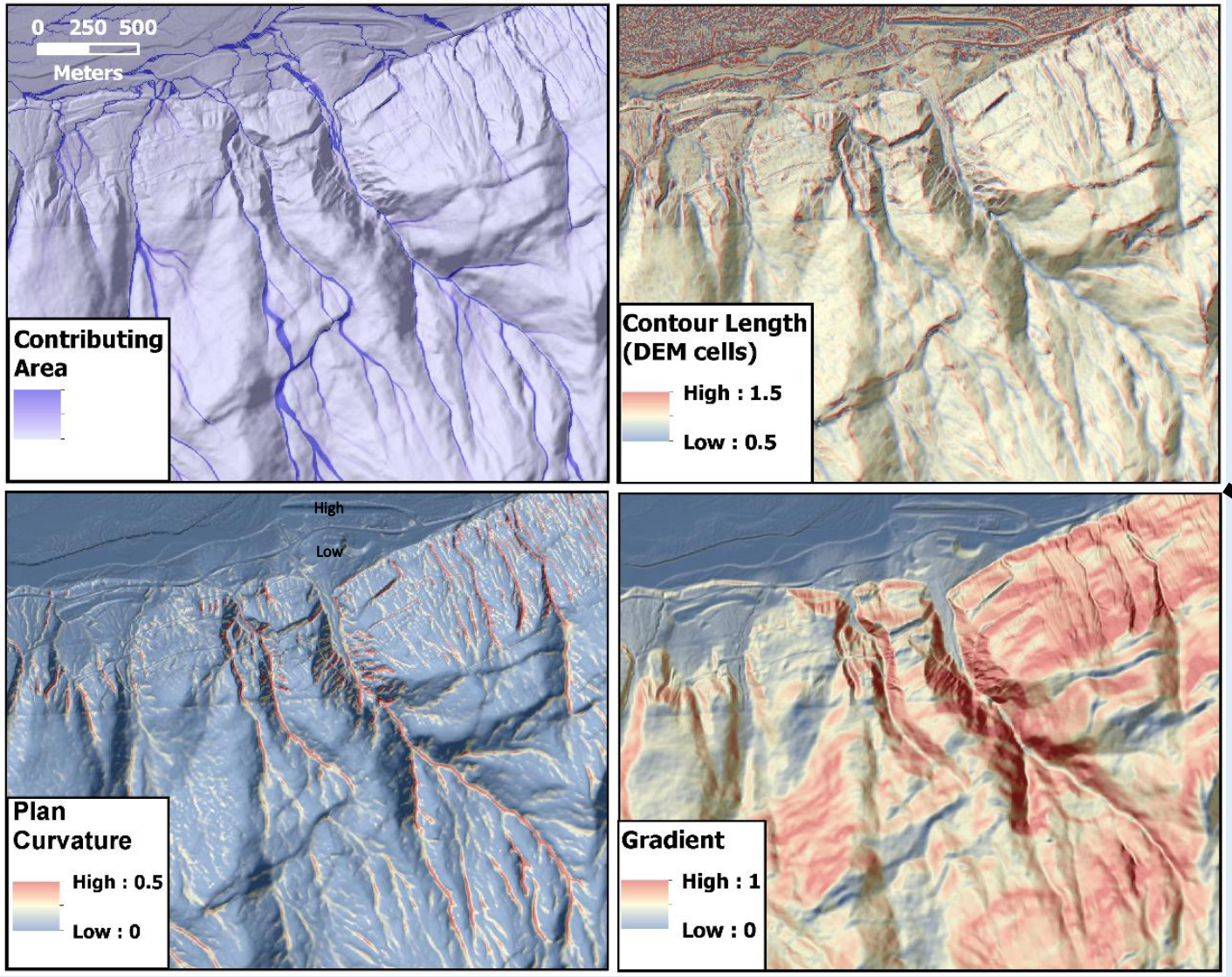
Watershed Restoration: Optimizing Site Selection with a Focus on Agricultural Areas in the Nehalem Watershed, Western OR

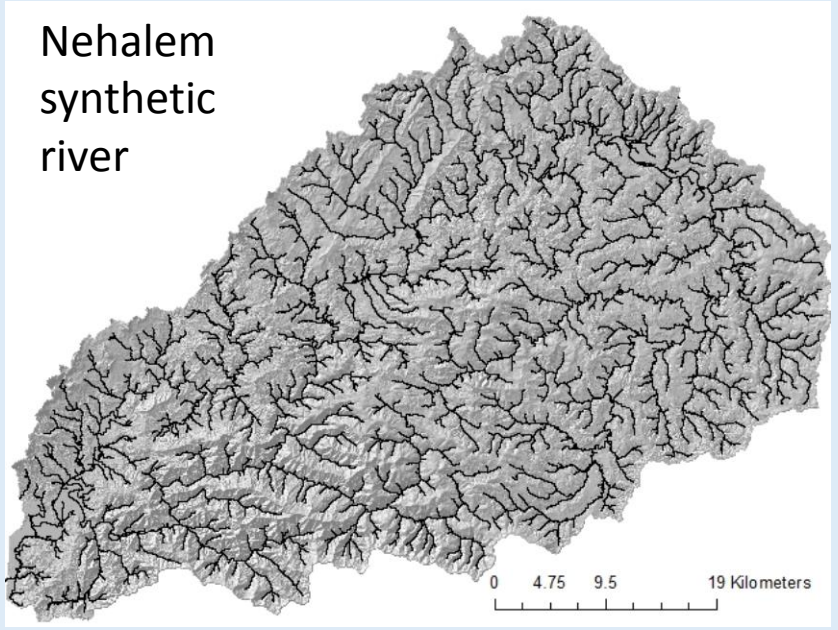
Prepared for:
NOAA, ODFW & Nehalem Watershed Council
by:
TerrainWorks (NetMap)/www.terrainworks.com
February 2014

This short Powerpoint shows the part of the Nehalem-NetMap analysis that applies to identifying restoration sites on agricultural lands

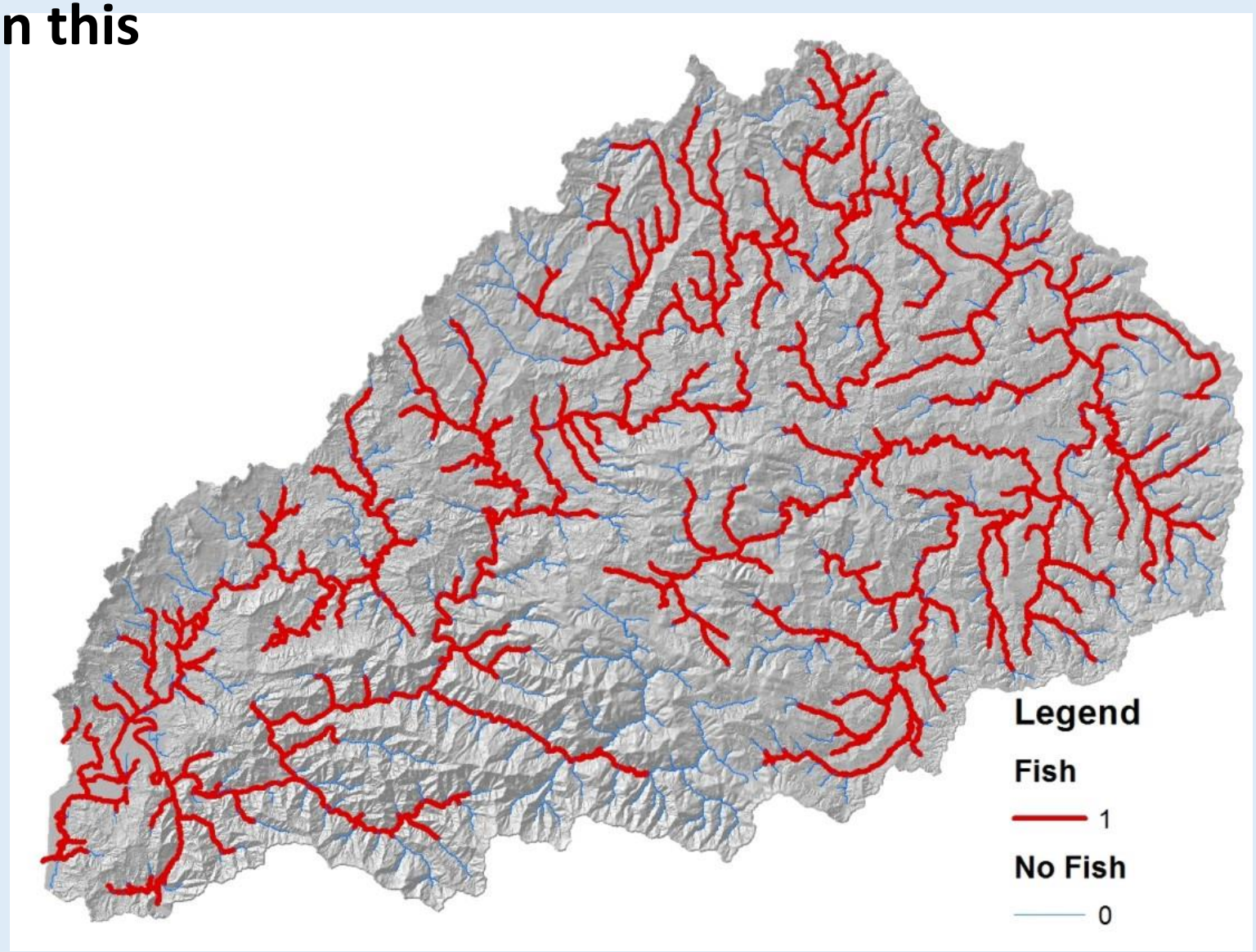
Other aspects of the analysis not shown here cover forest lands forest roads, and slope stability

First, we build a synthetic river network (stream layer) directly from LiDAR DEMs



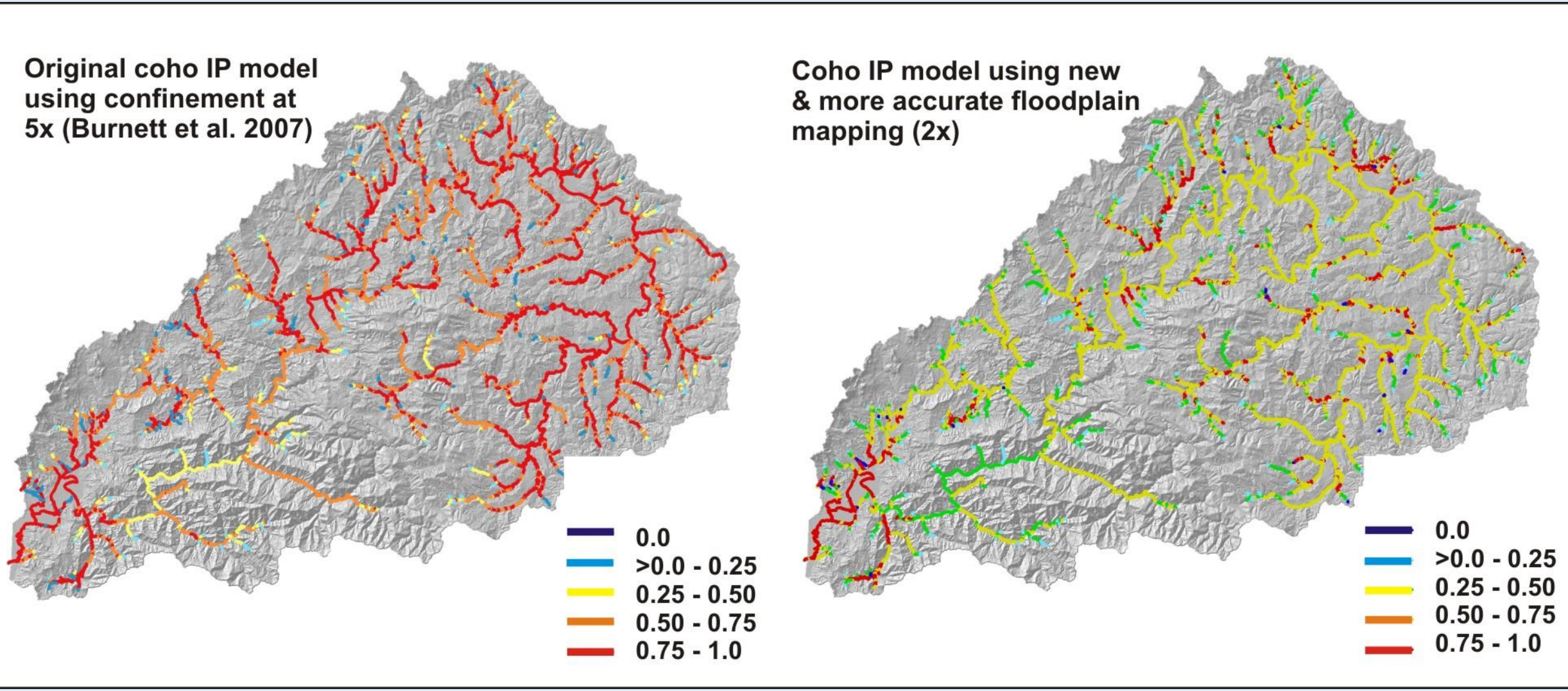


Next we predict abundance and quality of fish habitat, in this case for coho salmon

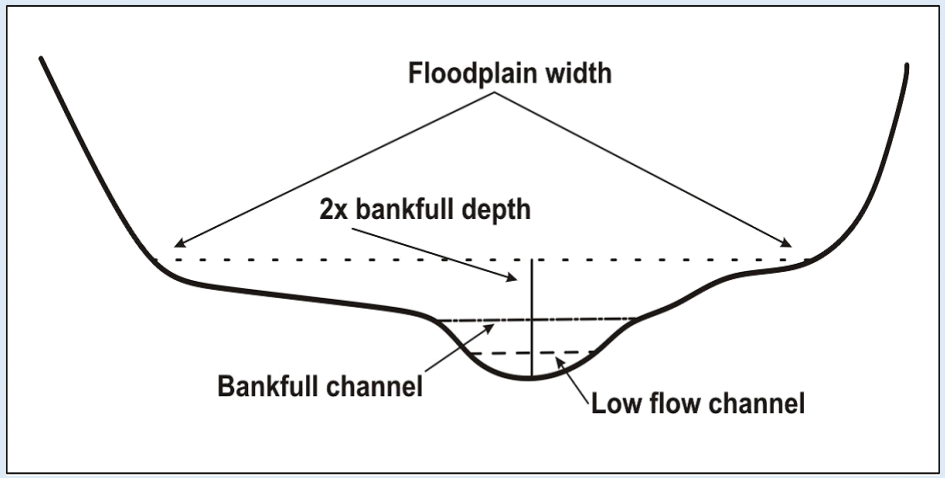


Coho Intrinsic Potential (e.g., intrinsic landscape position)

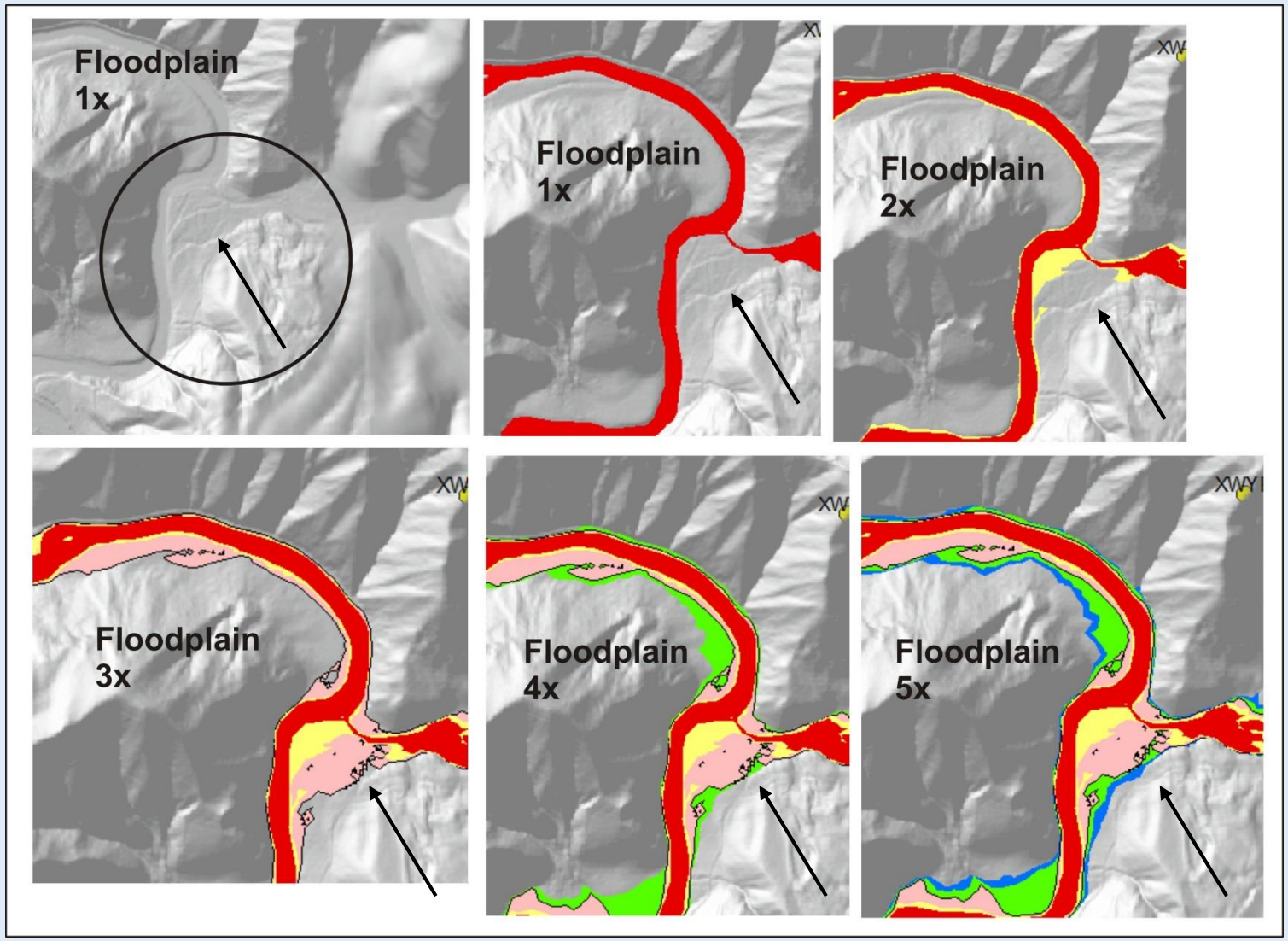
-gradient, confinement; mean annual flow; (Burnett et al. 2007)



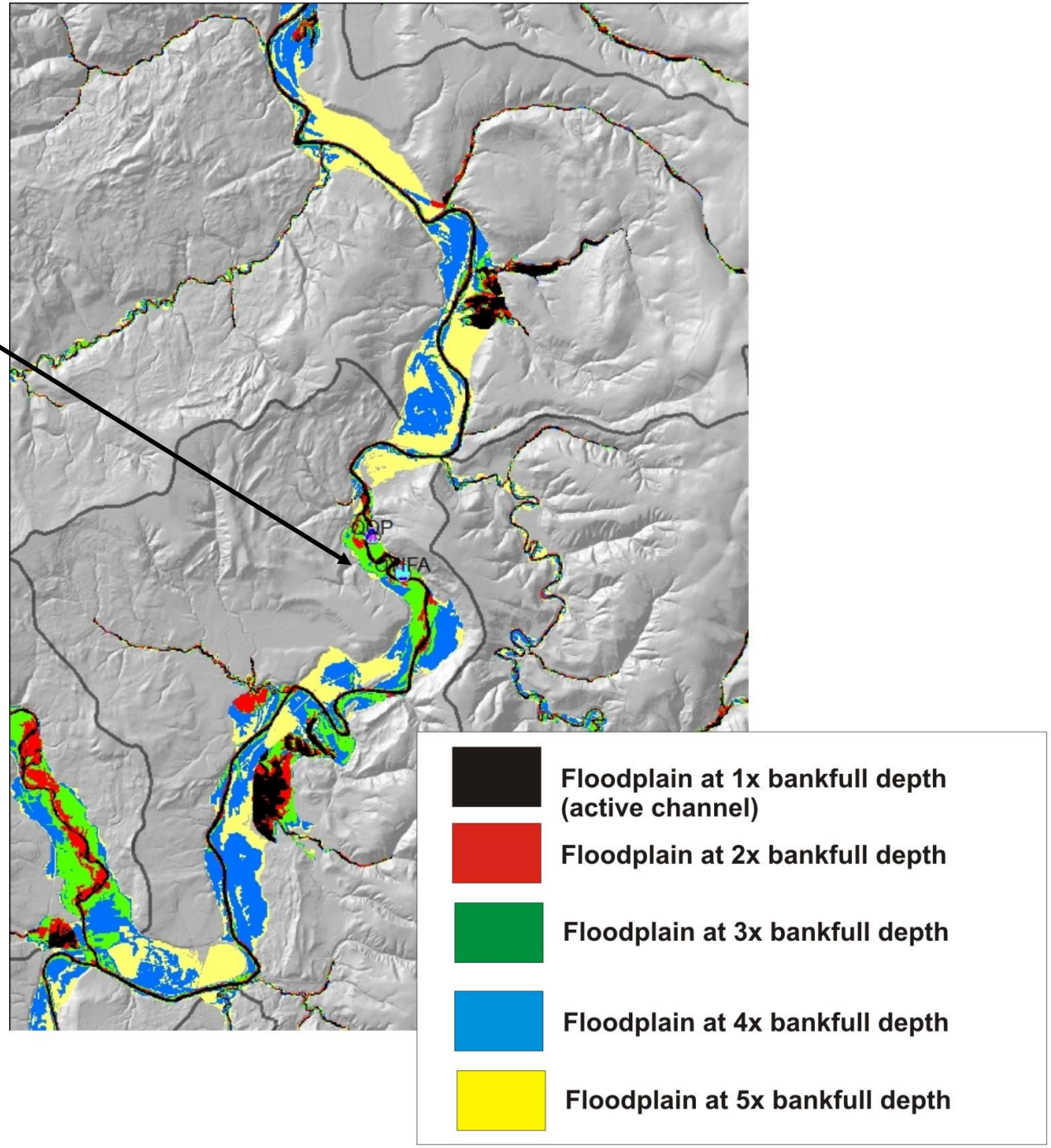
Next, we map floodplains of varying height and flood magnitude above the channel

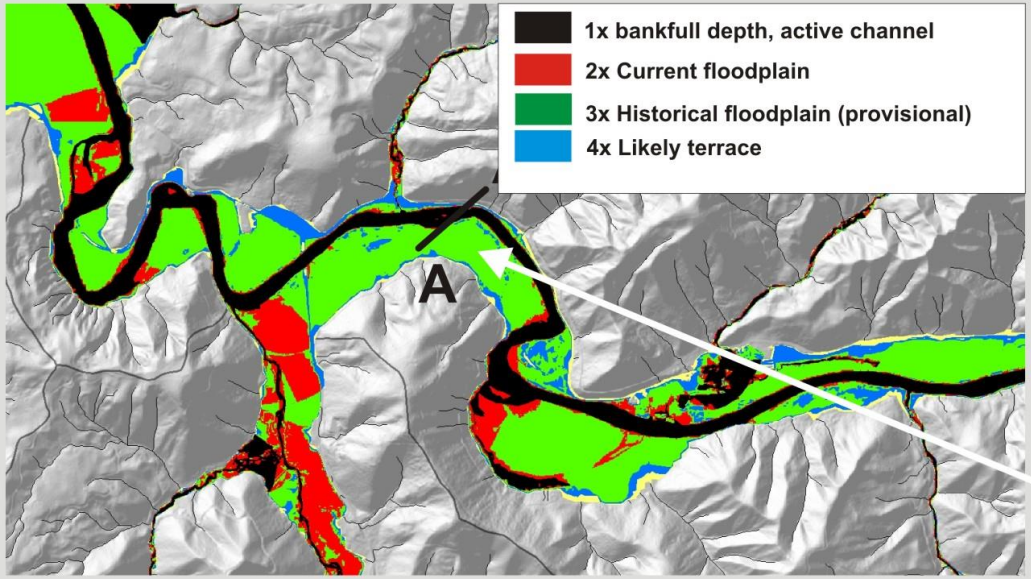


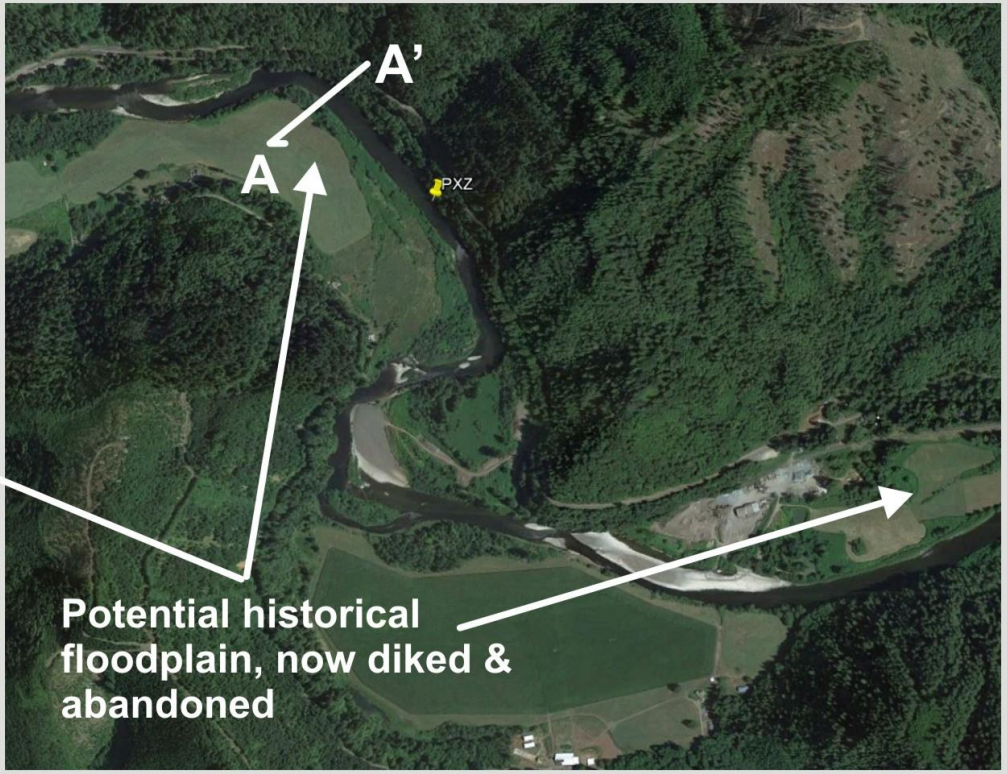
NetMap's floodplain mapping tool

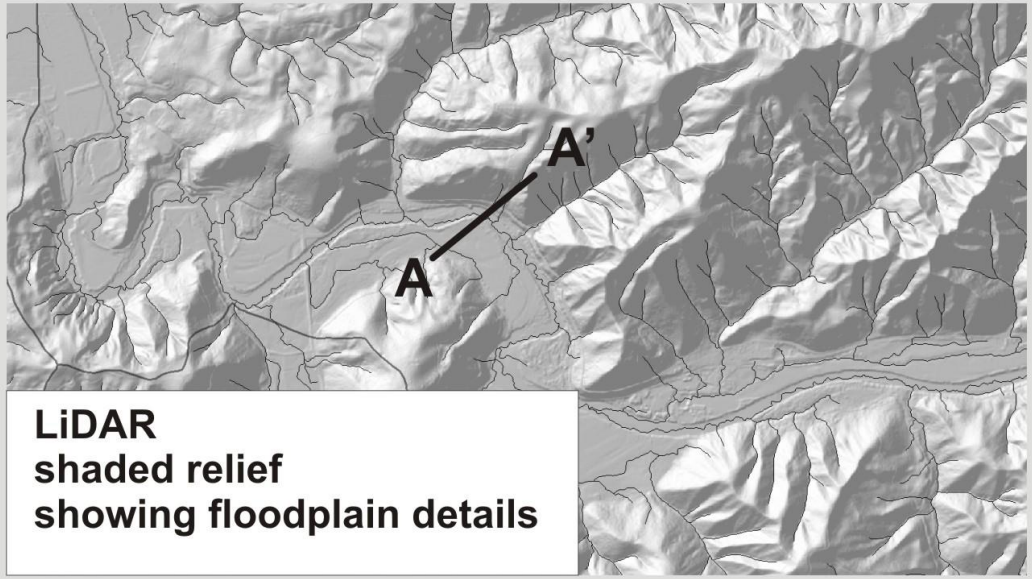


Potentially historical active floodplains, channel now incised

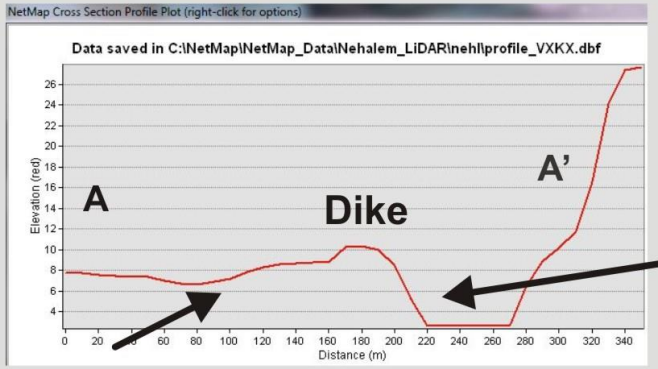






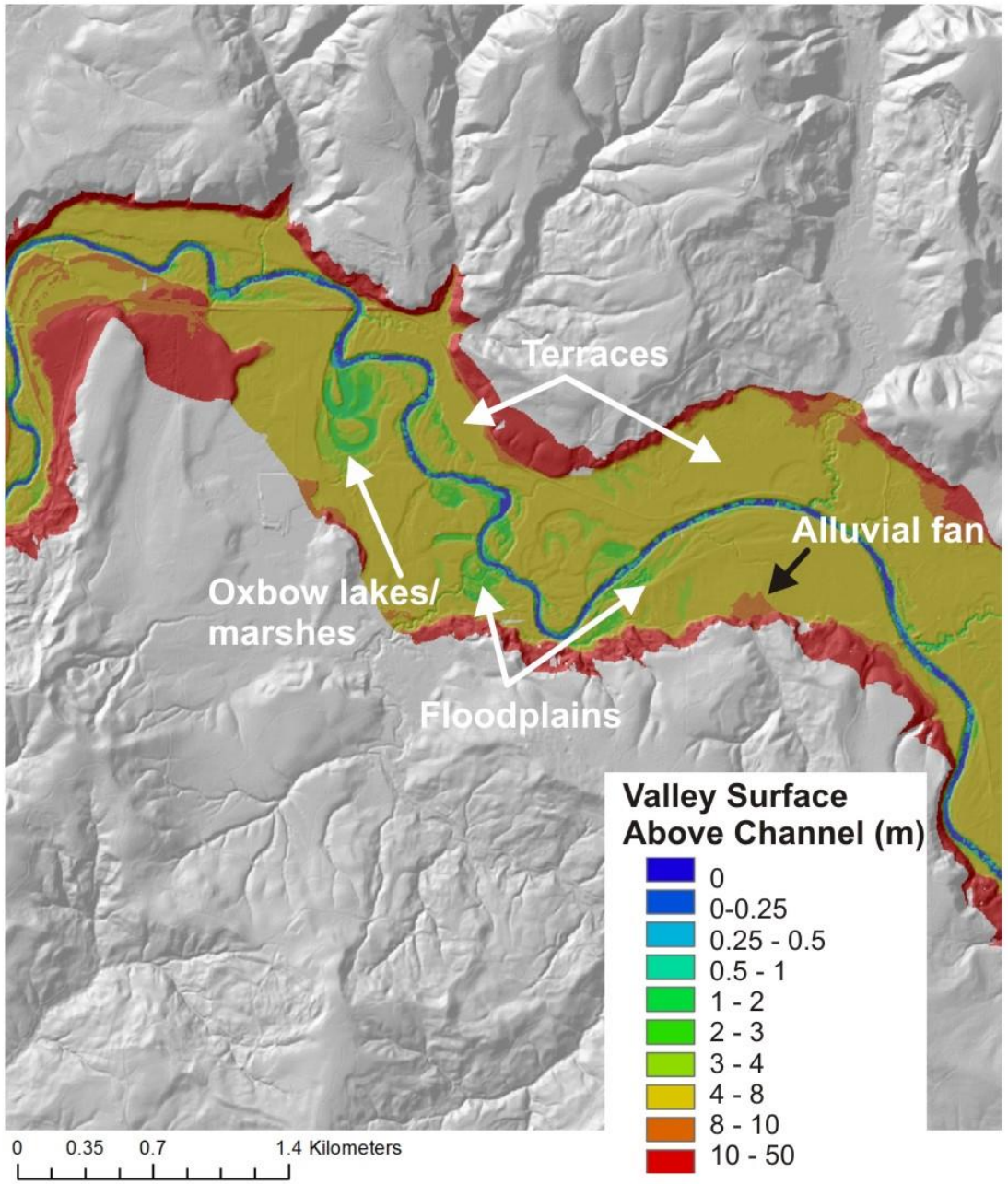


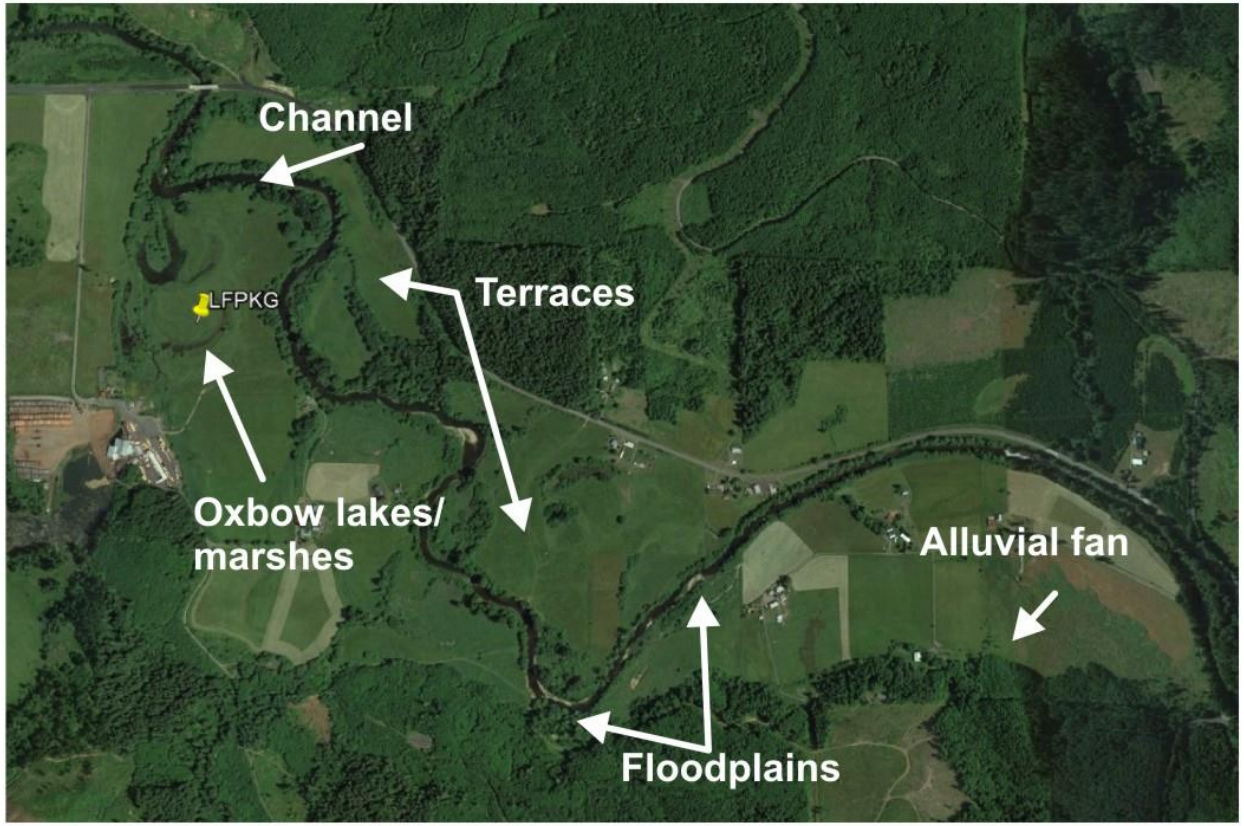
LiDAR
shaded relief
showing floodplain details



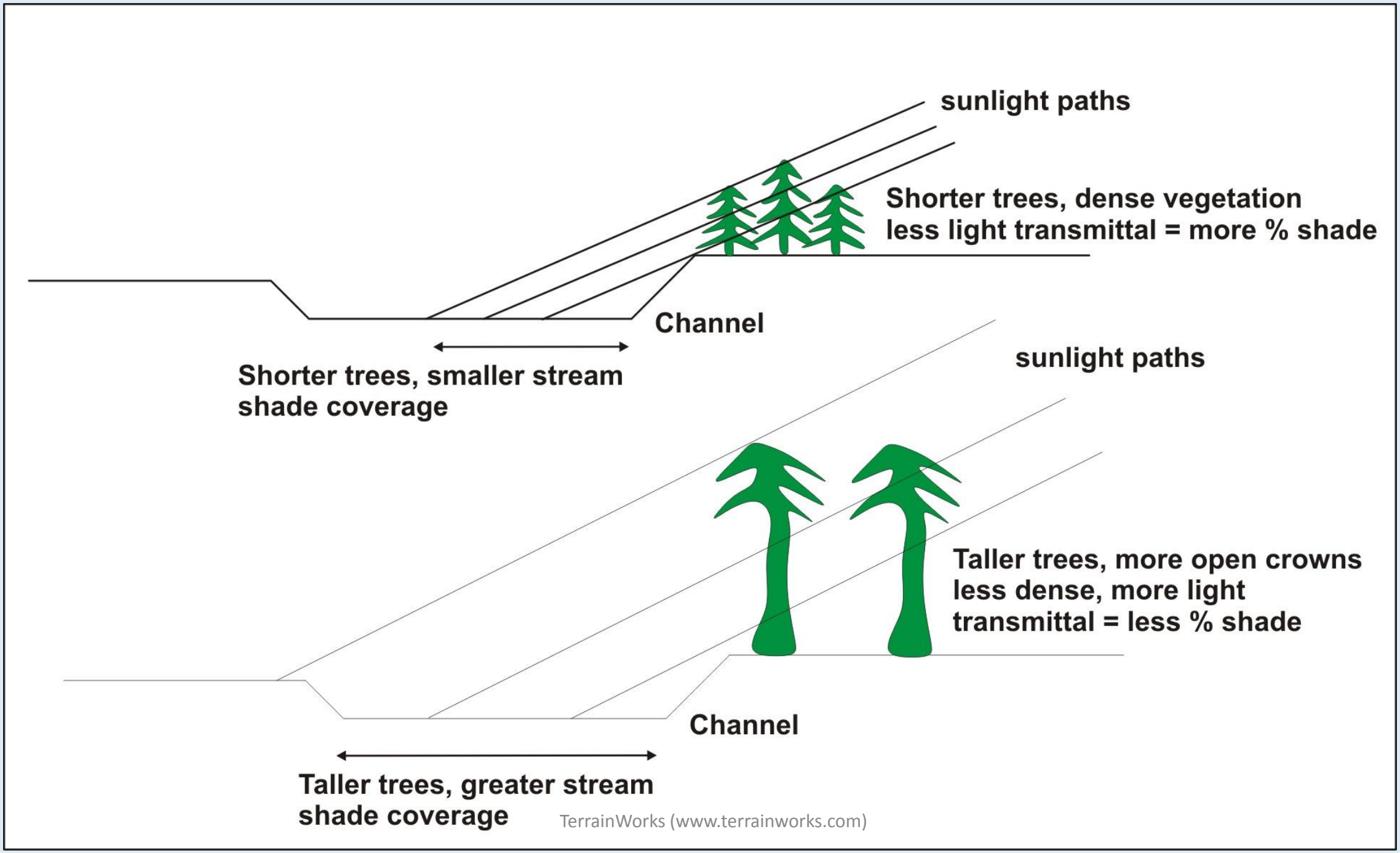
Active channel

Historical floodplain


Terraces
Alluvial fan
Oxbow lakes/
marshes
Floodplains
Valley Surface
Above Channel (m)
0
0-0.25
0.25 - 0.5
0.5 - 1
1 - 2
2 - 3
3 - 4
4 - 8
8 - 10
10 - 50
0 0.35 0.7 1.4 Kilometers

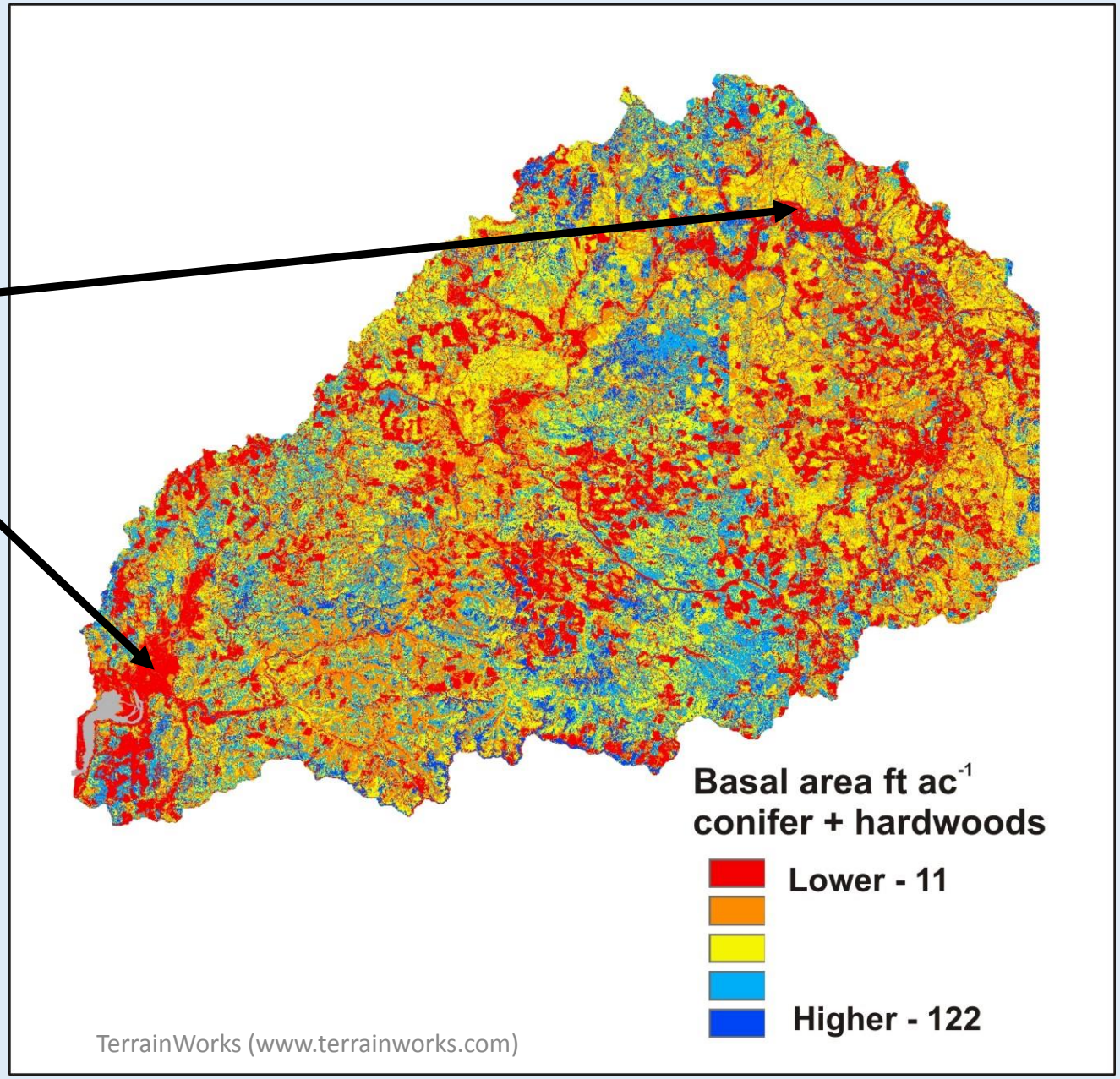

Channel
LFPKG
Terraces
Oxbow lakes/
marshes
Alluvial fan
Floodplains

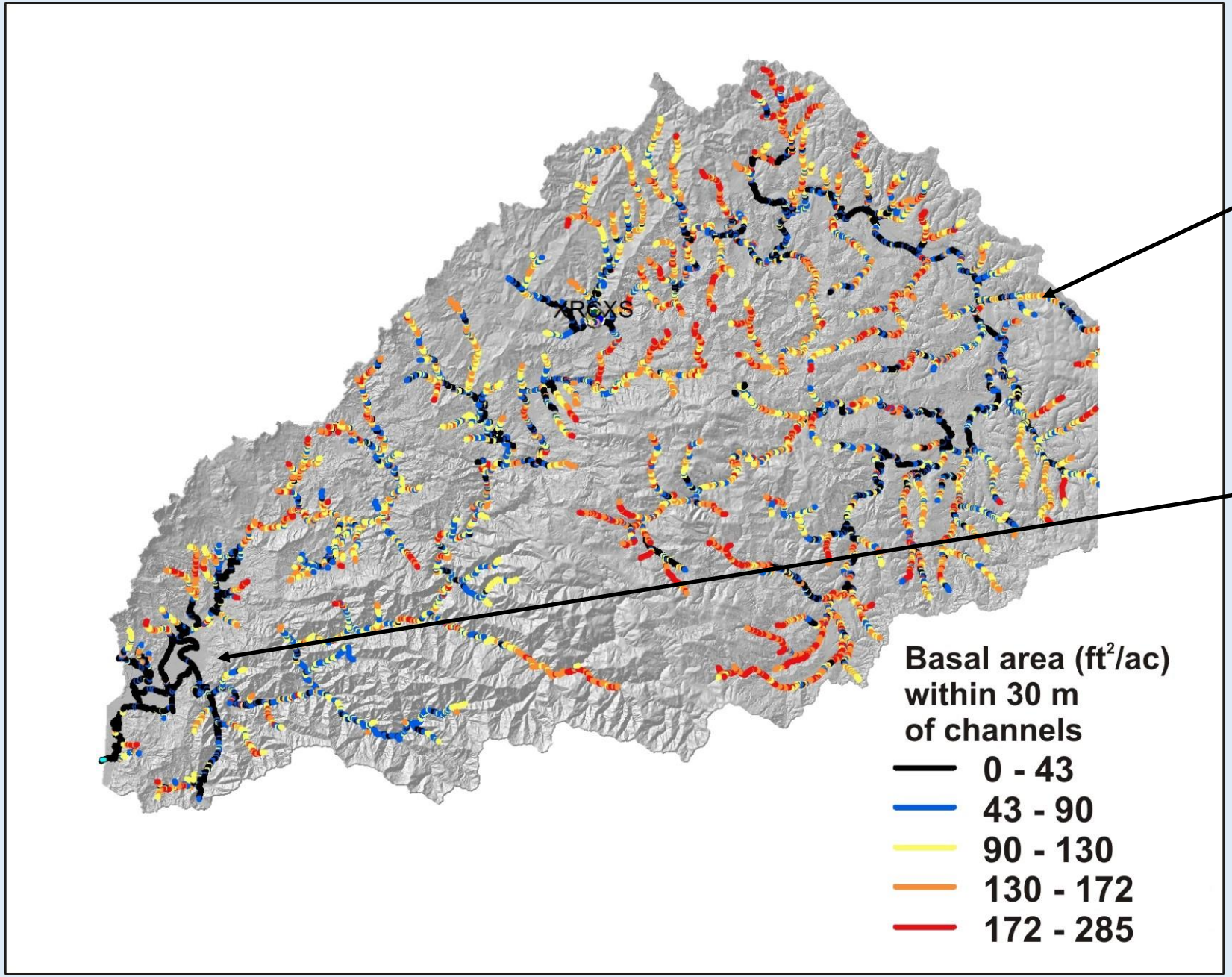
Then, we calculate current shade and thermal loading conditions along all streams in the Nehalem watershed and determine where additional shade is needed most, particularly in context with valuable fish habitats



Basal Area (conifers & hardwoods), 30 m each side of channel – represented in stream channels

Smaller amounts of vegetation commonly are found along streams in valley floors, in agricultural areas.



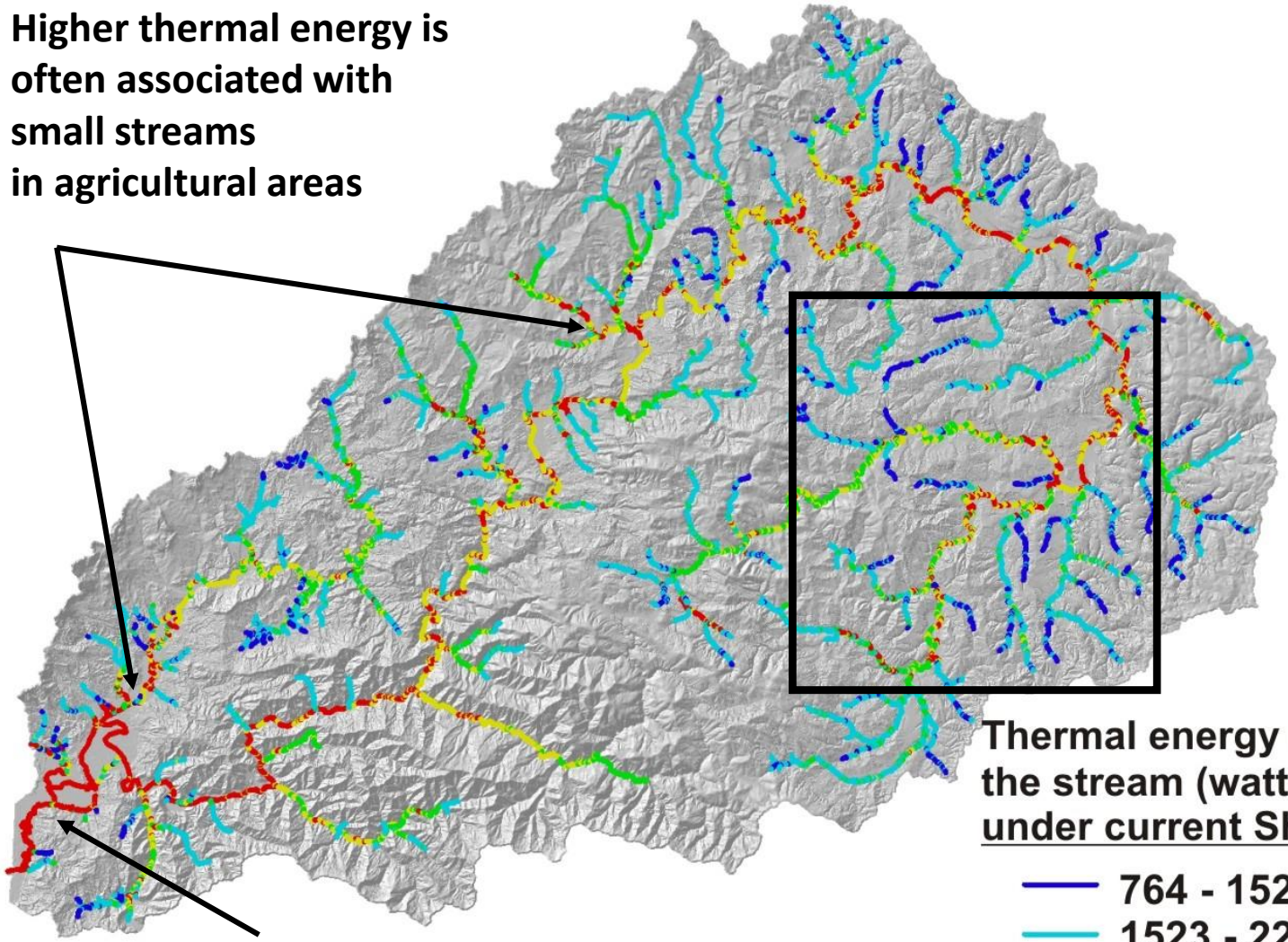


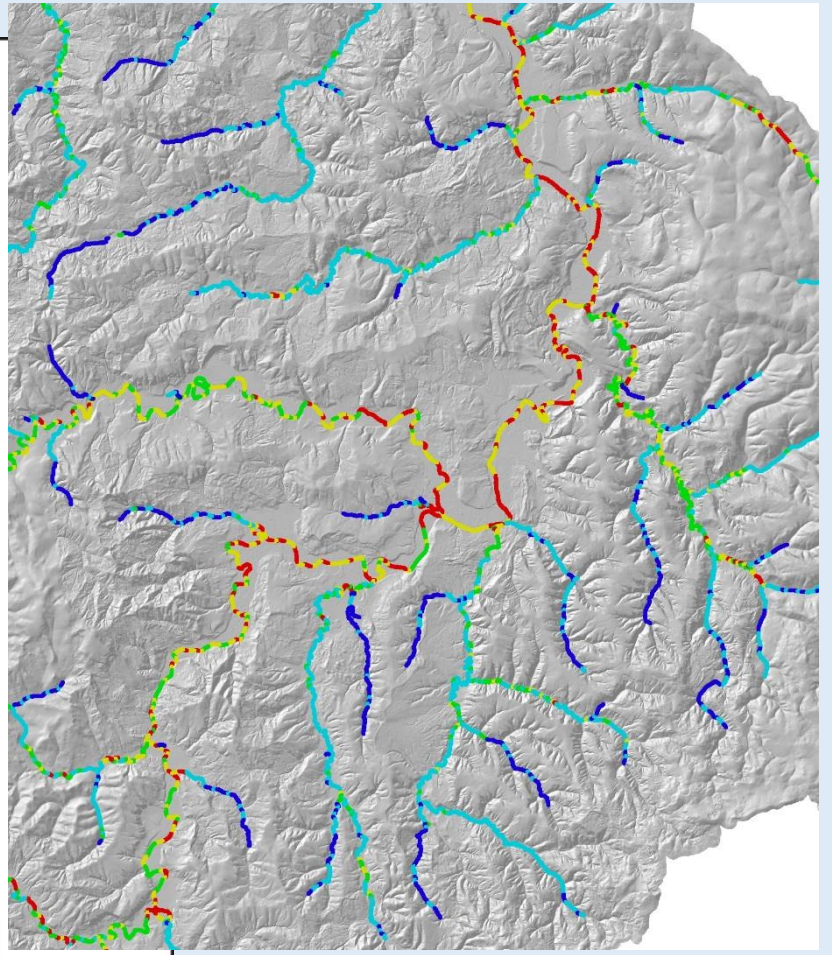
Many areas along mainstem fish bearing reaches have low shade.

Many small tributaries in agricultural areas also have low shade

TerrainWorks (www.terrainworks.com)

Higher thermal energy is often associated with small streams in agricultural areas

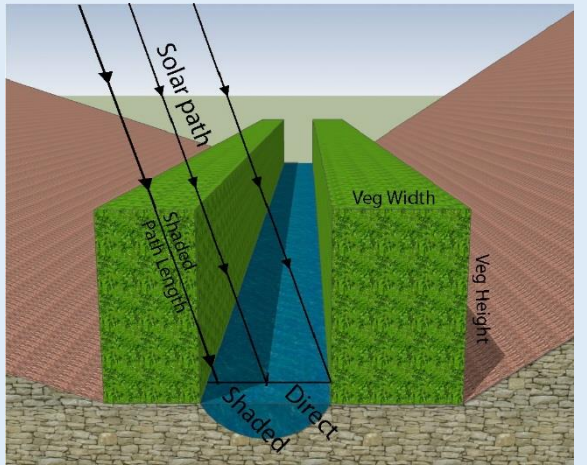


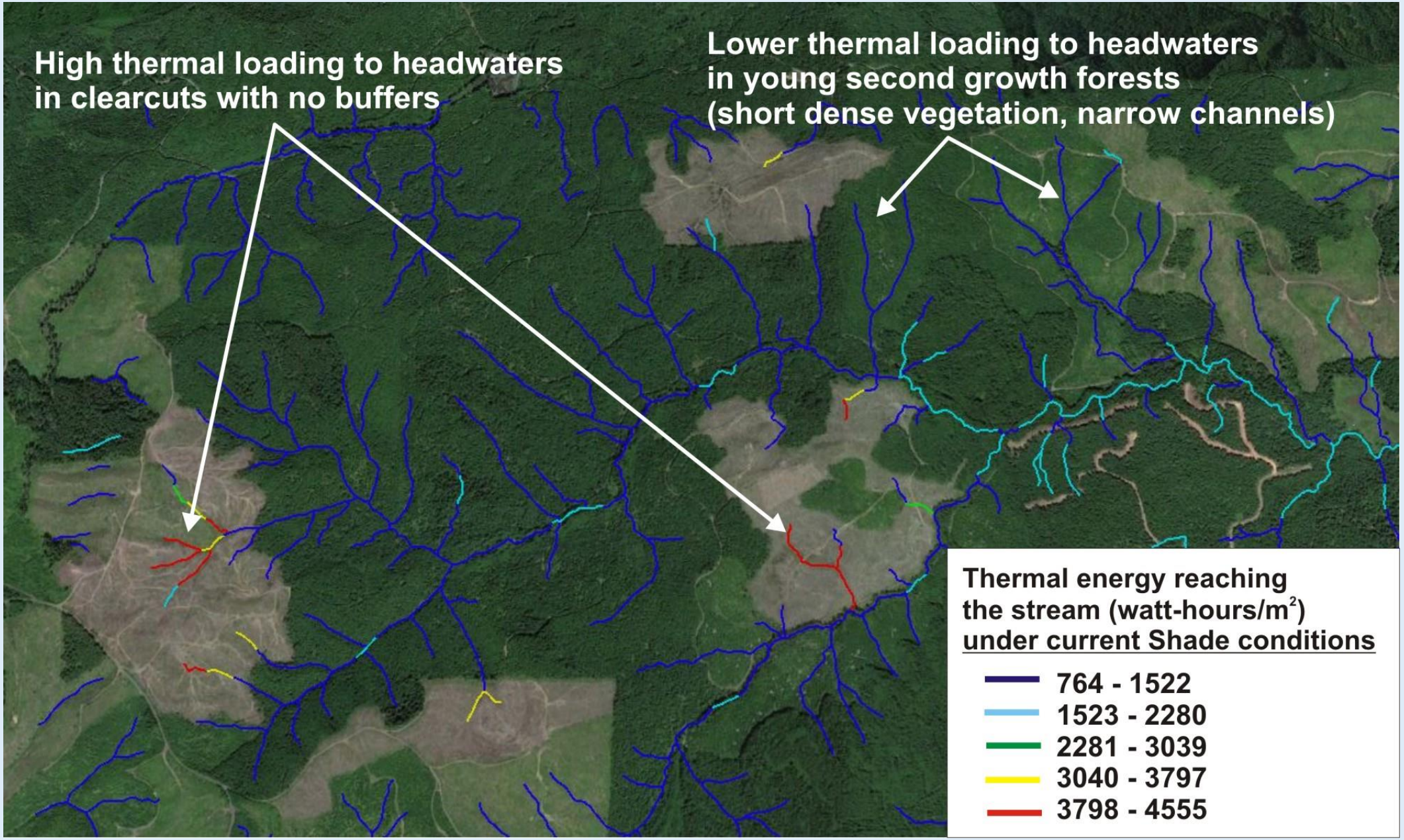


Thermal energy reaching the stream (watt-hours/m^2) under current Shade conditions

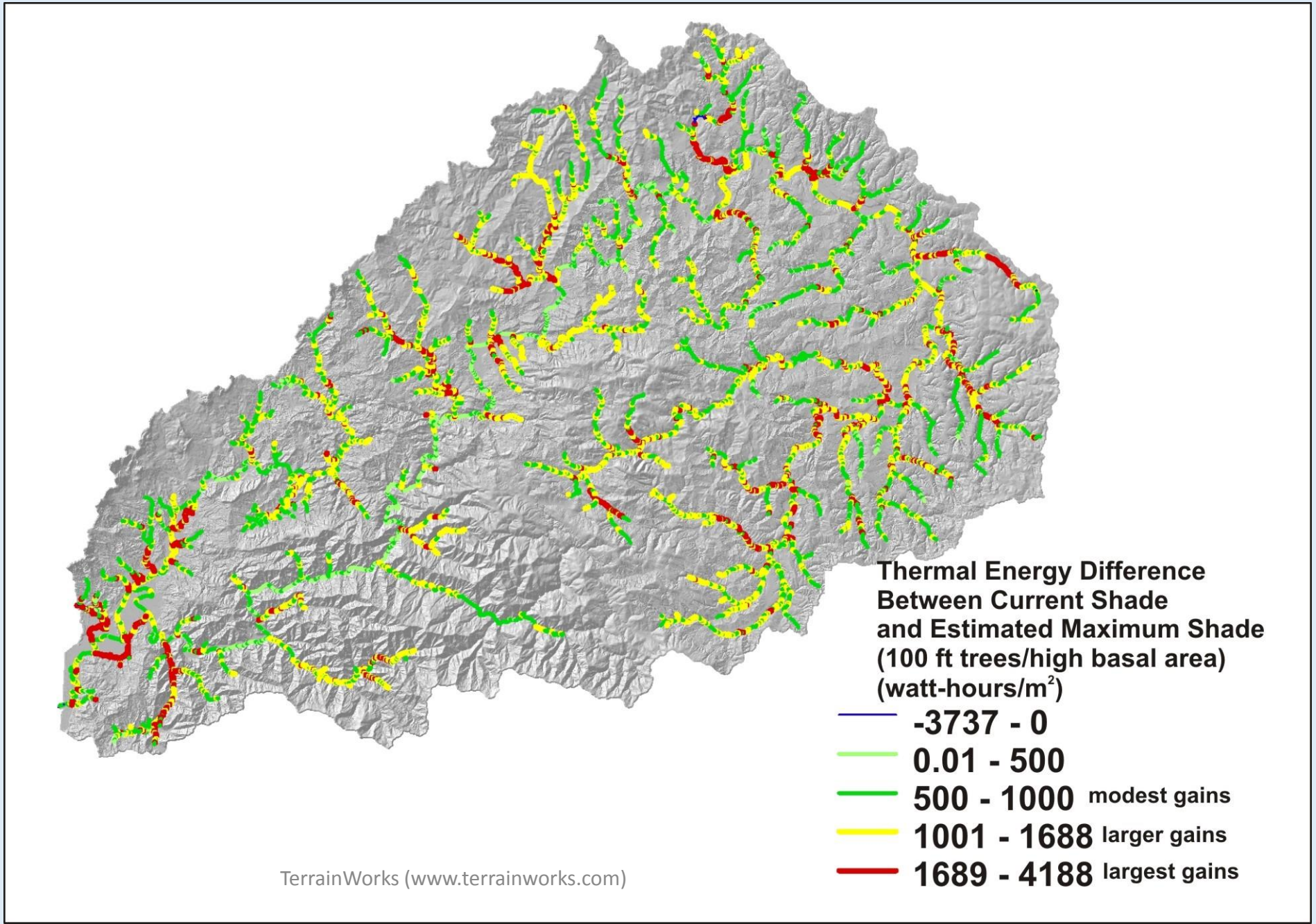
- 764 - 1522
- 1523 - 2280
- 2281 - 3039
- 3040 - 3797
- 3798 - 4555

Higher thermal along wide mainstem rivers is mostly natural and hence additional shade would have minimal effects

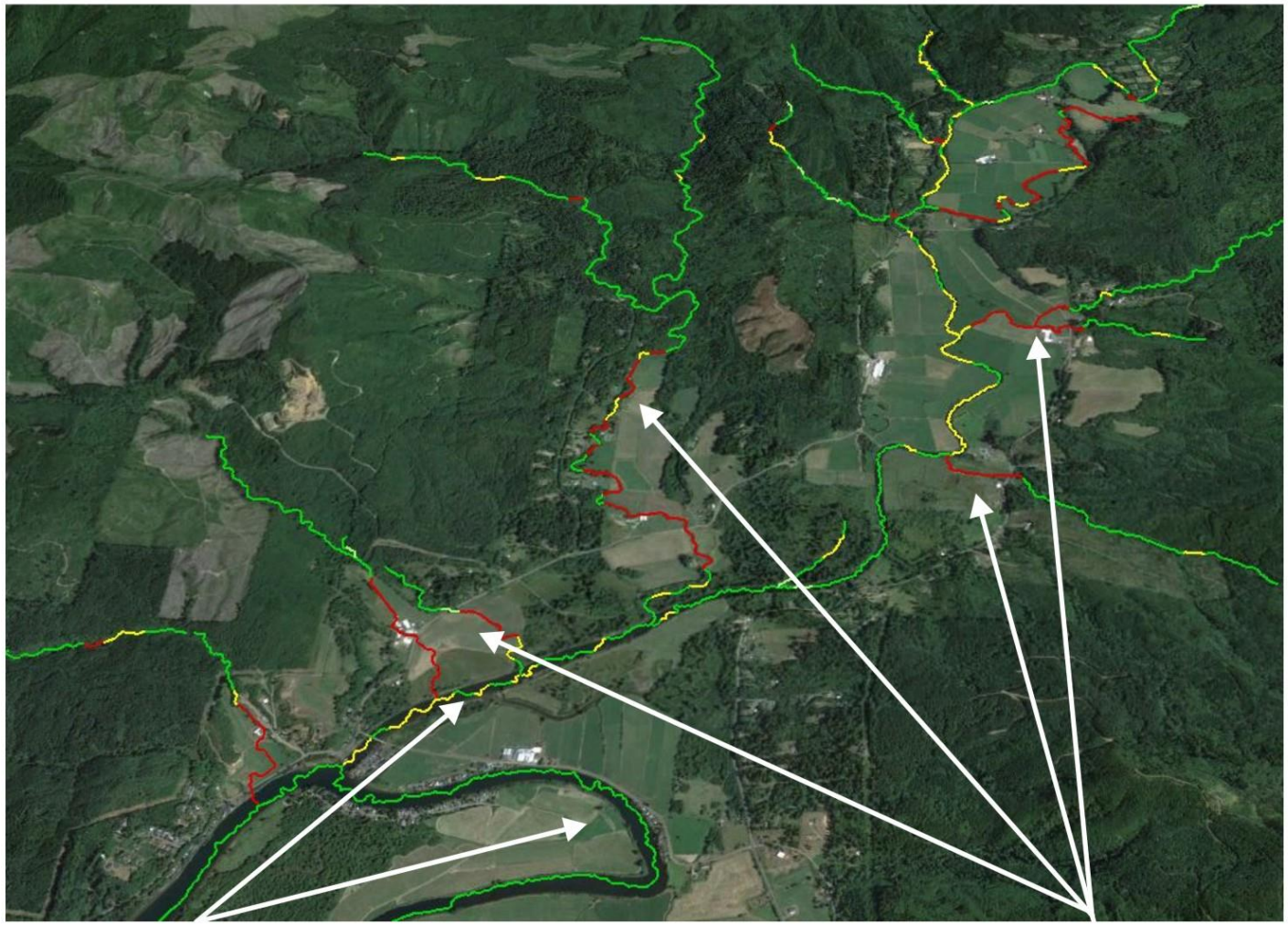



High thermal loading to headwaters
in clearcuts with no buffers
Lower thermal loading to headwaters
in young second growth forests
(short dense vegetation, narrow channels)
Thermal energy reaching
the stream (watt-hours/m²)
under current Shade conditions
764 - 1522
1523 - 2280
2281 - 3039
3040 - 3797
3798 - 4555

Where is increased shade needed most?



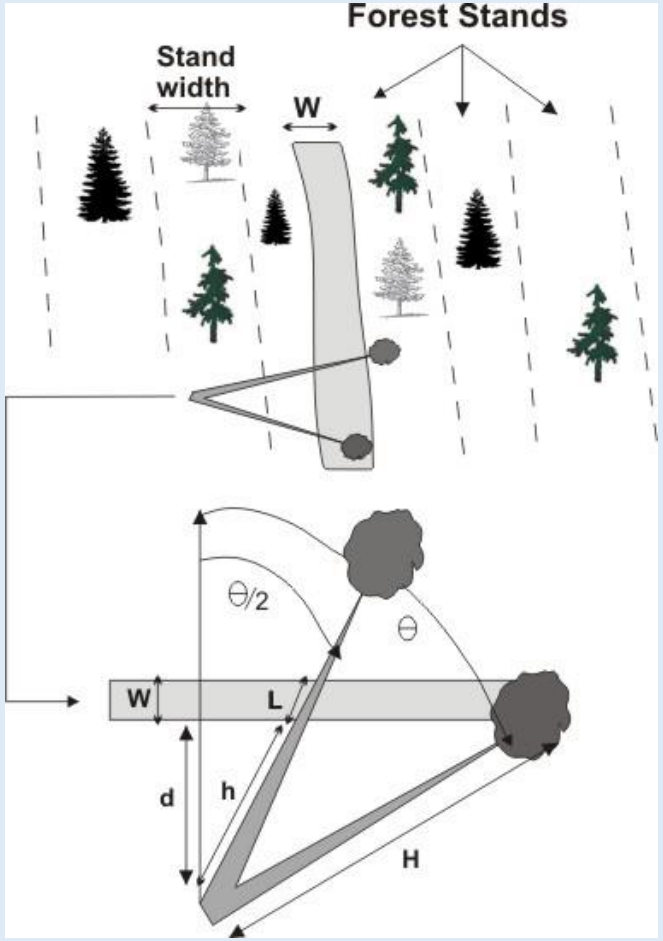
Red and yellow areas are those that could benefit from increased shade (reduced thermal energy to channels)



Shading and thus thermal energy in larger rivers cannot be significantly impacted by increasing shade, except very locally

Smaller channels in areas of no shade would have the greatest benefit and most of these overlap with high quality coho habitat potential (e.g., high IP scores)

We also calculate in-stream wood recruitment potential along all streams

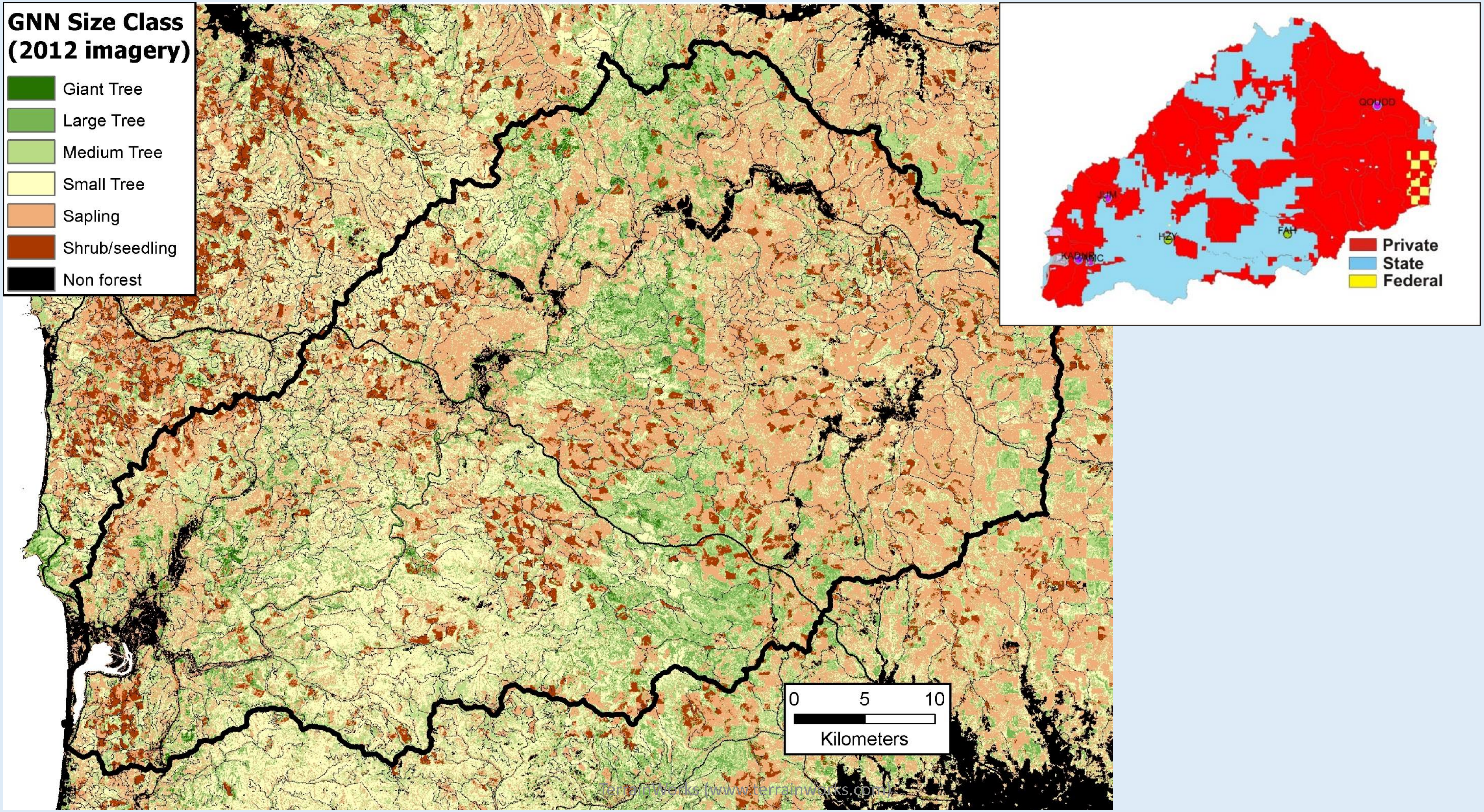


NetMap's in-stream wood model

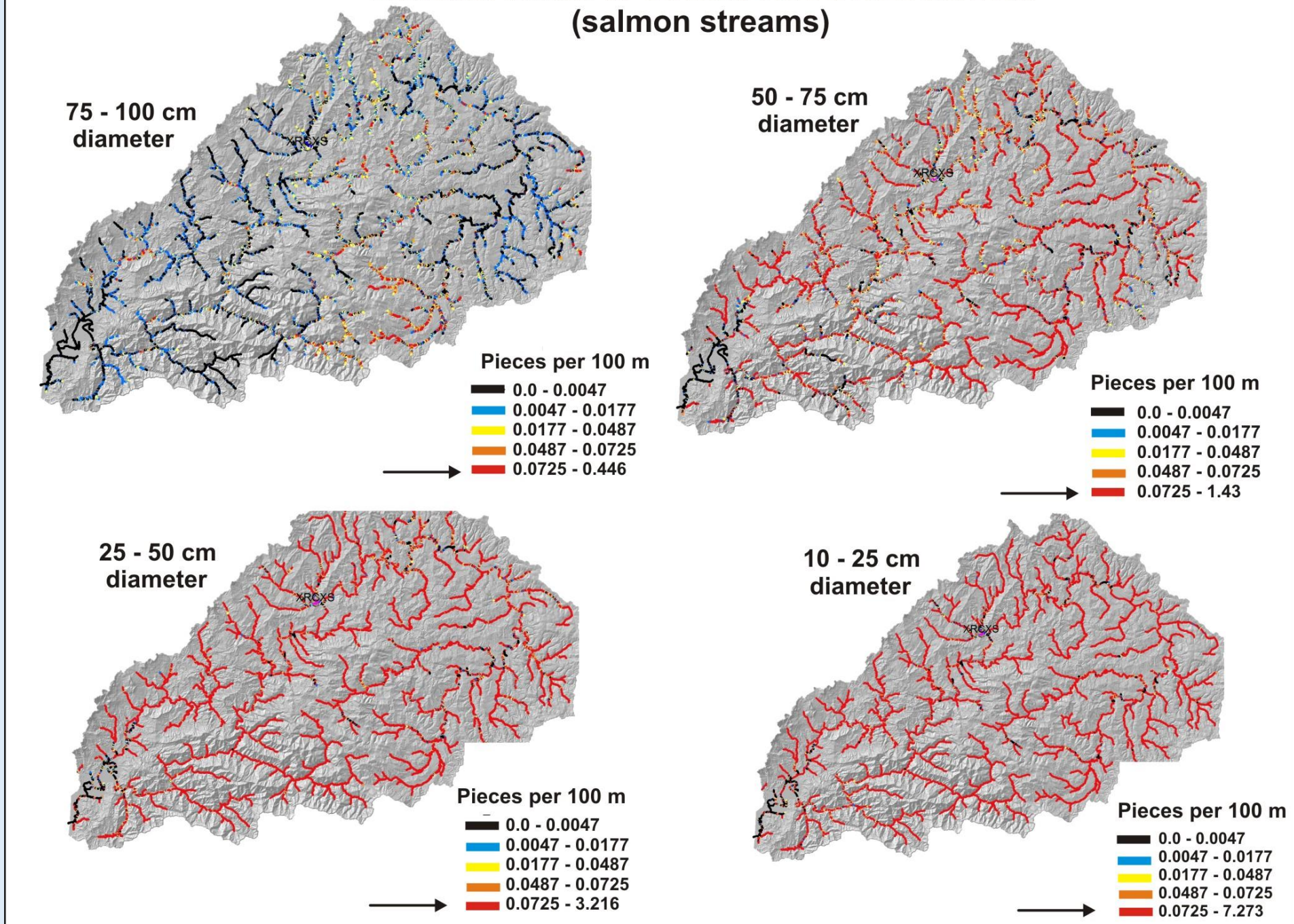
Use digital data on vegetation characteristics

⊟ ⊟	SIZECL	none	CATEGORICAL	Size class, based on QMD_DOM and CANCOV, modified slightly from O'Neil et al. (2001)

Code Value	Description
1	Shrub/seedling (QMD_DOM < 2.5 or CANCOV < 10)
2	Sapling/pole (QMD_DOM >= 2.5 and < 25.0)
3	Small tree (QMD_DOM >= 25.0 and < 37.5)
4	Medium tree (QMD_DOM >= 37.5 and < 50.0)
5	Large tree (QMD_DOM >= 50.0 and < 75)
6	Giant tree (QMD_DOM >= 75.0)

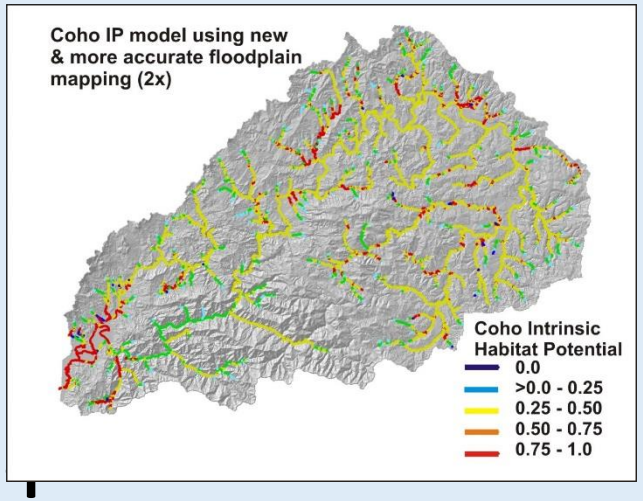

GNN Size Class
(2012 imagery)
Giant Tree
Large Tree
Medium Tree
Small Tree
Sapling
Shrub/seedling
Non forest
0 5 10
Kilometers
Private
State
Federal

Current Annual In-Stream Wood Recruitment (salmon streams)



Decision Space: Spatially Explicit Maps

Coho fish habitat quality



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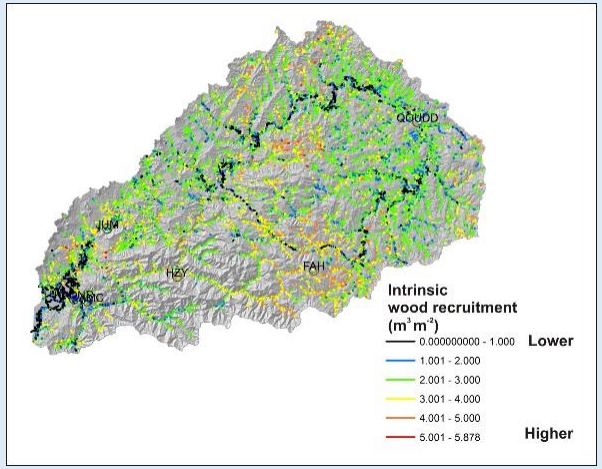
Current wood recruitment



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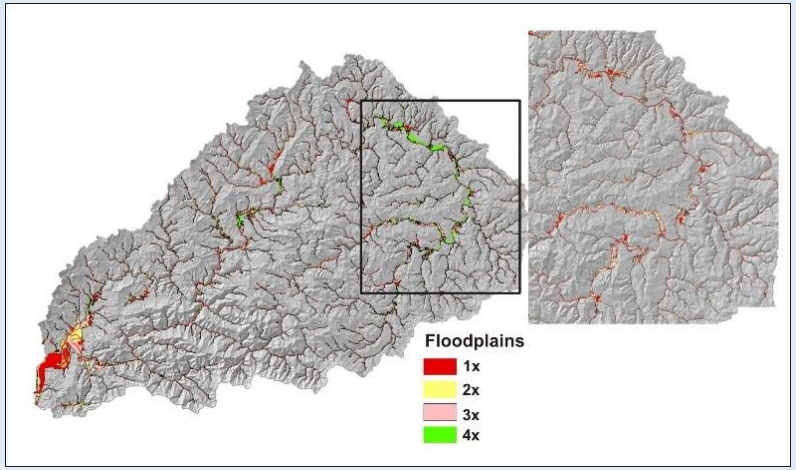
Floodplains



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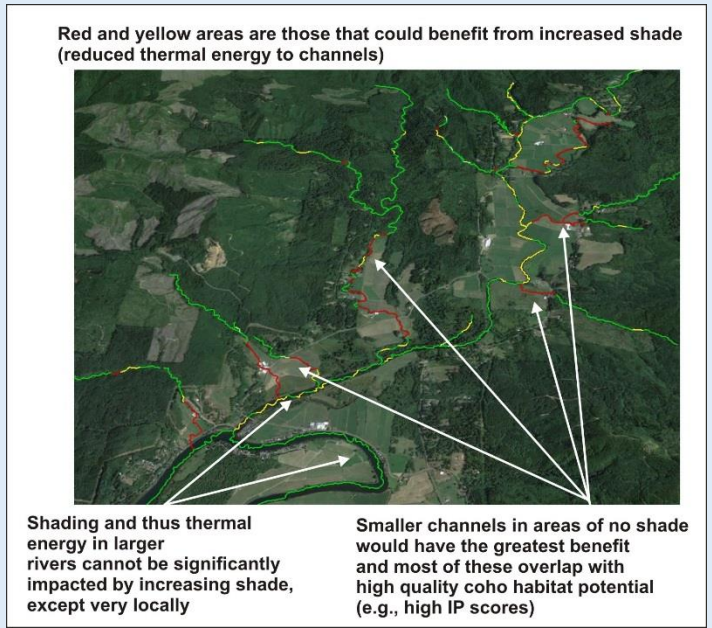
Shade – basal area/thermal loading



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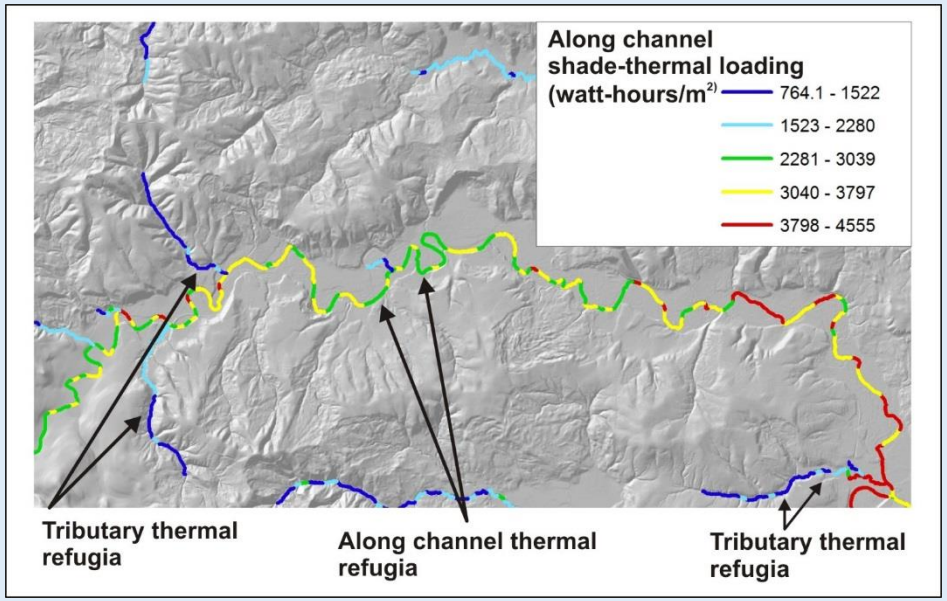
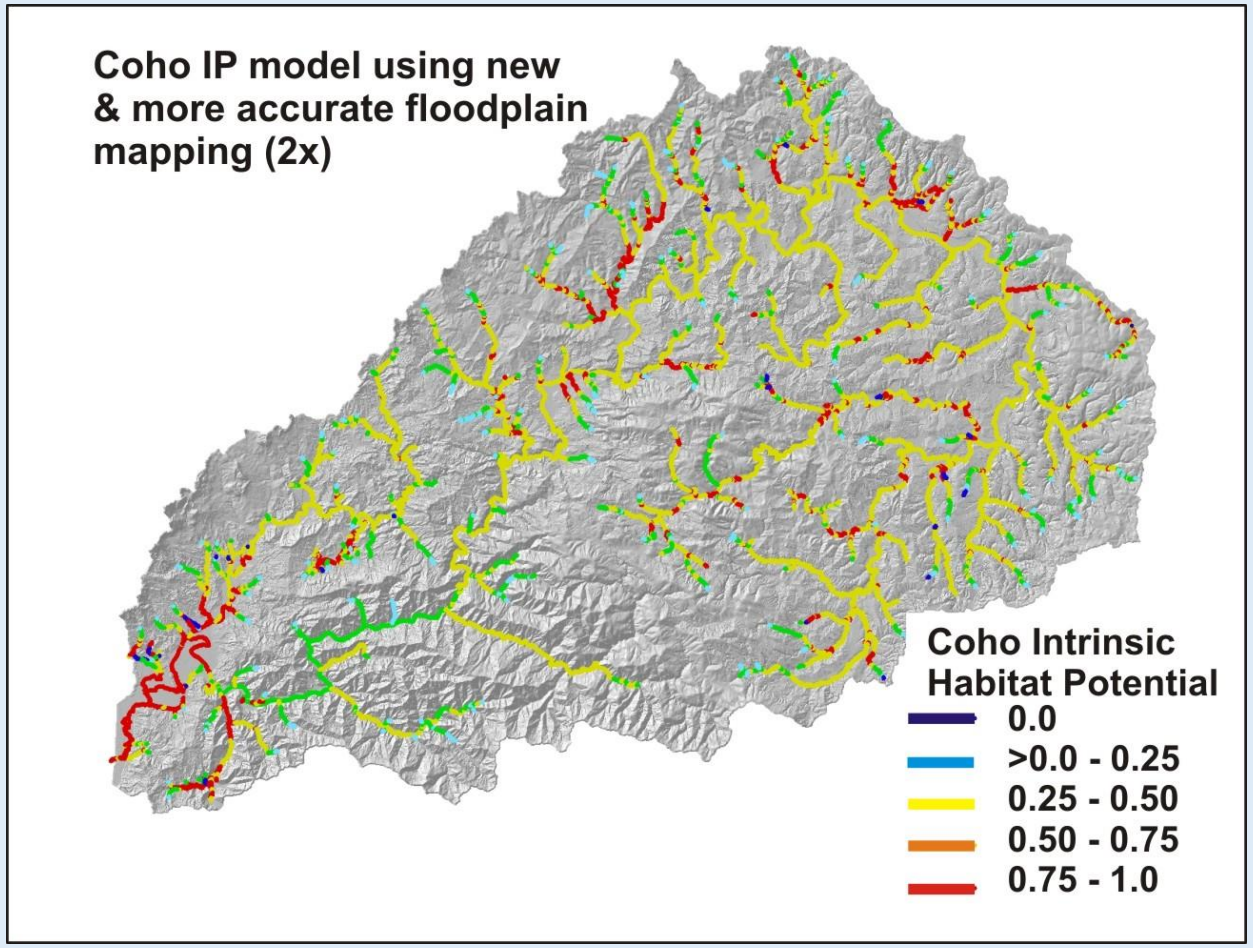
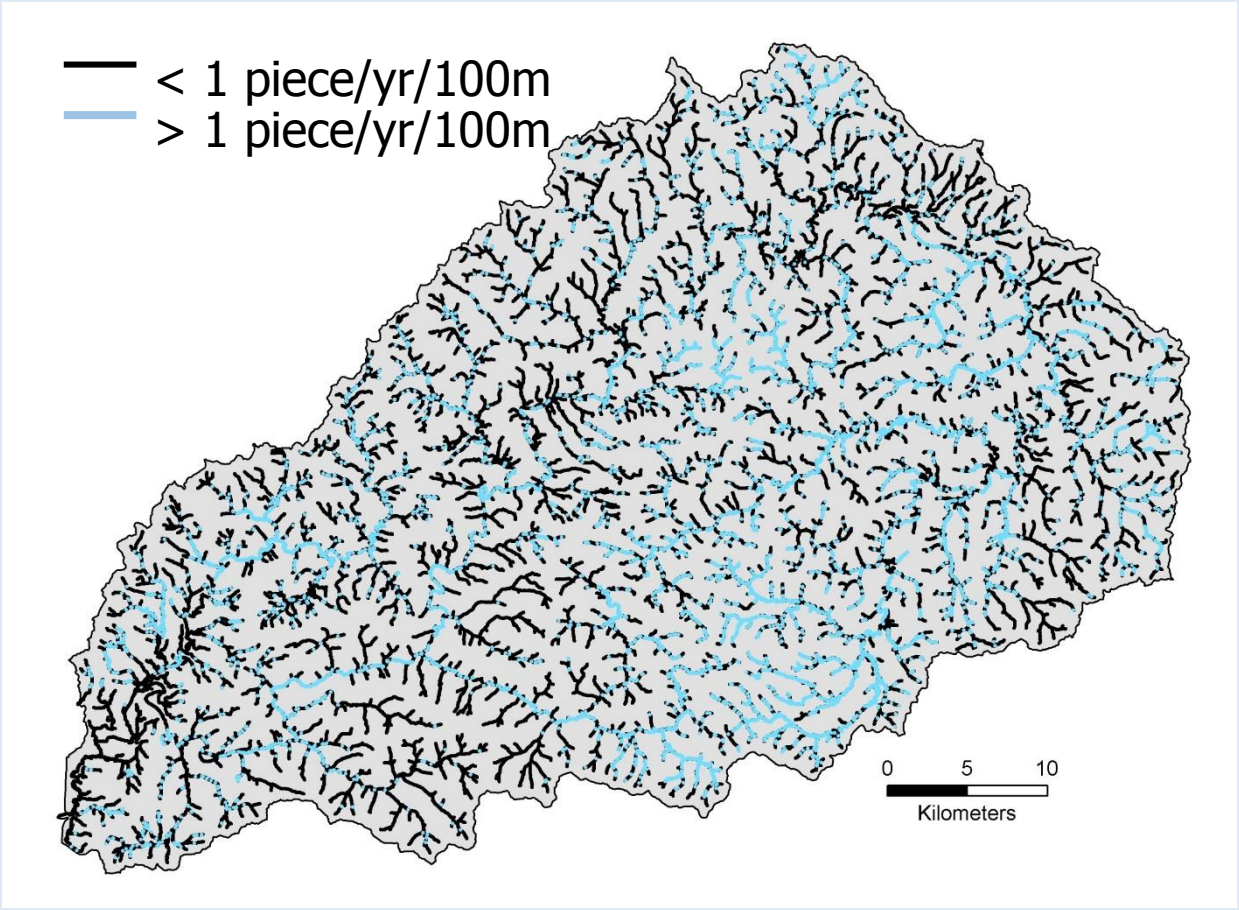
Thermal Refugia



Combine coho intrinsic potential + wood recruitment (visual)



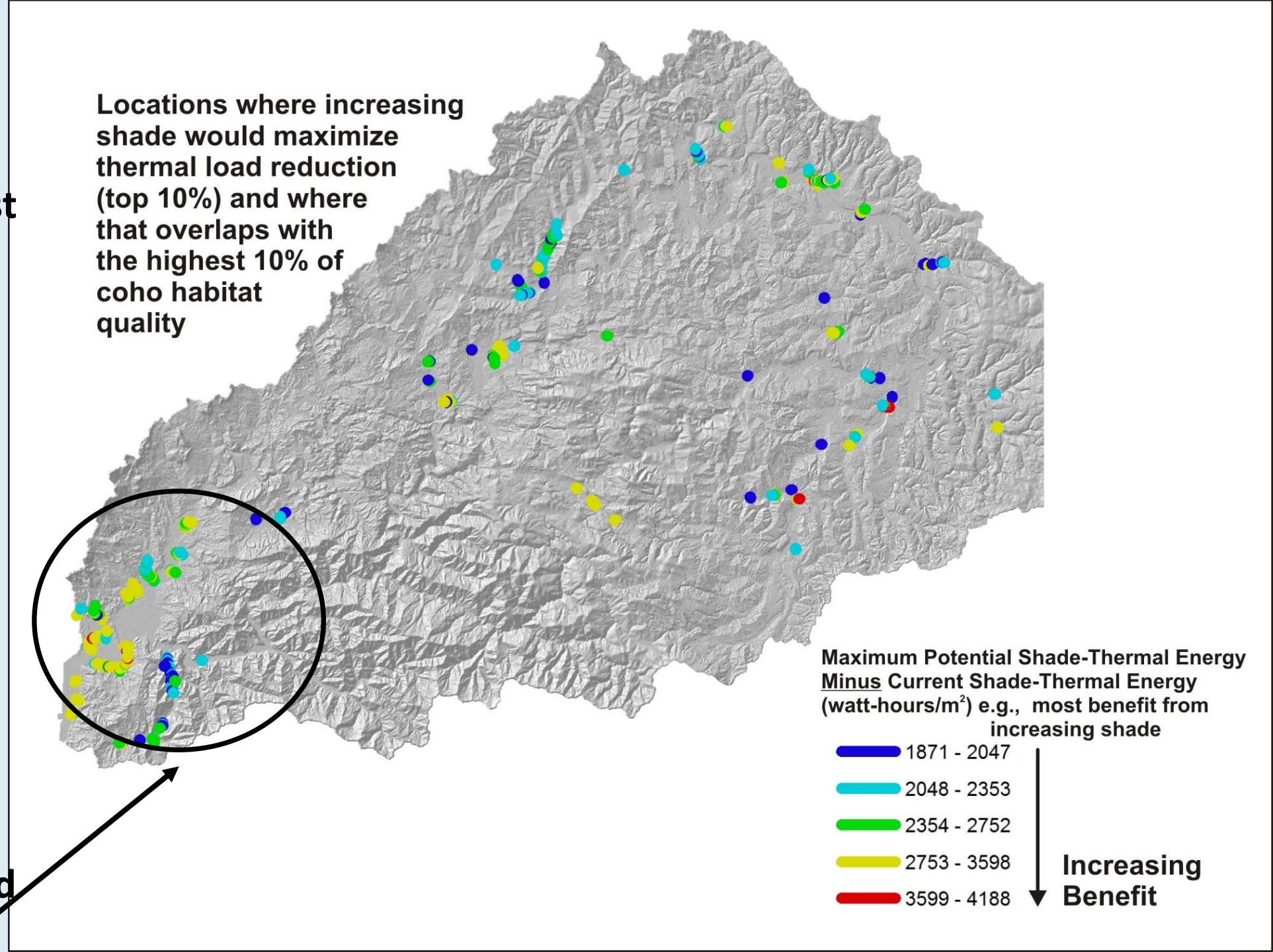


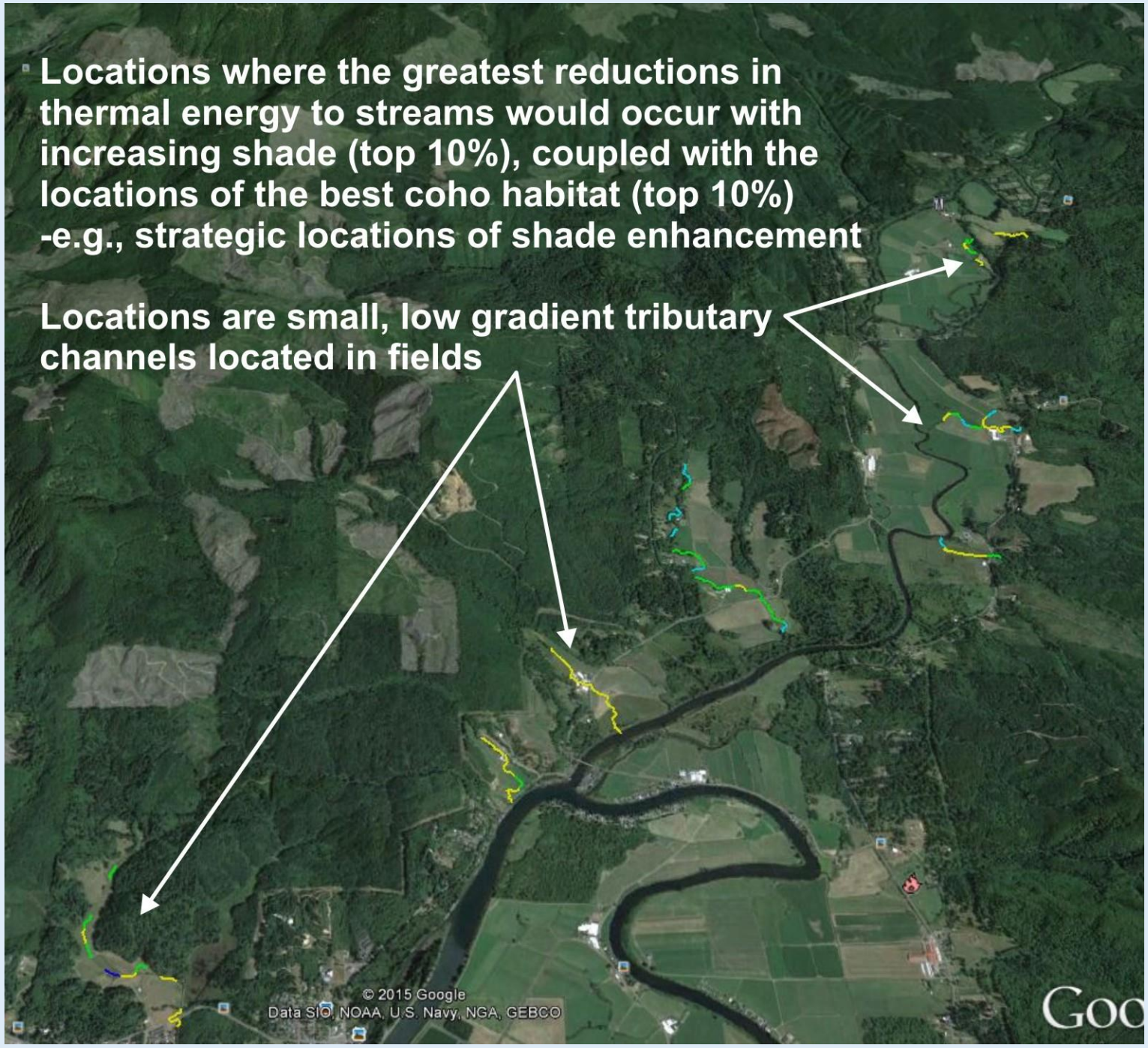
Where does the best coho habitat overlap with the best wood recruitment? – protect!

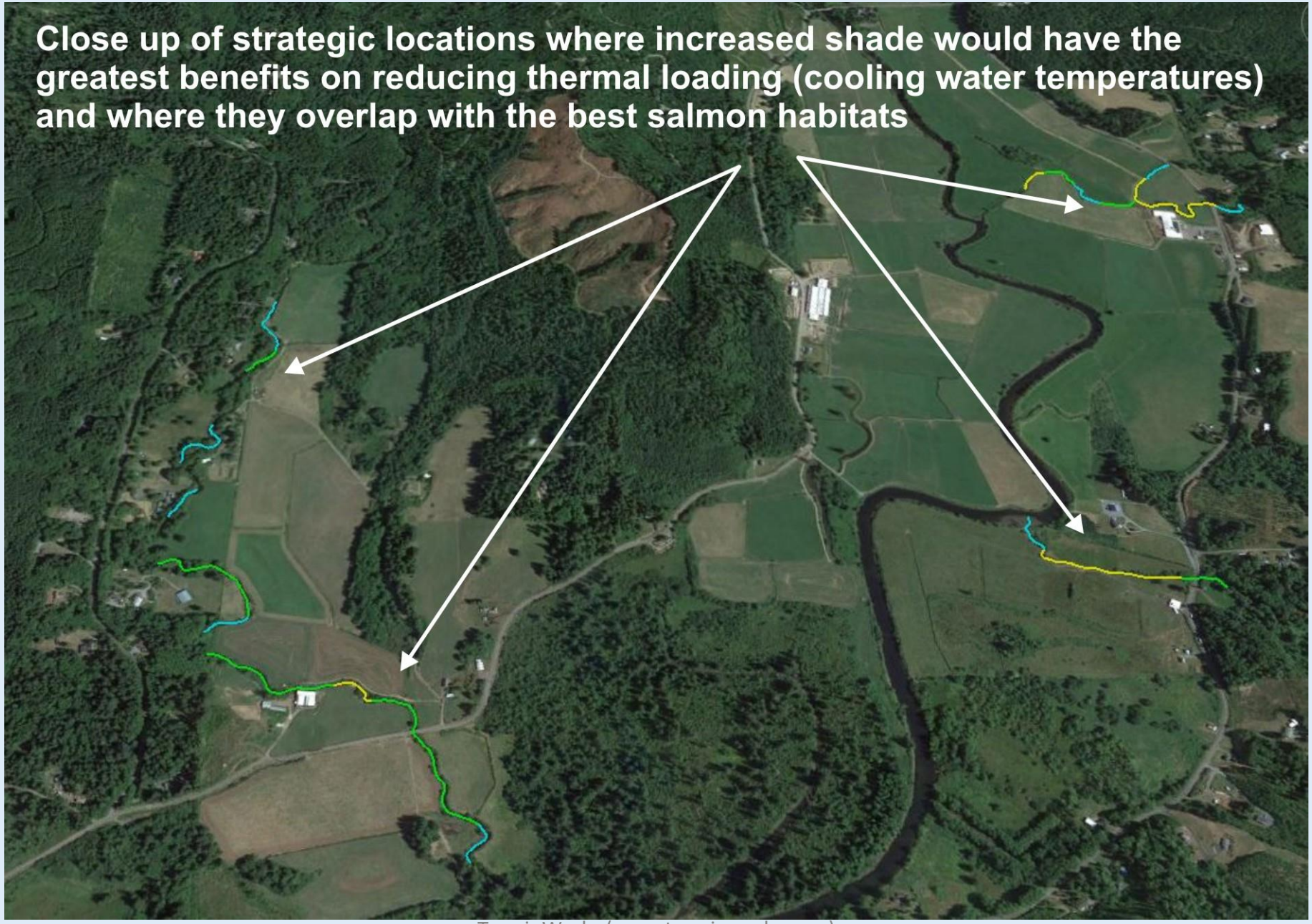
Where does the best coho habitat overlap with the worst wood recruitment? – restore!

Identify strategic locations where increasing shade would have the greatest benefits

Agricultural areas are highlighted where high value coho habitat overlaps with shade and large wood deficits – the highest in the entire watershed



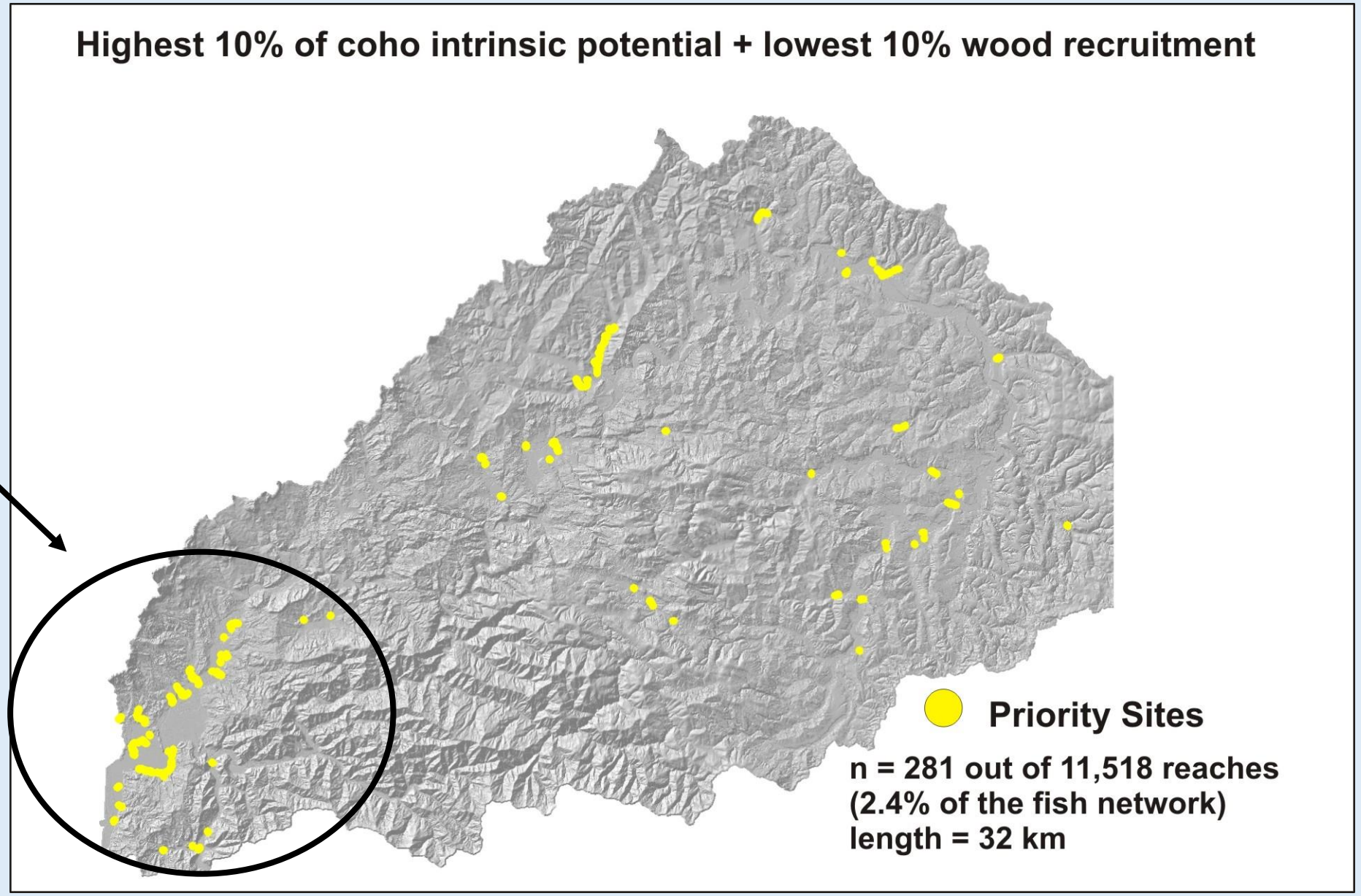

Locations where the greatest reductions in thermal energy to streams would occur with increasing shade (top 10%), coupled with the locations of the best coho habitat (top 10%) -e.g., strategic locations of shade enhancement
Locations are small, low gradient tributary channels located in fields
© 2015 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO



TerrainWorks (www.terrainworks.com)

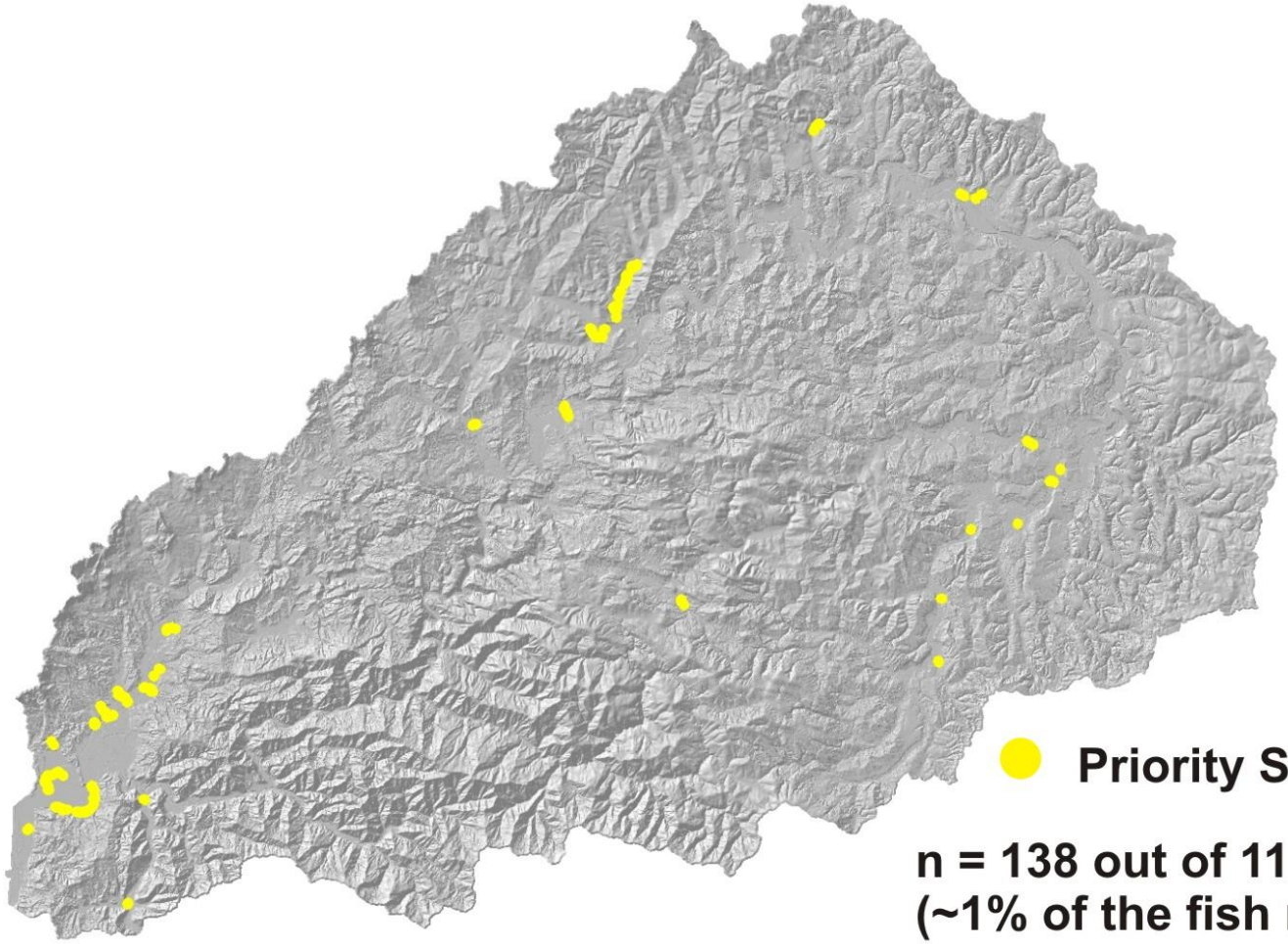
Application: Optimize Locations for Riparian Treatments or In-stream Structures

Agricultural areas stand out



Application: Impaired habitat hotspots as restoration targets

Highest 10% of coho habitat + highest 10% of floodplain width + lowest 10% wood recruitment + lowest 10% of basal area (shade)



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