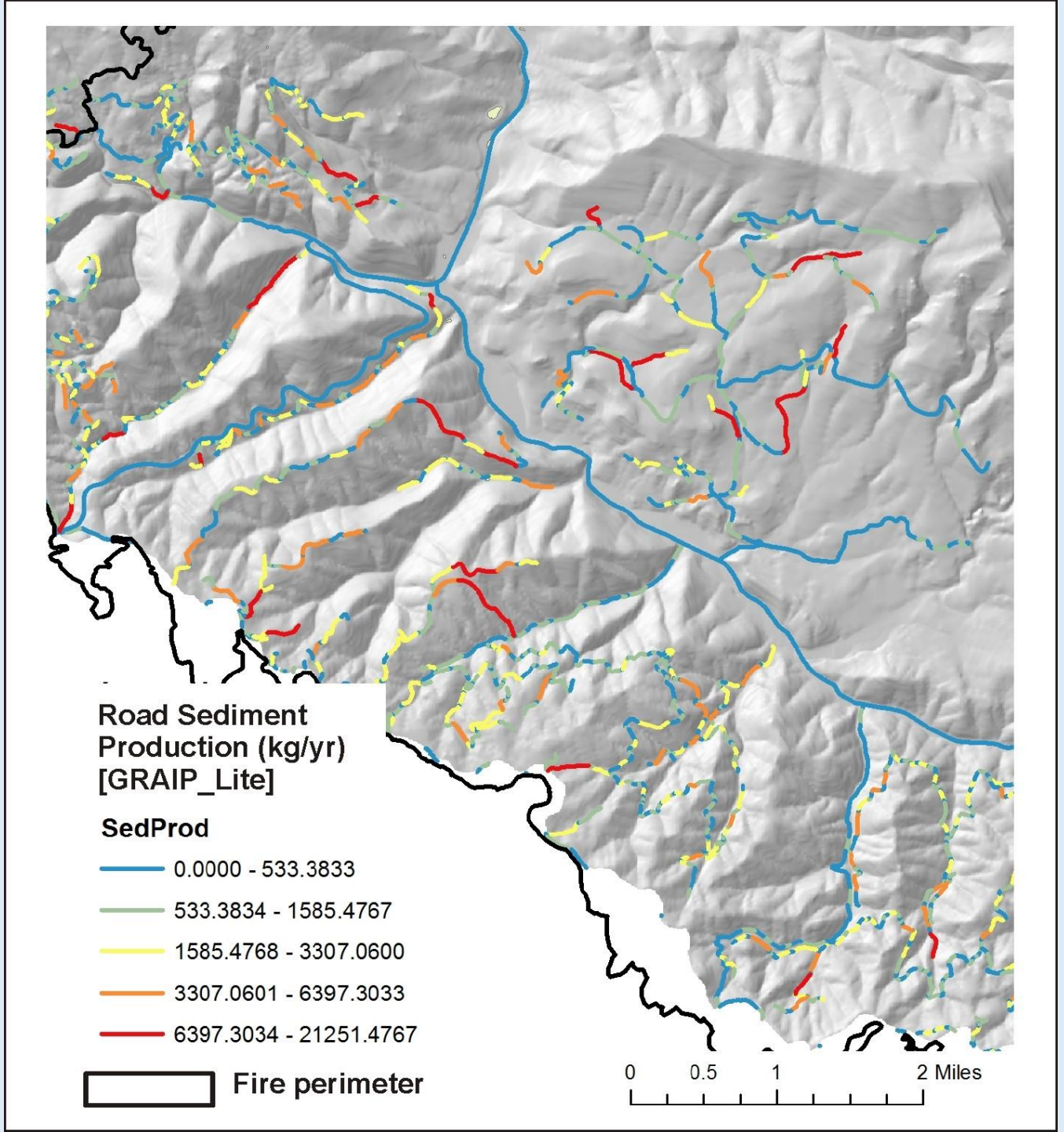
Fire that reduces infiltration capacity will result in a larger proportion of forest roads delivering sediment to stream channels (these could be targeted for restoration)

Road Management in Post Wildfire Environments

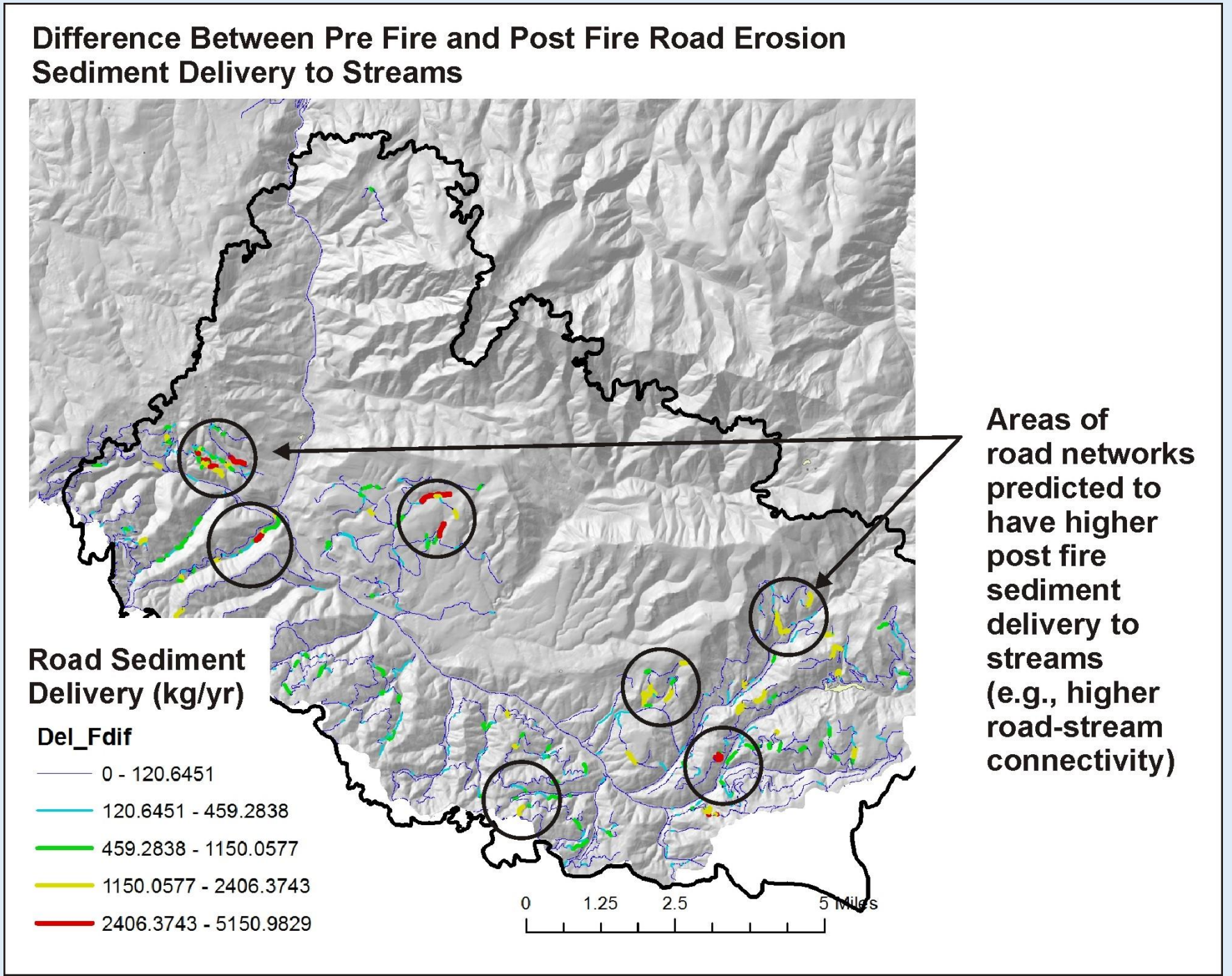
Start with Burned Area Reflectance Classification [BARC] Map)



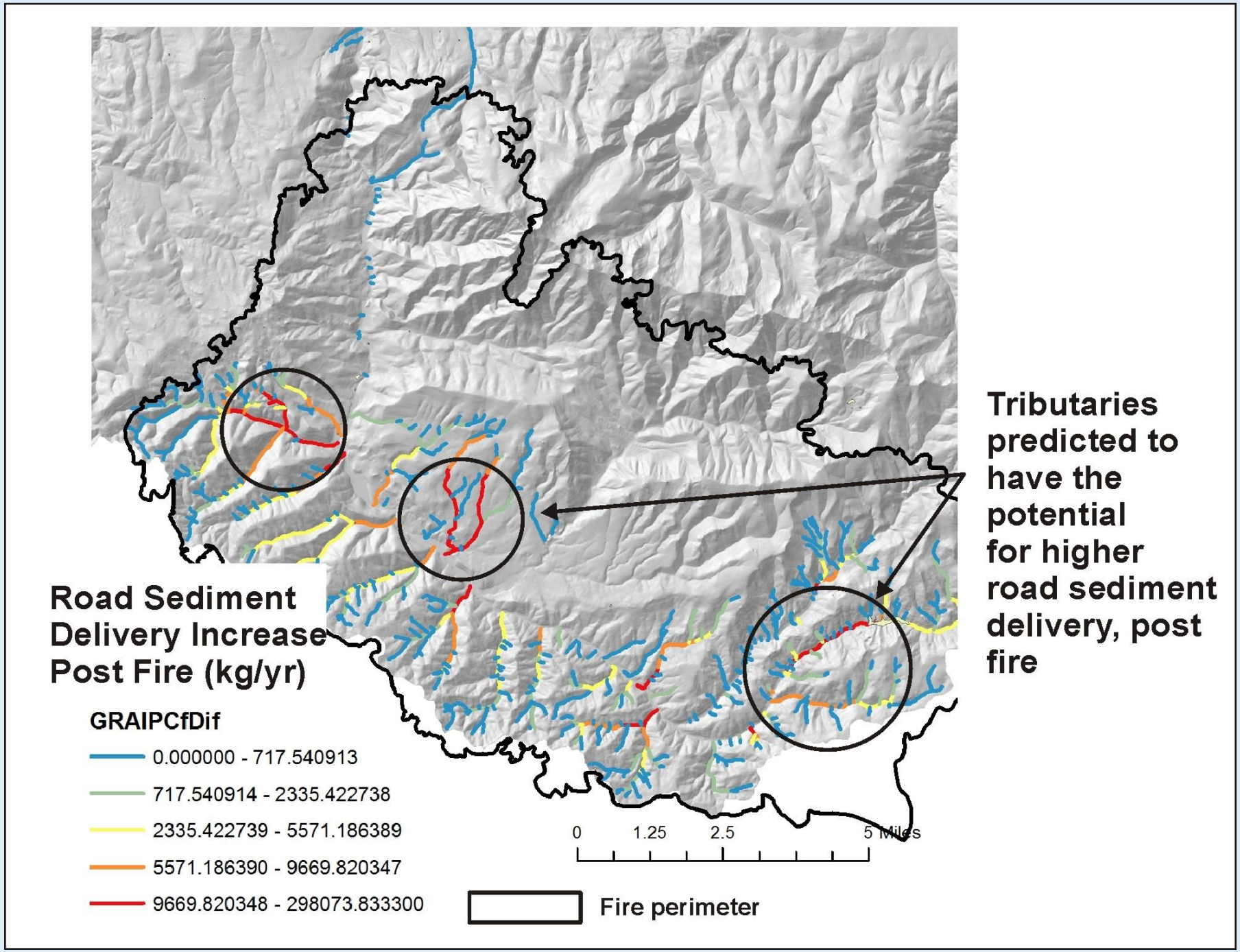
First, start with road sediment production



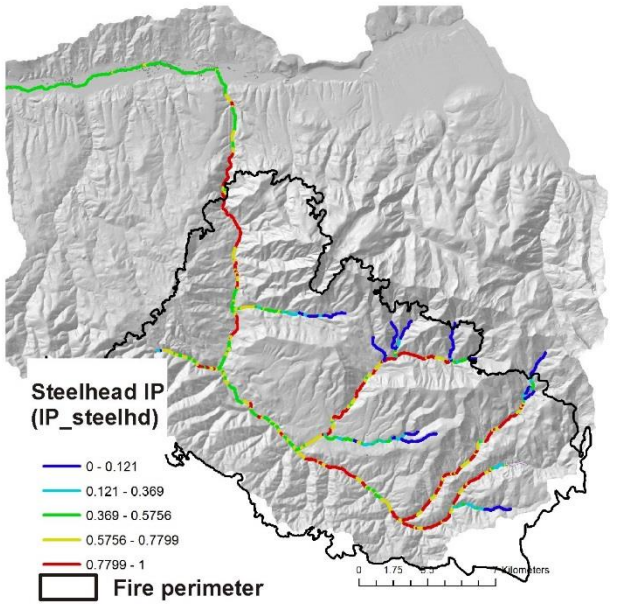
Next, calculate sediment delivery pre fire and compare that to sediment delivery post fire, and identify areas of predicted increases



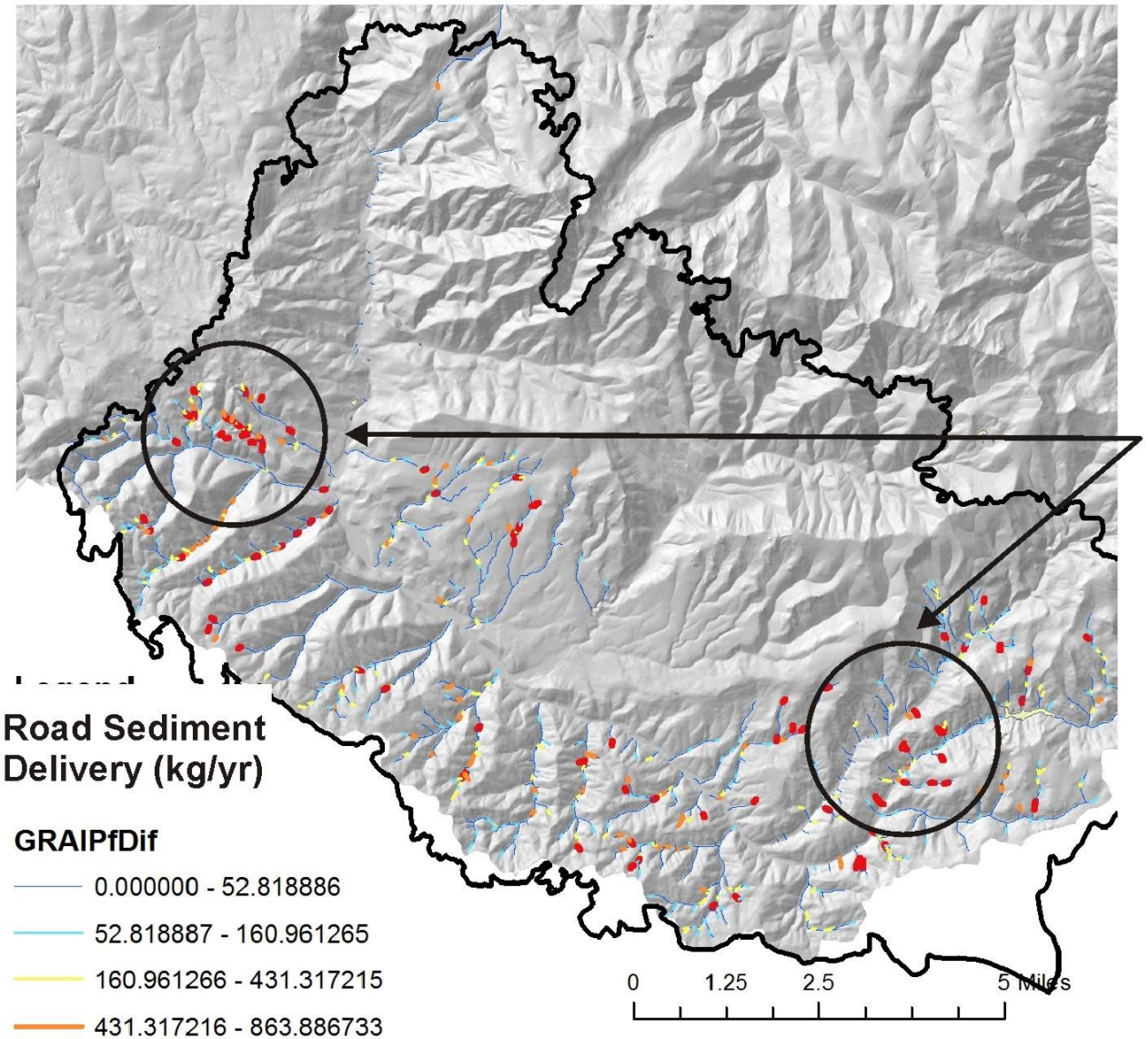
Identify tributary scale increases in delivery of road sediment



Then compare it to locations of high quality and sensitive aquatic habitats



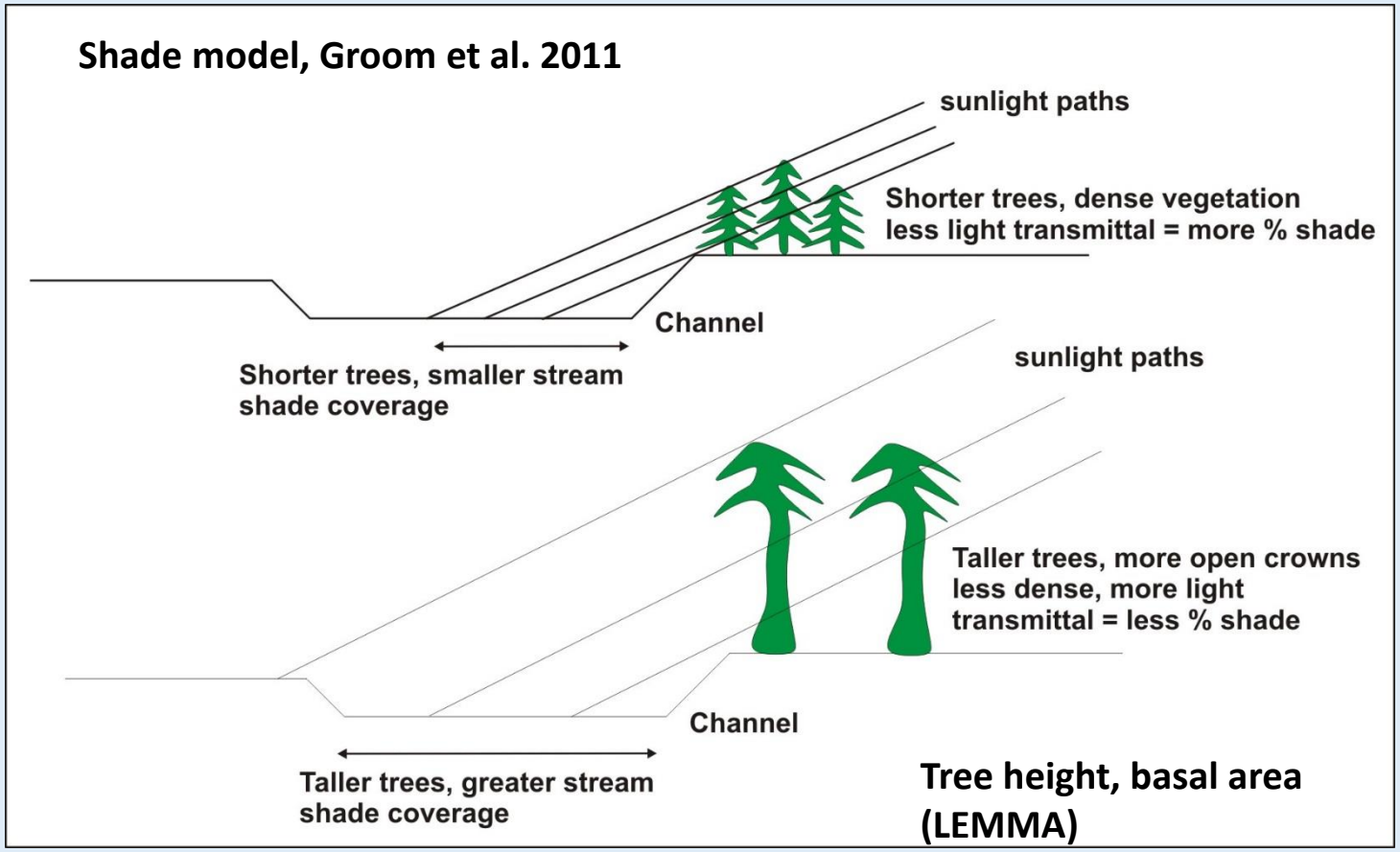
Difference between pre-fire and post fire road erosion sediment delivery to streams (predicted point sources as shown in streams)

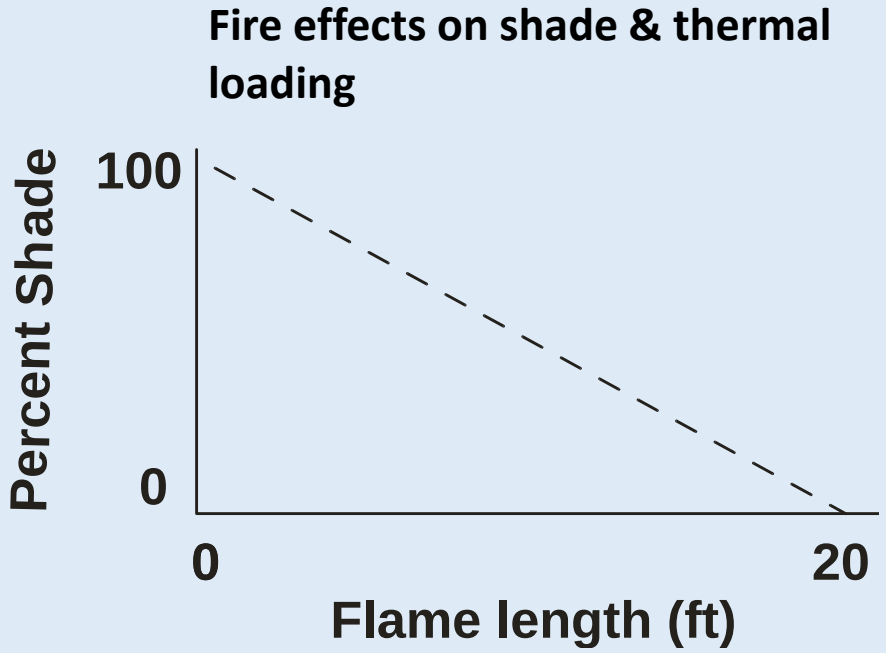


Areas of overlap between predicted higher road sediment delivery post fire and high quality steelhead habitat

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

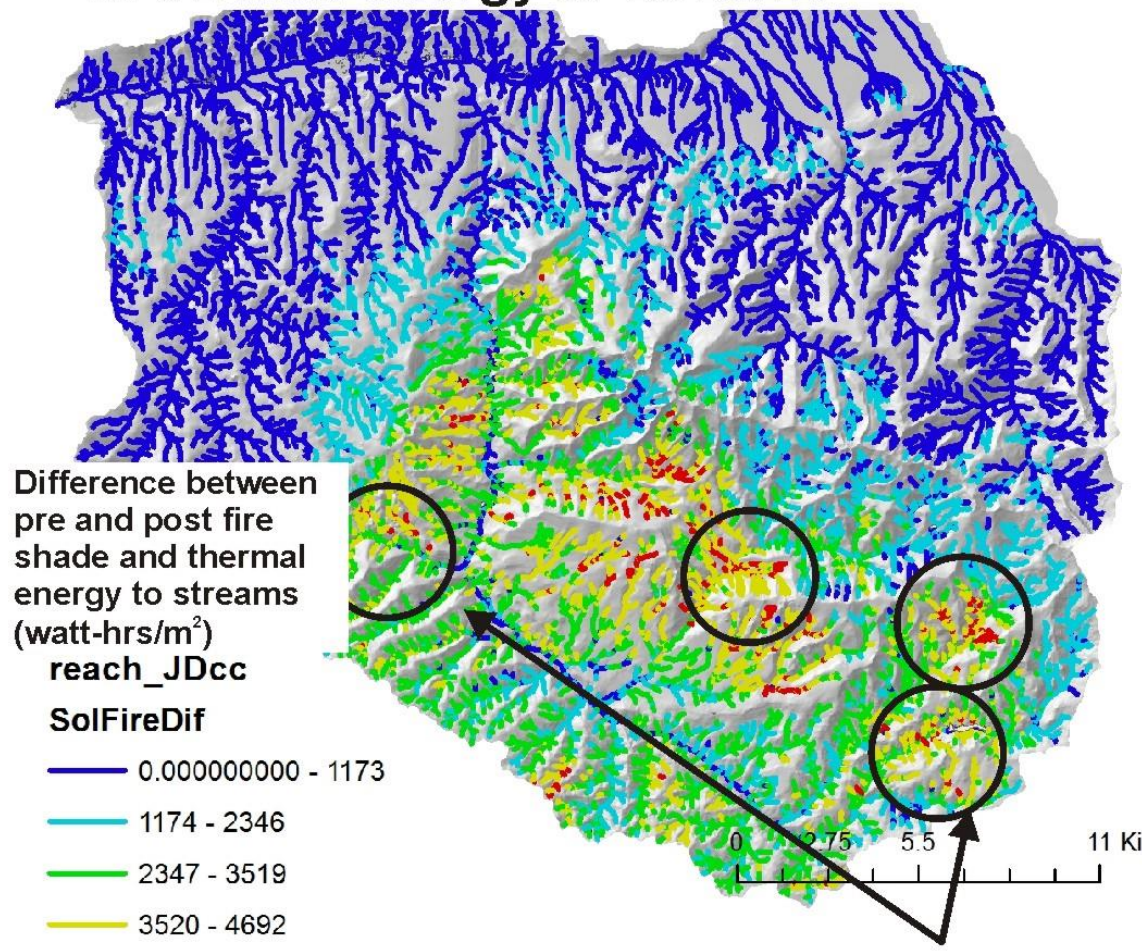
Riparian – Current Shade/Thermal Energy



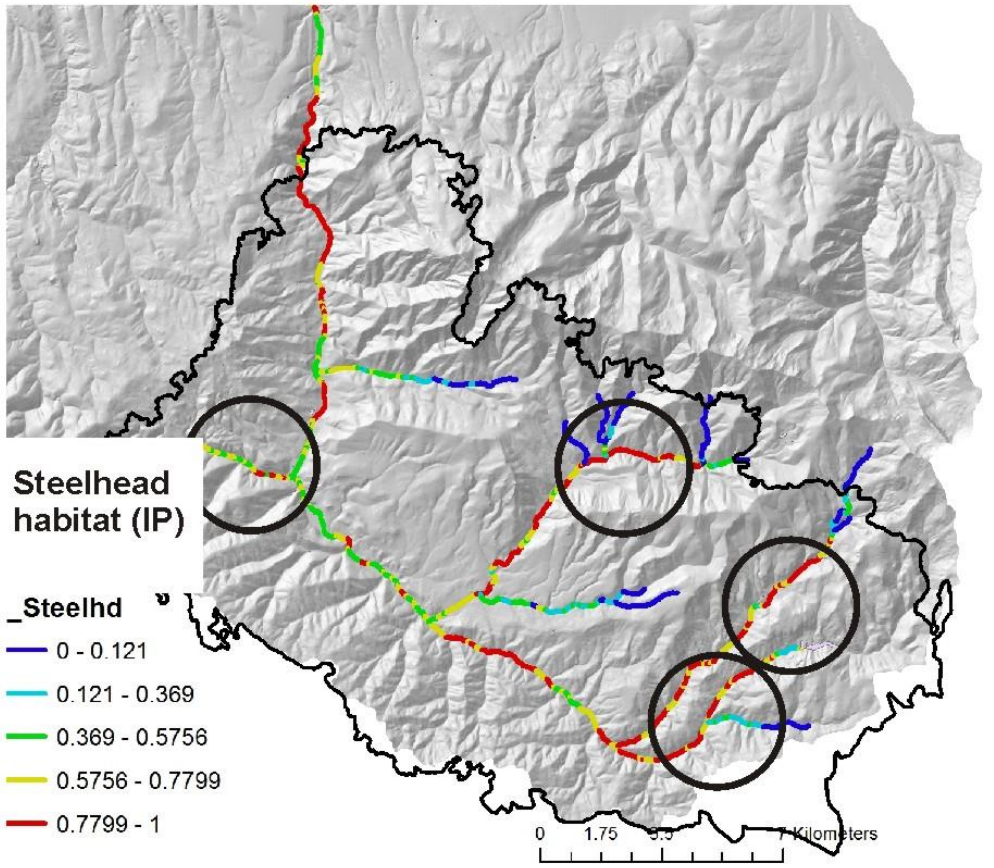


(where fire would have the largest impacts on the thermal regime, including loss of thermal refugia)

Post fire loss of shade and increases in thermal energy to streams



Steelhead habitat (IP)



Largest decreases in post fire shade and increases in thermal energy, overlapping with best steelhead habitat

See more detailed presentation on using NetMap in Pre-Wildfire and Post-Wildfire Environments

Pre Wildfire: http://www.netmaptools.org/Pages/FireFish/NetMap_Fire&Fish.pdf

Post Wildfire: http://www.netmaptools.org/Pages/CanyonCreek_BAER_Netmap.pdf

and more information at TerrainWorks website: http://www.terrainworks.com/

TerrainWorks designs and builds the most advanced watershed and landscape analysis system in the world. Learn more about NetMap virtual watersheds, watershed analysis tools, online technical help and tools at: www.terrainworks.com. Contact us with questions, we are here to help.