



**Use of Photo Interpretation in
Landscape Evaluations:
The Okanogan-Wenatchee Forest
Restoration Strategy**

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Theory to Practice Workshop
Lubrecht Experimental Forest

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Objectives

- Background
- Forest Restoration Strategy
 - Landscape Evaluation
 - Terrestrial Evaluation
 - Aquatic Evaluation
 - Landscape Diagnosis and Prescription
- Quality Assurance/Quality Control
- Adaptive Management and Monitoring

White-Headed Woodpecker



Some Background

- Forest Restoration Strategy
 - Science/Management Collaboration
 - District Review and Input
 - Science Review
 - Provincial Advisory Committee Review



Key Forest Restoration Issues


- Landscape Evaluation
 - Integration across resources
 - Treatment priorities
- Road/Aquatic Interactions
 - Integration
 - Aquatic restoration priorities
- Key Ecological Features
 - Large and old trees
 - Within-stand Spatial Patterning
- Efficient Planning
 - Double restoration footprint over the next 10 years.

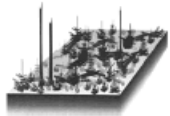


Landscape Evaluation

“landscape evaluations concerned with the restoration of ecosystems might be based on a set of ecological indicator measures against reference conditions for those same indicators” from Reynolds and Hessburg 2005

Why Photo Interpretation?

- Detail to use in project level planning
 - Comparable to reference conditions
 - Assess spatial patterns
 - New imagery and technology
 - Lack of an alternative
- 
- 20-25 cm resolution
 - On-screen 3-d image
 - On-screen digitizing
 - 2 m spatial accuracy



A. Stand Initiation (SI): Growing space is reoccupied following a stand replacing disturbance.



E. Young Forest Multi-Strata (YFMS): Two or more cohorts are present through establishment after periodic disturbances. Large and/or old early seral trees are often at reduced density from fire or logging.



B. Stem Exclusion Open Canopy (SEOC): Below-ground competition limits establishment of new individuals.



F. Old Forest Multi-Strata (OFMS): Two or more cohorts and strata are present including large, old trees.



C. Stem Exclusion Closed Canopy (SECC): New individuals are excluded through light or below-ground competition.



G. Old Forest Single Strata (OFSS): Single stratum stands of large, old trees. Relatively few young trees are present in the understory.



D. Understory Reinitiation (UR): Initiation of a new cohort as the older cohort occupies less than full growing space.

*Canopy Closure

*Canopy Layers

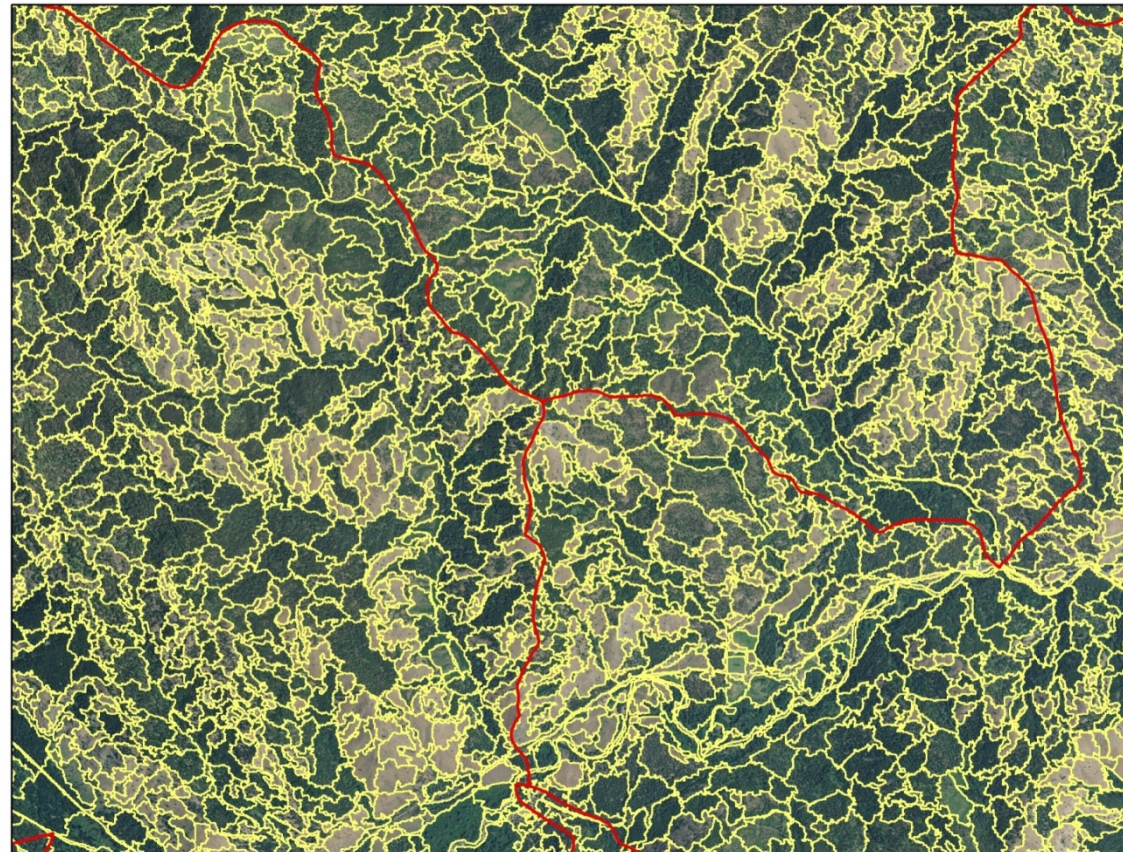
*Overstory Species

*Understory Species

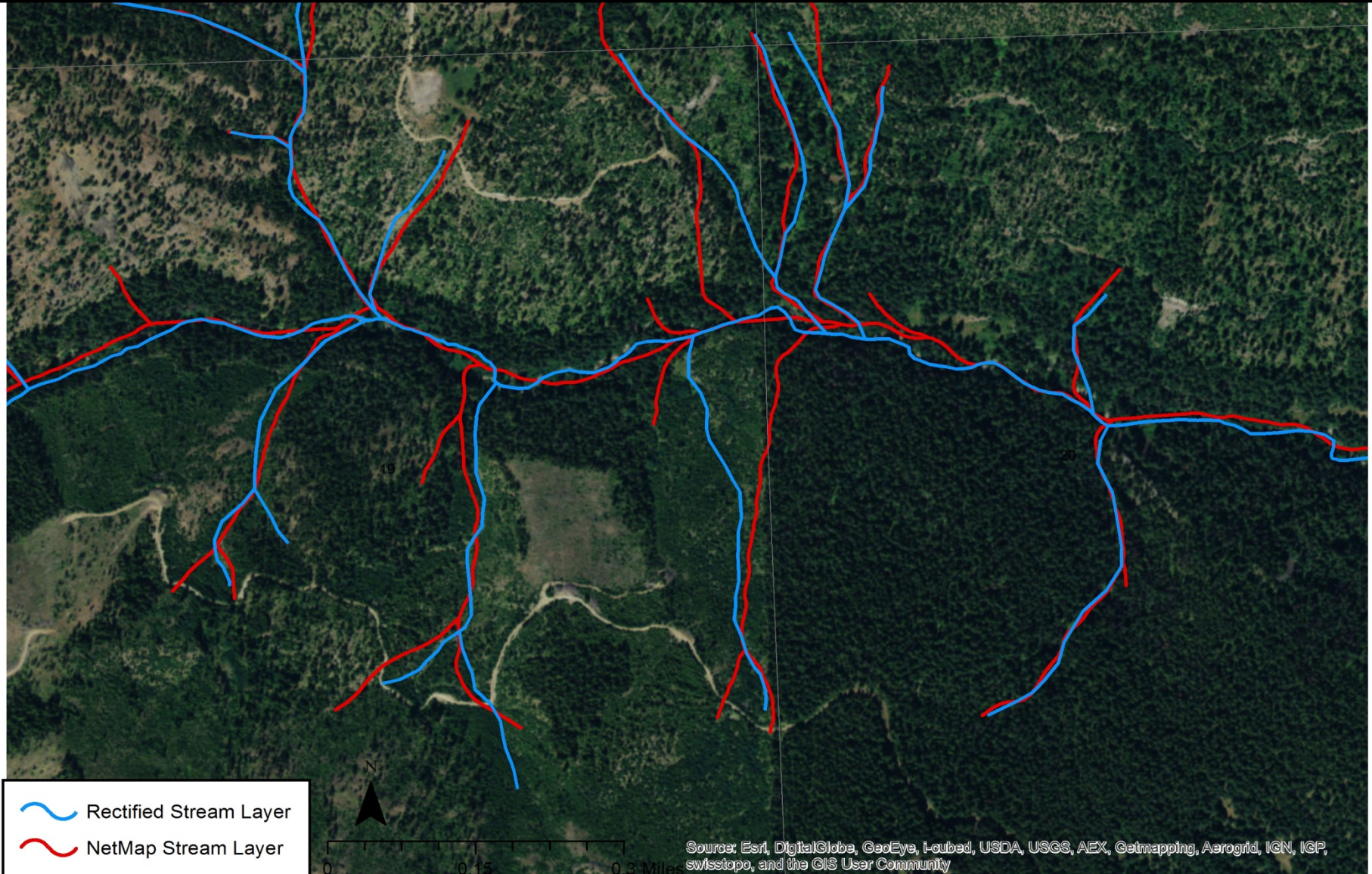
*Tree Size

*Snags

*Clumpiness

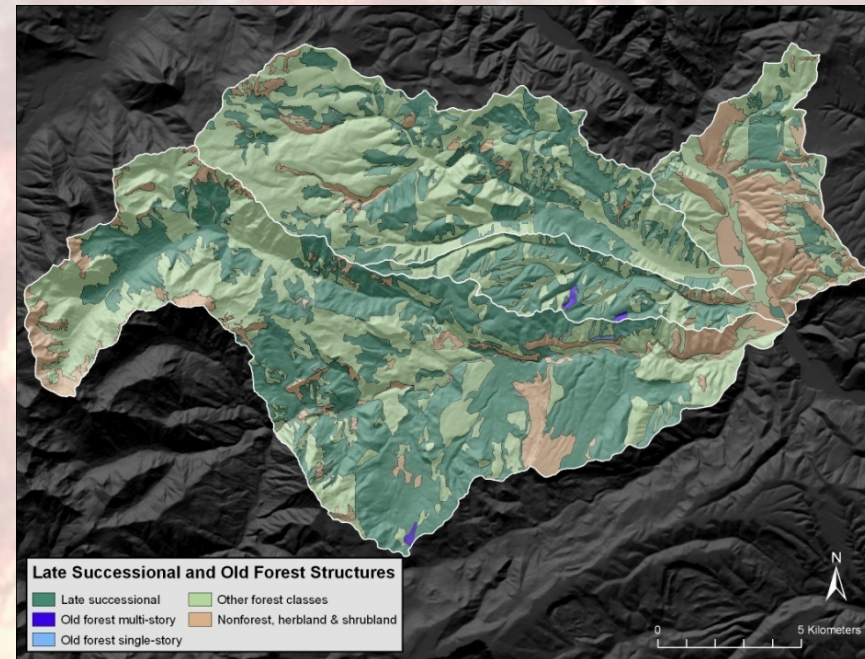


North Fork Taneum Creek Watershed (HUC 12) Preliminary Aquatic Resource Assessment



Reference Conditions

- Objective Measure of Current Conditions
 - More resilient landscapes and watersheds
- Changes Over Time
 - Historical Range of Variation
 - Future Range of Variation
- Amount and Configuration
 - Percent landscape
 - Aggregation Index
 - Patch Density
 - Largest Patch Index



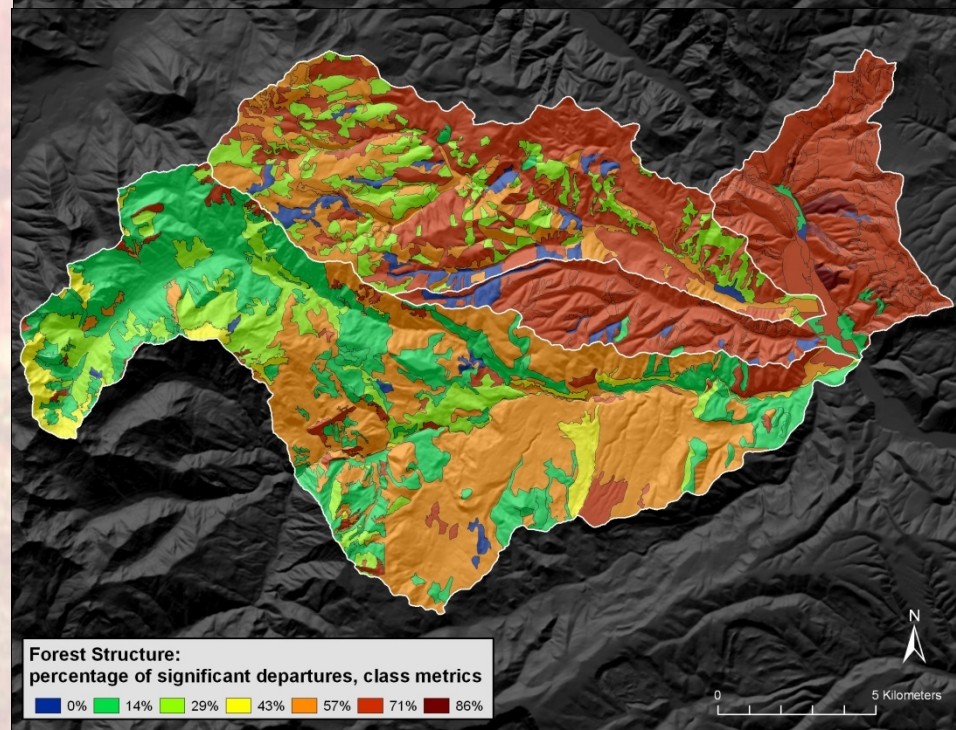
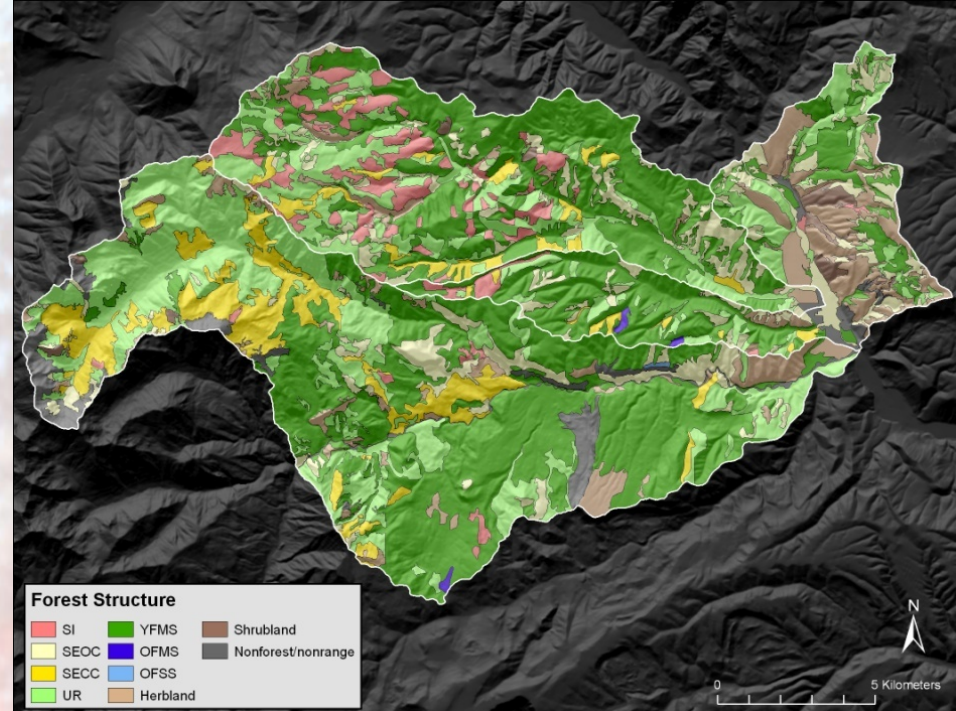
A photograph of a forest fire. Bright orange and yellow flames are visible, rising from the ground and spreading between tall, thin trees. The scene is hazy and smoky, with the fire being the central focus. The text 'Terrestrial Landscape Evaluation' is overlaid in the center of the image.

Terrestrial Landscape Evaluation

Key Indicator	Key Questions	Datalayers	Potential Tools
Vegetation Pattern	What is the amount and spatial arrangement of cover types, structure classes and cover x structure?	PVT, Cover Type, Structure Classes	Photo-interpretation, Departure Analysis, CC-HRV-FRV, Spatial Metrics
Insect and Disease Vulnerability	What is the current amount and spatial arrangement of forest structure that is susceptible to forest insects and diseases?	PVT, Cover Type, Structure Classes	Insect and Disease Risk Models, CC-HRV-FRV, Spatial Metrics
Landscape Fire	How can treatments be strategically located to interrupt landscape fire flow?	Fire “sending areas”	Fire Modeling done at subbasin scale or larger
Stand Level Fire	What is the current condition of fuel conditions and fire behavior compared to reference conditions?	Vegetation data used to map fuels	Fire modeling, Departure Analysis CC-HRV-FRV, Spatial Metrics
Focal Wildlife Species Habitats (2-5 species)	What is the current amount and spatial arrangement of focal species habitat?	Vegetation data used map focal species habitats	Departure Analysis, CC-HRV-FRV, Spatial Metrics

Vegetation Pattern

- Cover-type, Potential Vegetation, Structural Classes
- Insect and Disease Risk
- Departure from Reference Conditions
 - Natural Range of Variability
 - Future Range of Variability



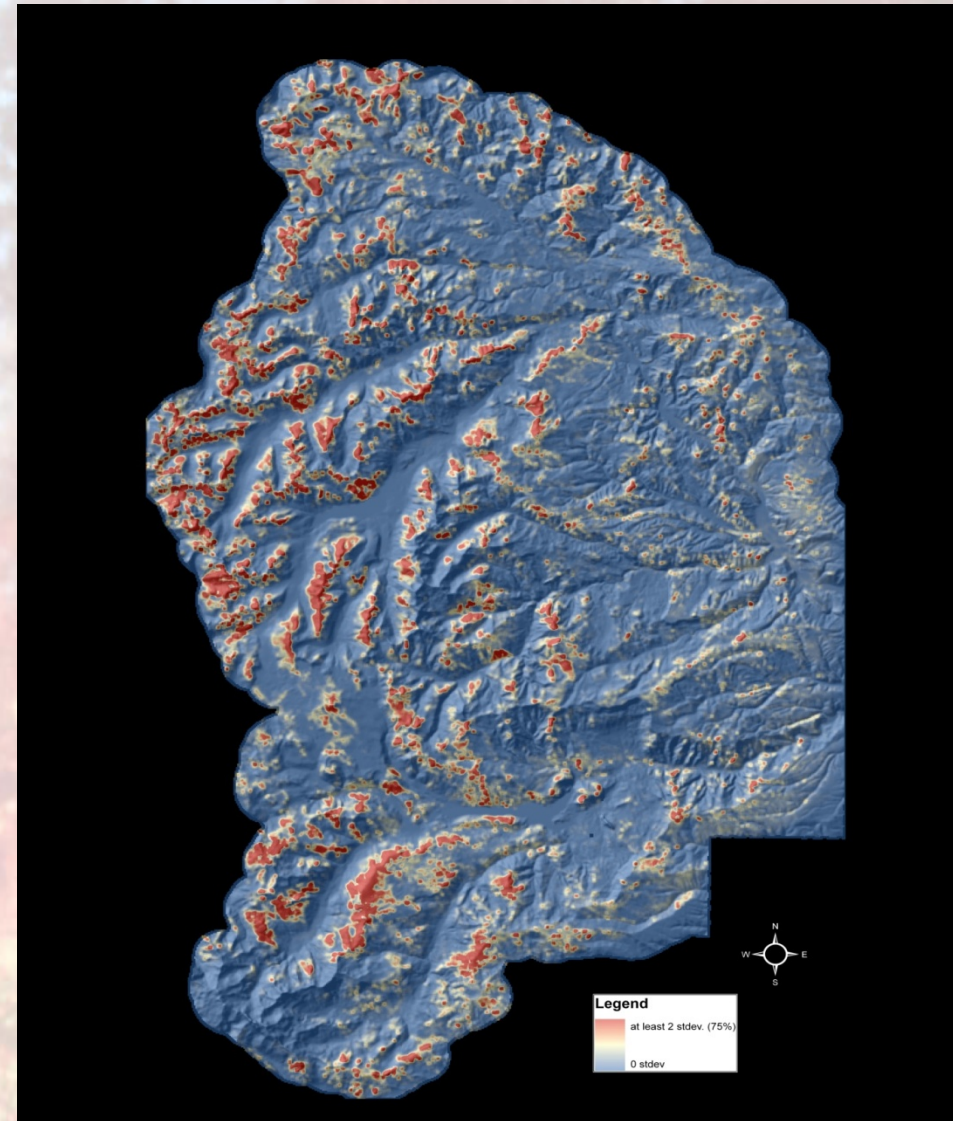
Fire Movement

•Landscape Fire

- Areas fires are likely to start and move from
- Known fire starts
- Fire modeling

•Stand Level Fire

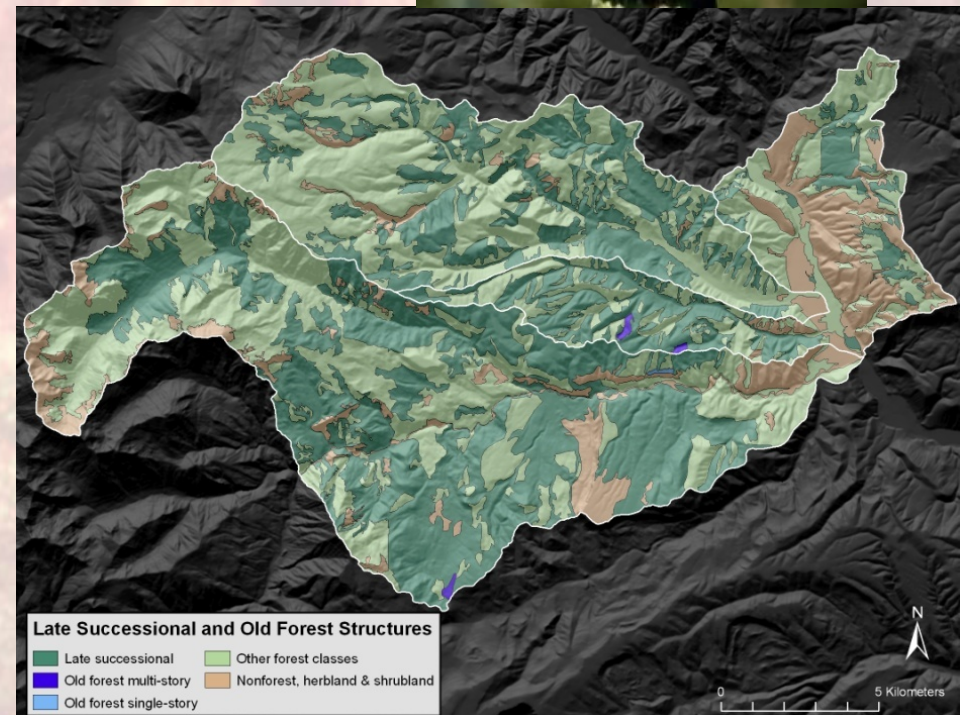
- Stand level fuel conditions
- Rate of spread, fireline intensity, etc.
- Compared to reference conditions





Wildlife Habitat

- Focal Wildlife Species
 - Northern spotted owl -NWFP
 - Northern goshawk-EastScreen
 - White-headed woodpecker
 - Other focal species: American marten, pileated woodpecker
- Reference Conditions
 - Current amount and arrangement of habitats
 - HRV, FRV



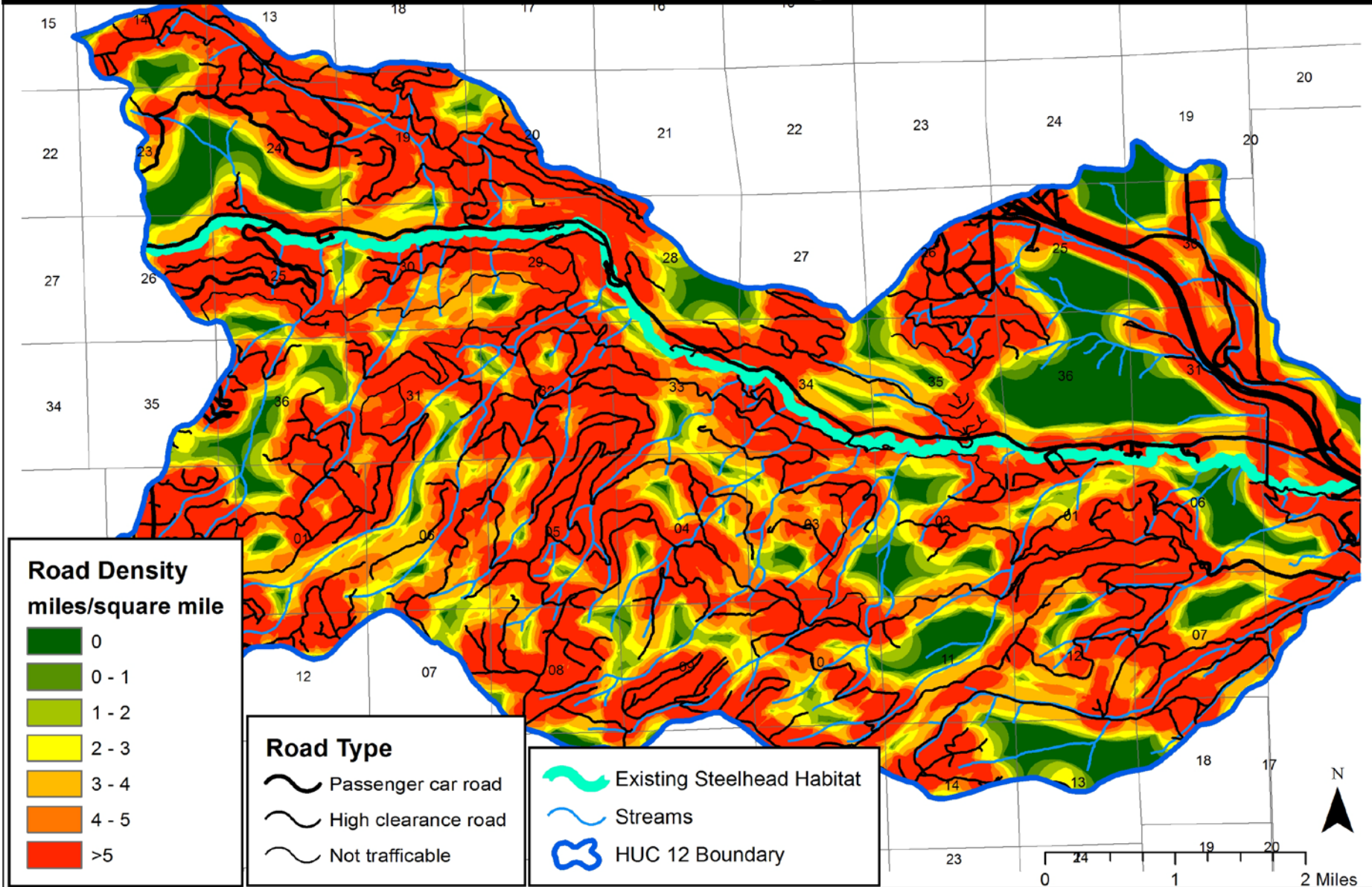
A photograph of a forest fire. Bright orange and yellow flames are visible, rising between several tall, dark tree trunks. The background is a hazy, blueish-grey, suggesting smoke or a clear sky. The overall scene is dramatic and somewhat somber.

Aquatic Landscape Evaluation

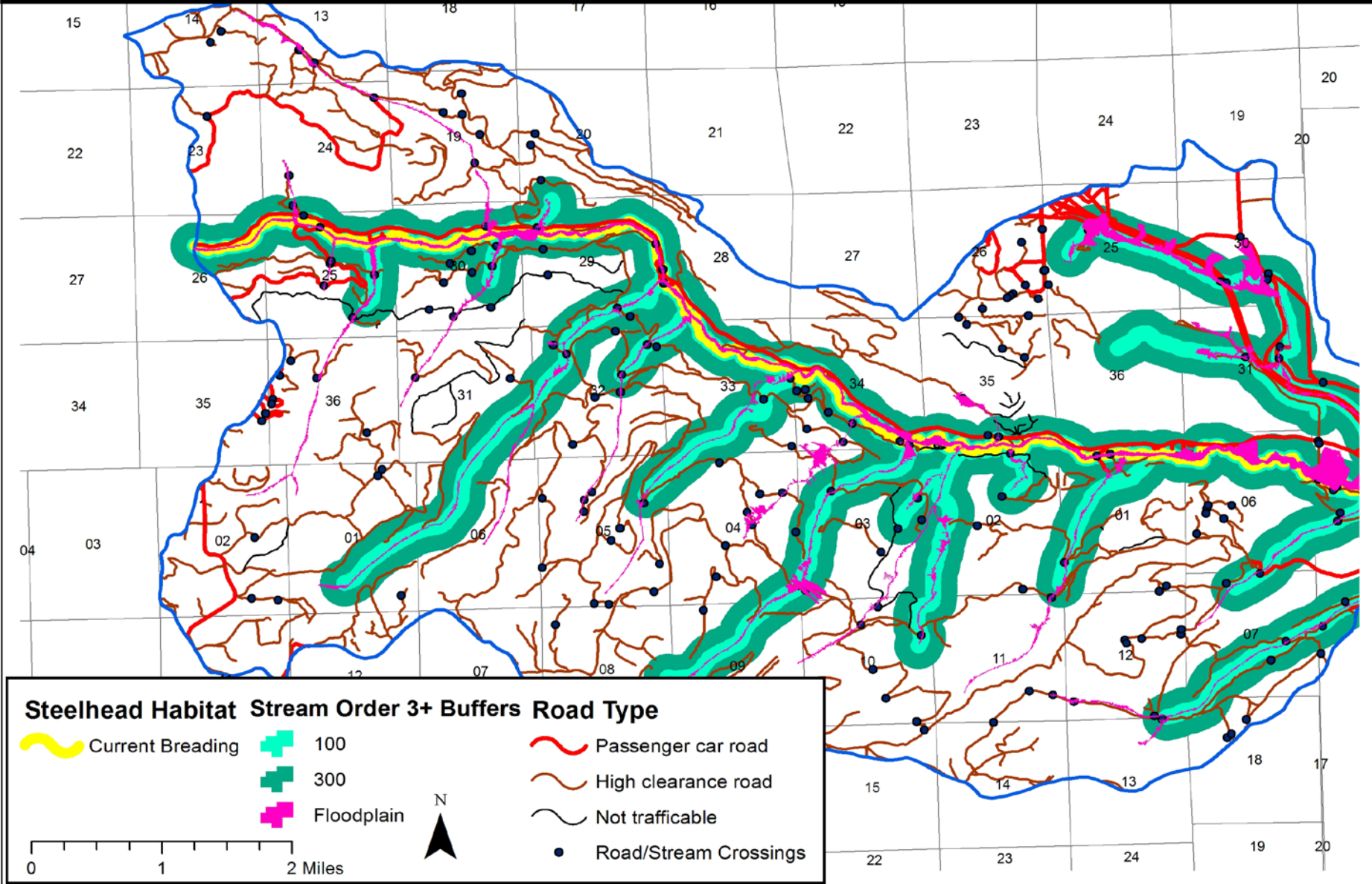
Watershed/Stream Process	Key Questions	Datalayers	Tools
Runoff and Stream Flow	How are forest roads influencing the drainage network? How will vegetation management influence snow accumulation, retention, and runoff?	Roads, streams, DEM, vegetation cover, snow	UCSRB Snow DST, CC-HRV-FRV
Erosion and Sediment Supply	Which roads are contributing fine sediment to streams? Which roads interrupt wood and coarse sediment delivery to streams?	Roads, streams, DEM, LTAs, vegetation cover	OWNF Proced., Graip-Lite, Erosion-Potential Delivered
Riparian Conditions	What is the current condition of riparian habitats to provide shade, wood, filter sediment, etc.?	Stream-type, Vegetation, grazing, large trees	Riparian Reserves, CC-HRV-FRV
Channel, Floodplain, and Habitat Dynamics	How have human activities impacted the amount and function of floodplains?	Floodplains, DEM, roads, other human developments	Floodplain Mapping Tool, LiDAR, in-channel surveys
Habitat Connectivity	How have human developments affected aquatic organism passage? Do barriers prevent access to current and future cold water?	Road-stream crossings, barrier inventory, current and potential fish habitat, cold water	Barrier data, Field evaluations, intrinsic habitat potential
Listed Fish Species	What is the current distribution of listed fish? Where is potential habitat? Are there key spawning and rearing habitats?	Current fish distribution, potential habitat, stream surveys	Fish distribution surveys, intrinsic habitat potential

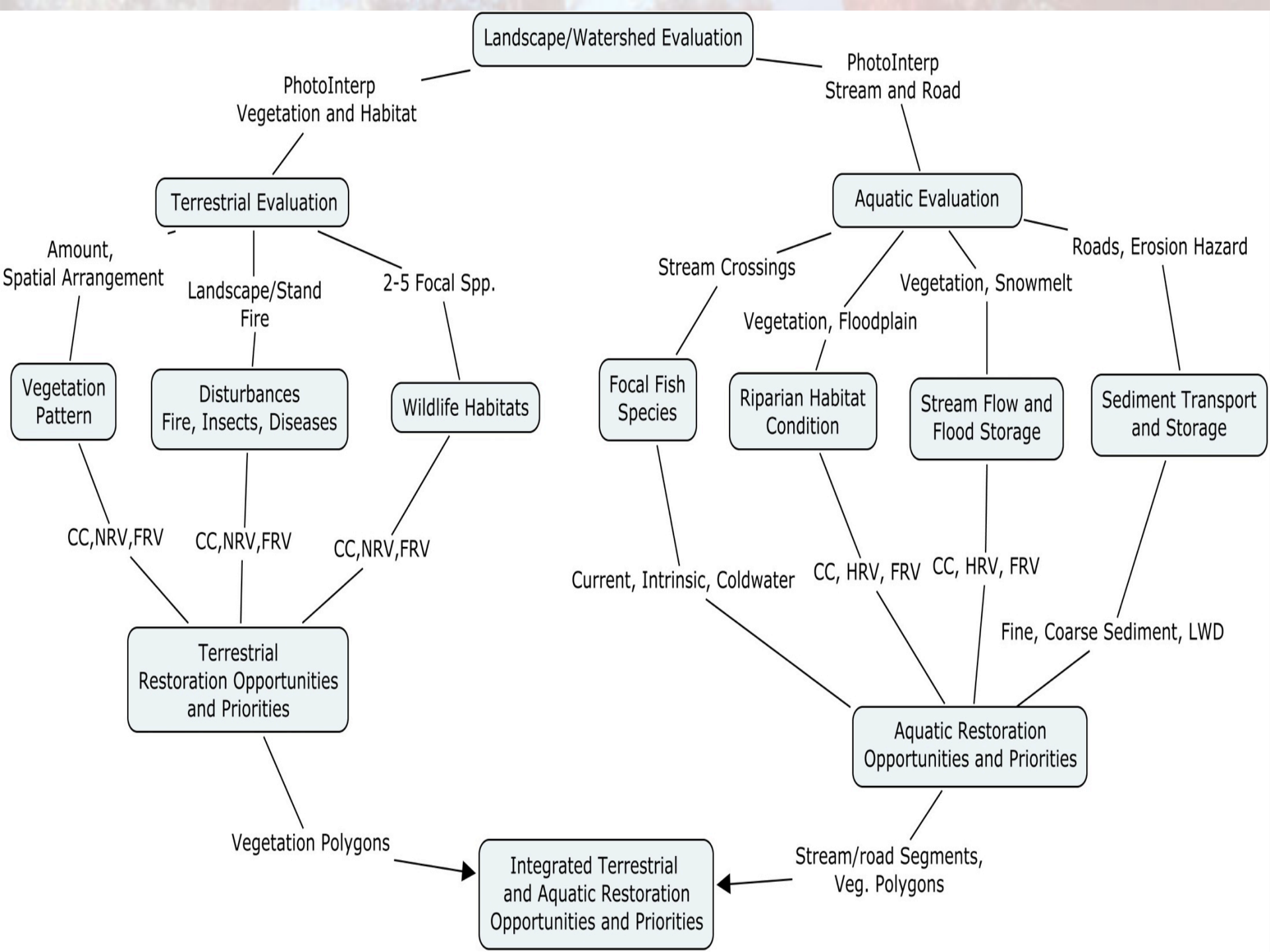
Taneum Creek Watershed (HUC 12)

Road Density

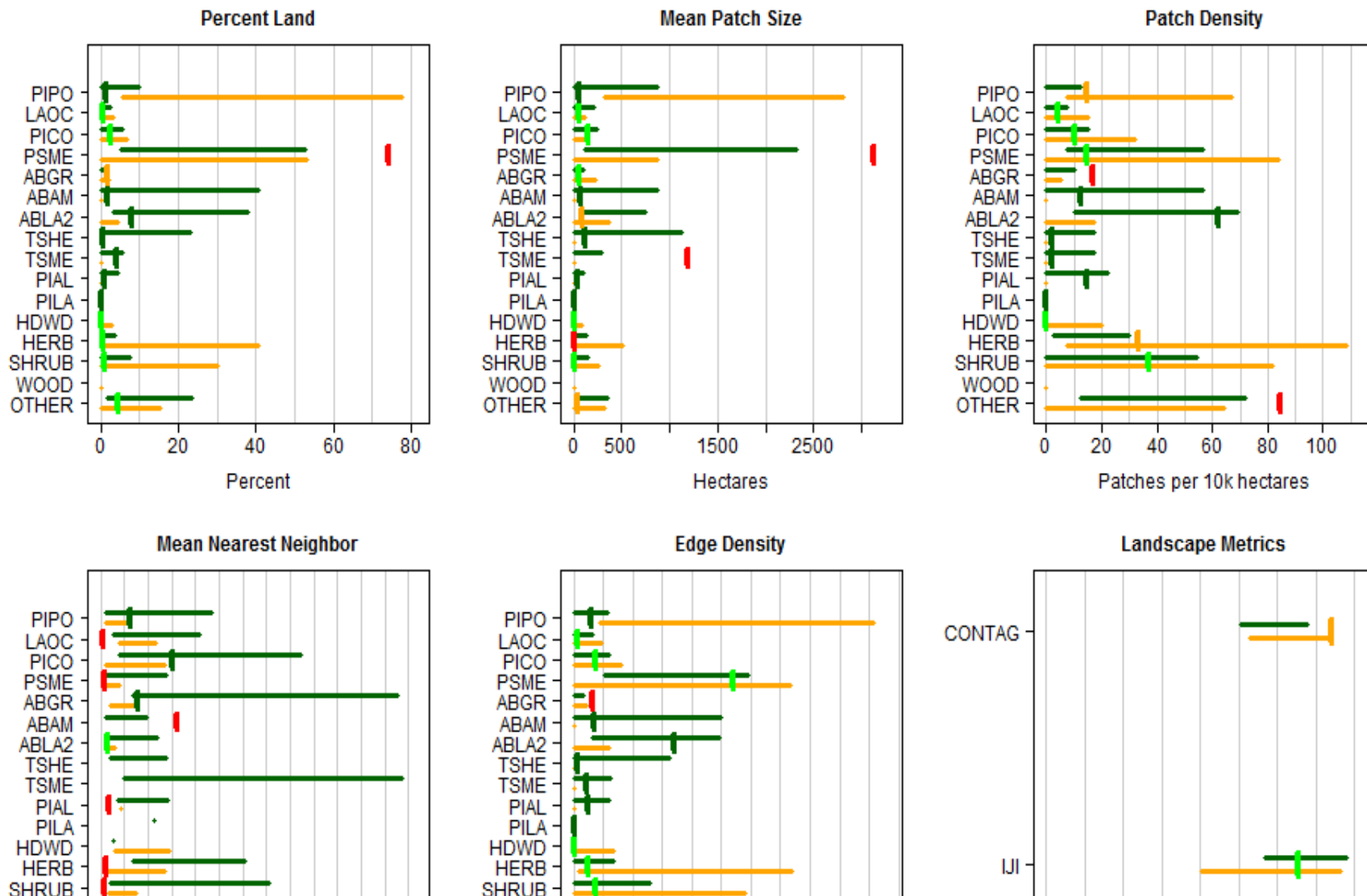


Taneum Creek Watershed (HUC 12) Preliminary Aquatic Resource Assessment





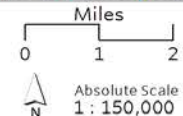
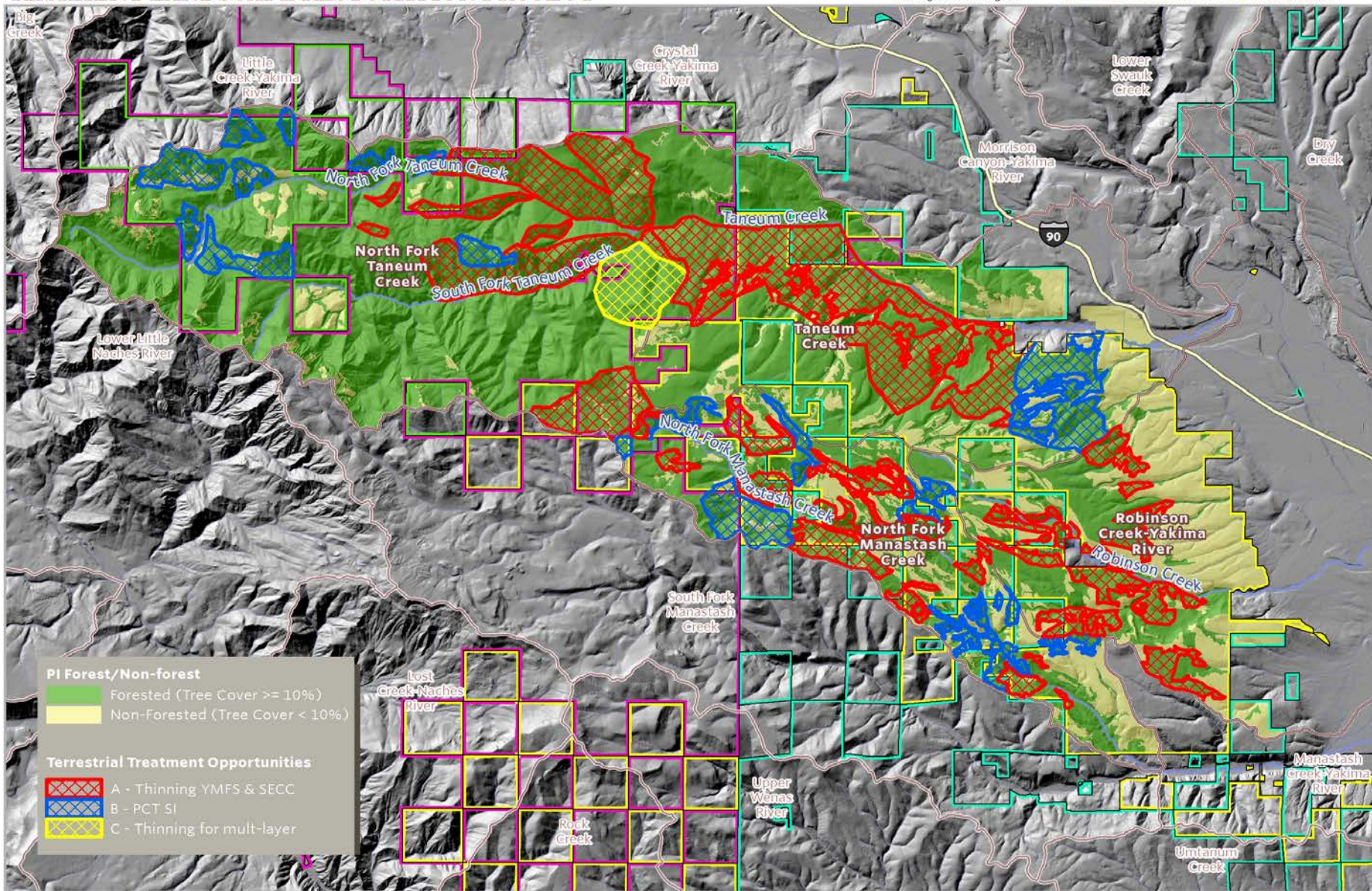
Landscape Diagnosis and Prescription



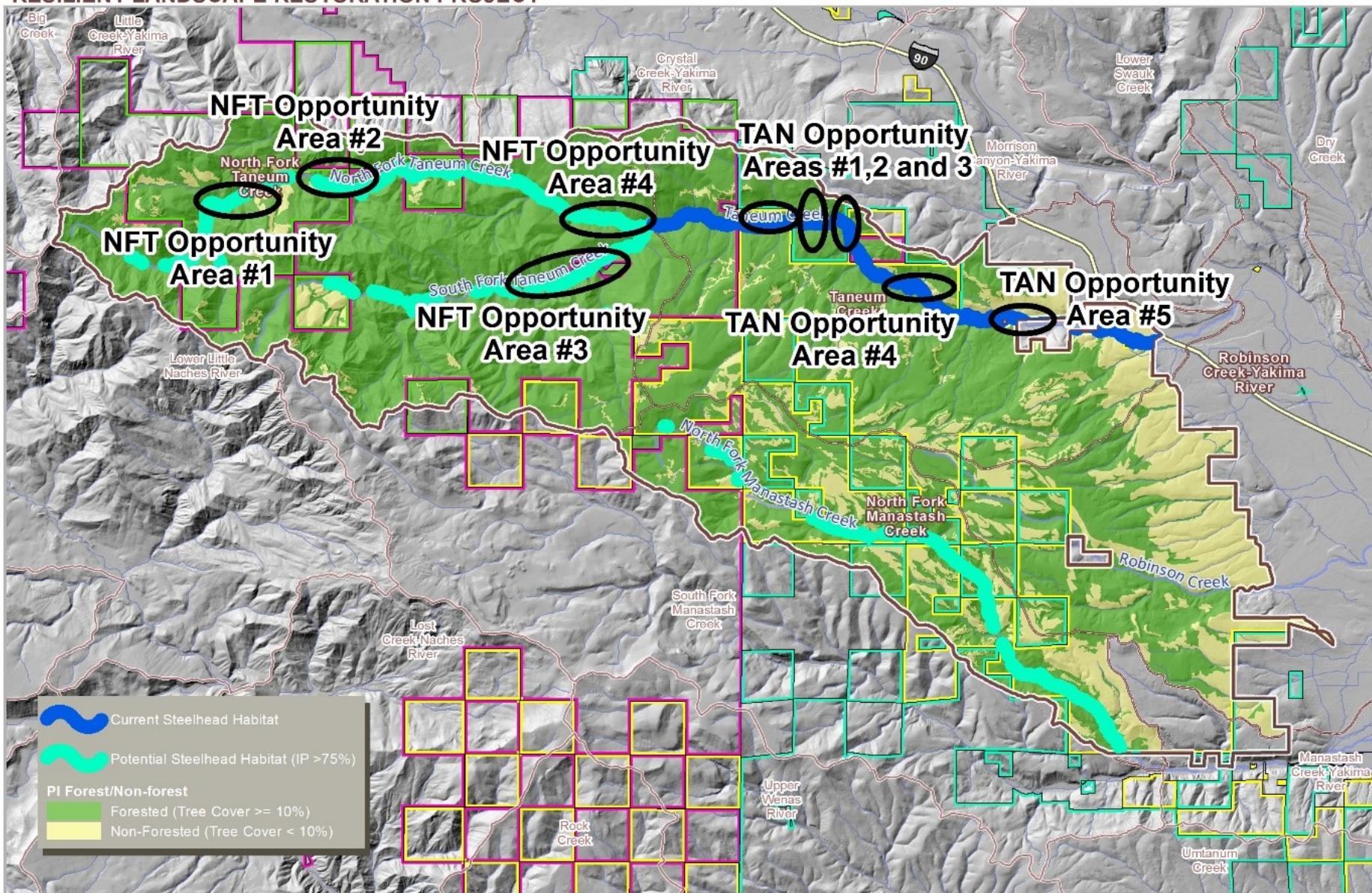
Landscape Prescription

- Restoration of Landscape and Watershed Resilience
- Ideal is to target the zone of overlap between HRV and FRV
- Identifies amount and location of potential terrestrial and aquatic restoration treatments
- An integrated package of restoration opportunities and priorities vetted by scenario evaluation
- Used to develop Purpose and Need

MANASTASH-TANEUM RESILIENT LANDSCAPE RESTORATION PROJECT



MANASTASH-TANEUM RESILIENT LANDSCAPE RESTORATION PROJECT



MAP LEGEND

Project Area (for Public Display)

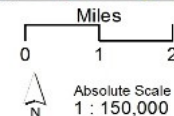
Watersheds not in Project Area (USGS HUC 12)

Owner: US Forest Service

Owner: WA Dept of Fish and Wildlife

Owner: WA Dept of Natural Resources

Owner: The Nature Conservancy



A photograph of a forest fire. Bright orange and yellow flames are visible, rising from the ground and between the trunks of tall, thin trees. The background is a hazy, light blue sky. The overall scene is one of a controlled or natural fire in a wooded area.

Quality Assurance/Quality Control

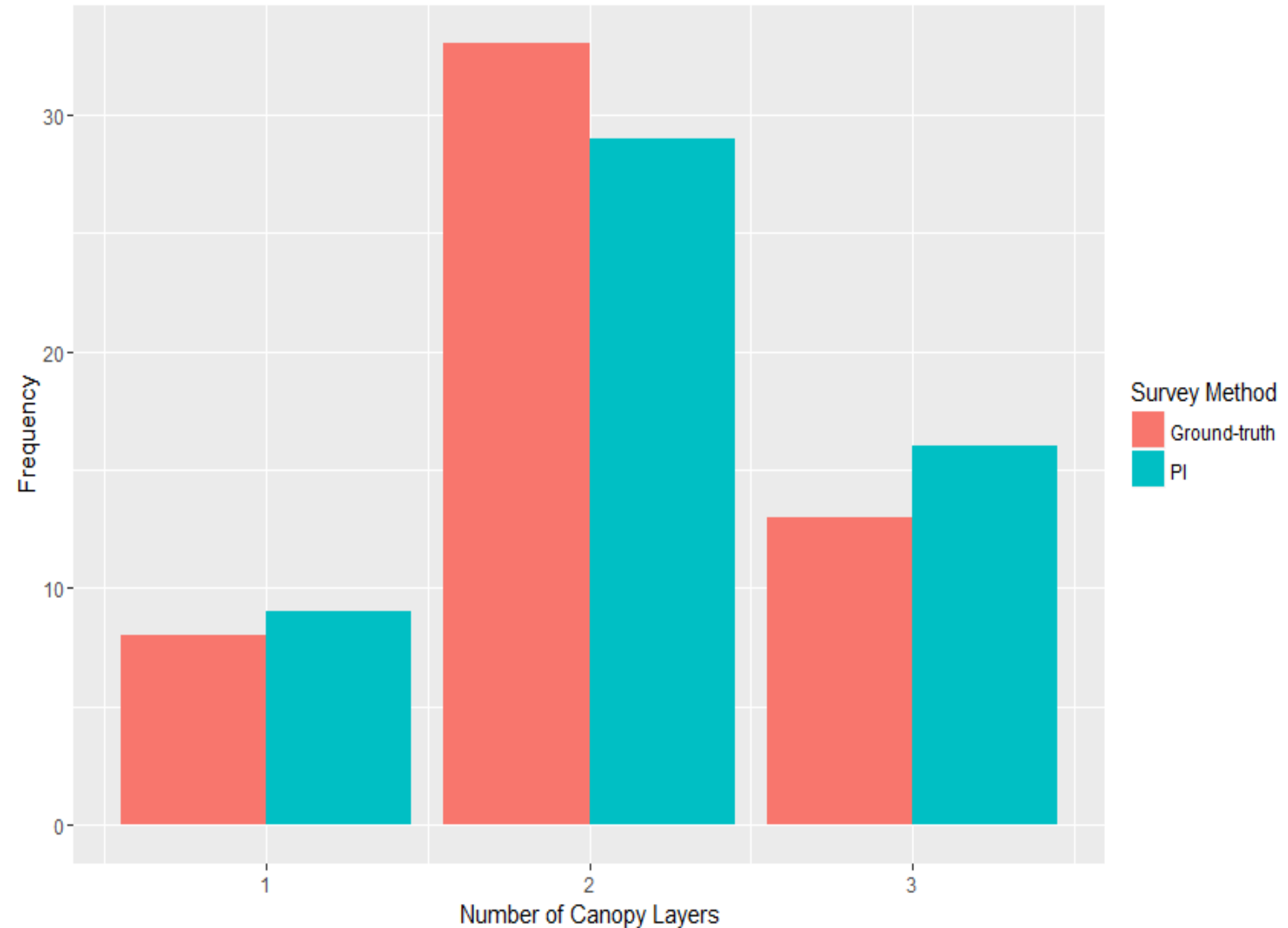
Quality Assurance versus Quality Control

- QA is done during the executing process
 - Focus on work being done now
 - Ensures team is following planned process
- QC is a monitoring process
 - Examines deliverables
 - Ensures deliverables are correct and meet “planned level of quality”

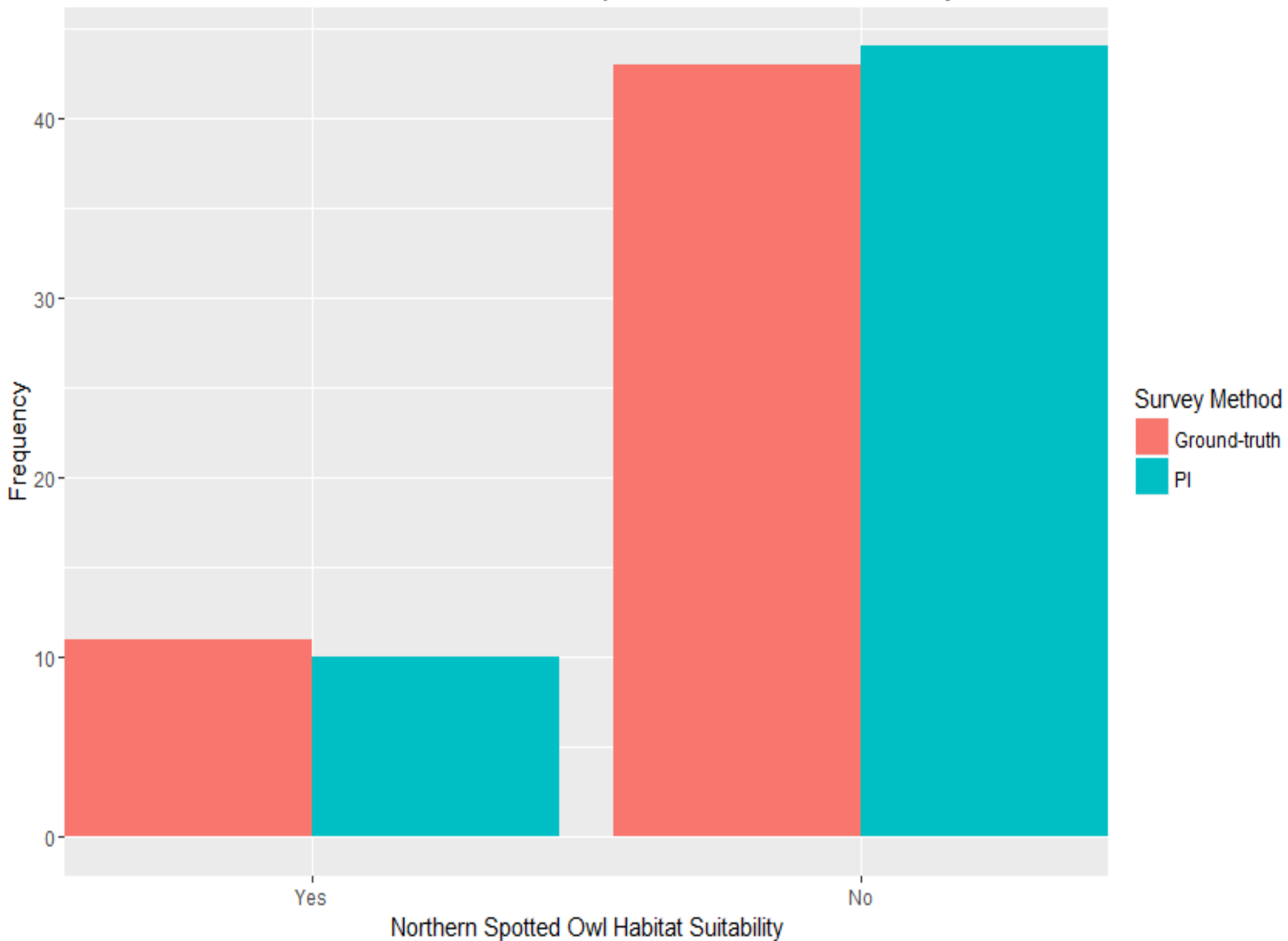
Quality Assurance

- Photo-Interpretation
 - Field time to get familiar with the area
 - Cross check of polygon delineation
 - Cross check of vegetation attributes
- Field Evaluation of Vegetation/Habitat Mapping
 - Independent from photo-interpreter
 - Stratified random sample of vegetation polygons to collect field data
- Revise Vegetation/Habitat Mapping as Needed

PI and Ground-truth Canopy Layers



PI and Ground-truth Northern Spotted Owl Habitat Suitability



Adaptive Management and Monitoring

- Photo interpreted landscapes provide a baseline for monitoring
- Allows a comparison of current condition, reference conditions, and landscape prescription
- Can be updated as projects are implemented or as conditions change (e.g., fires)
- Are we moving landscapes and habitats to more resilient conditions?

