Watershed Restoration by Stealth:
The W's of Watershed Restoration

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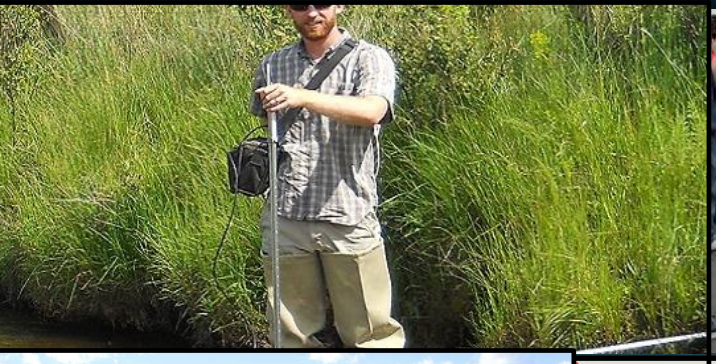
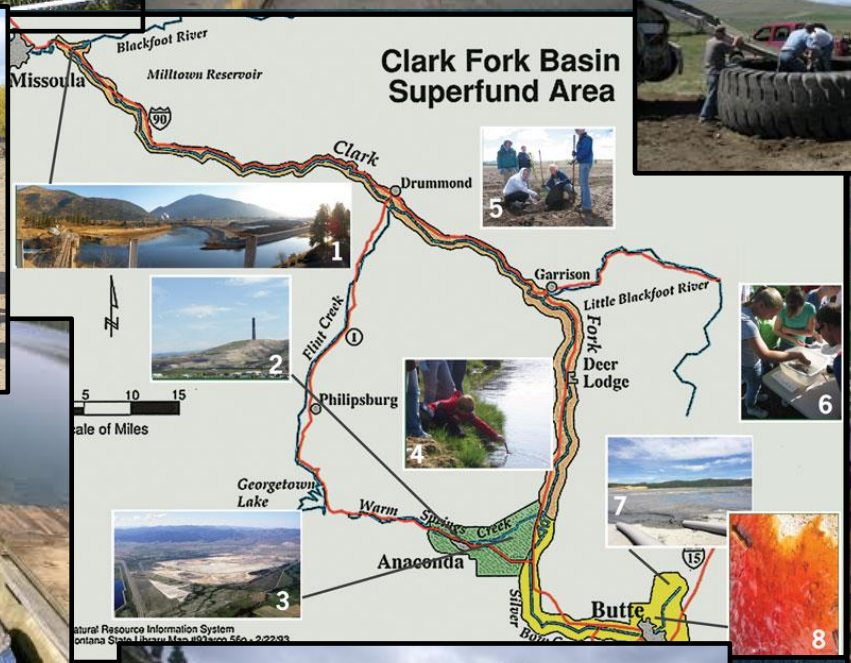
Lolo National Forest




Clark Fork Basin
Superfund Area
Blackfoot River
Milltown Reservoir
Missoula
90
Clark
Drummond
Garrison
Little Blackfoot River
Fork
Deer
Lodge
Flint Creek
1
Philipsburg
5
10
15
ale of Miles
Georgetown
Lake
Warm
Anaconda
Butte
15
1
2
3
4
5
6
7
8

Upper Clark Fork River Basin Restoration Fund
Quarterly Project and Fiscal Status Report
Second Quarter Fiscal Year, January 2015

Approaches

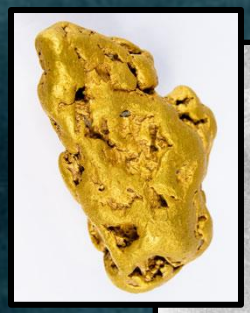
- Literature Reviews
- Studies and investigations
- Mapping
- Planning
- Assessment
- Prioritization
- Survey and Design
- Economic evaluations and efficiencies
- Implementation
- Monitoring
- Scoping, landowner meetings and collaborative development

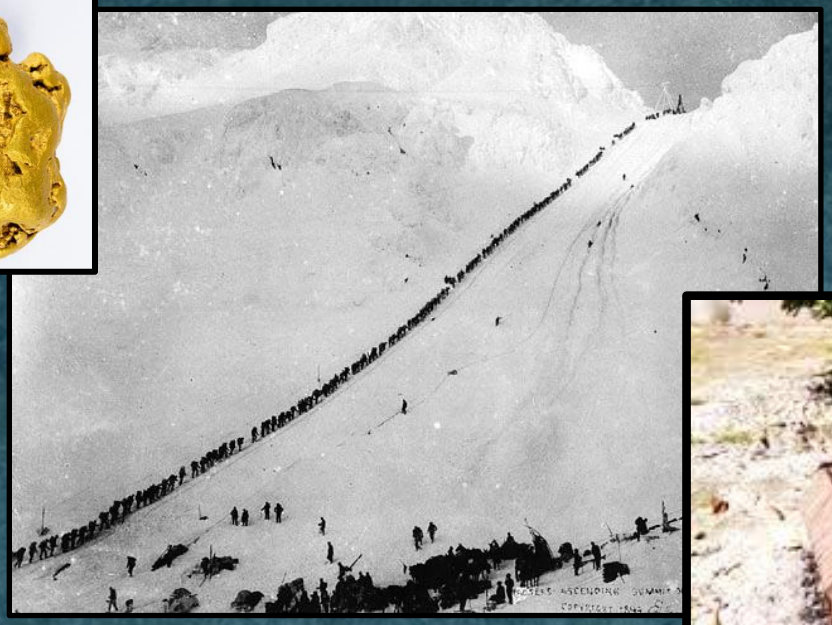
Activities

- Flow augmentation – 9 – water rights: use change, purchase, leases, transfer, reservoir storage; alternative irrigation,
- Stream and floodplain rehabilitation
- Aquatic passage at road-stream crossings
- Ditch entrainment/fish screens
- Riparian fencing
- Aquatic barriers
- Land acquisition
- Weed treatment
- Monitoring – flow, weed, fish, bird, project
- Maintenance

Questions for us:

- In our Rush of Restoration, will our approaches serve future generations?
- Are we performing “Random Acts of Restoration” and how can we avoid our projects becoming Relics of the Past?
- How can help assure sustainability and address the uncertainty?





The W's of Watershed Restoration

- Why here and now
- What types of projects
- Where are the projects located
- When is the best time
- Who is, and/or should be involved and accepting
- What the?: Adaptive Management – the key to sustaining success

Overview:

- "Watershed Restoration"
  - –Definition
  - –Value
- Components
  - –Definition
  - –Considerations for the future

- This presentation: Restoration vs. rehabilitation
- "Restoration" is used generally to describe multiple activities leading to watershed improvement

Watershed Restoration Goal

Sustaining Ecologic Integrity

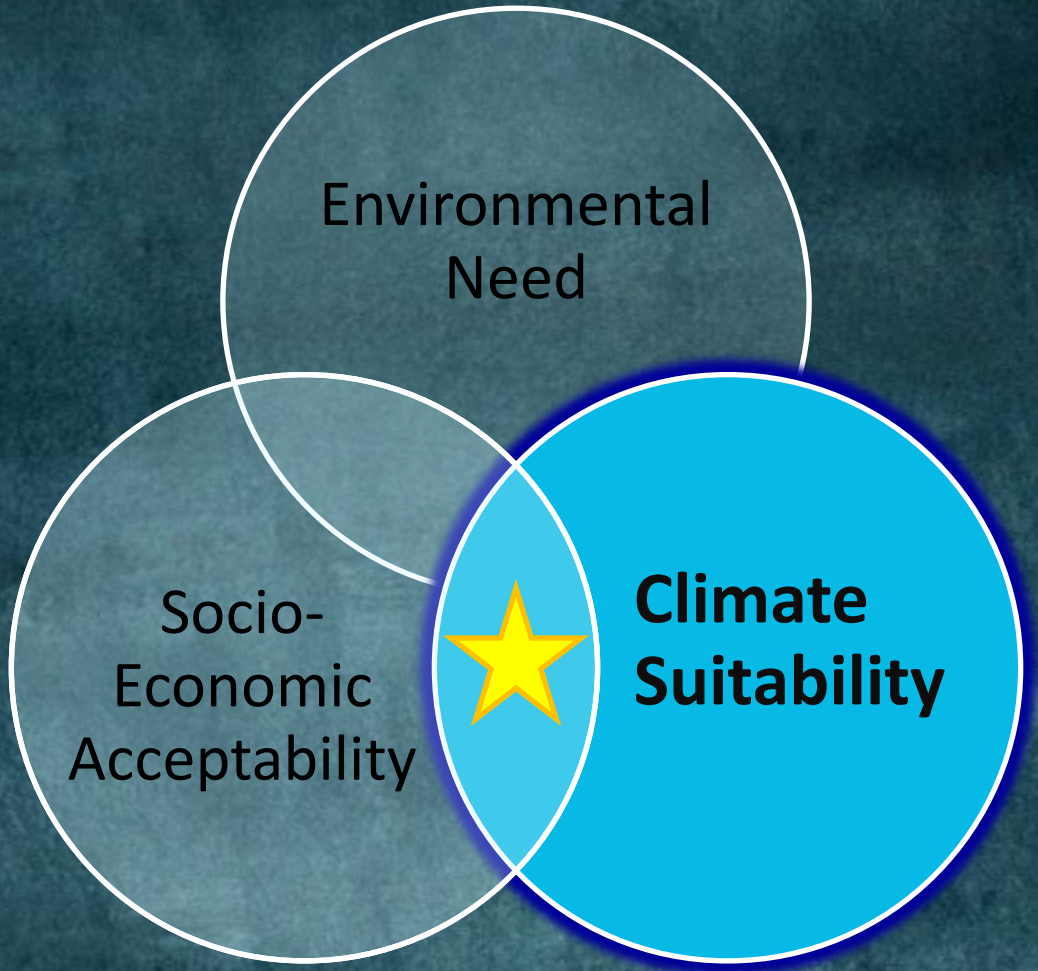
Why use a Watershed Approach?

- Addresses the problems in a holistic manner
- Stakeholders in the watershed are actively involved in the management strategies
- Nonpoint source pollution poses the greatest threat to water quality and is the most significant source of water quality impairment in the nation.


Is Our Restoration as Strategic as it could, or should be?

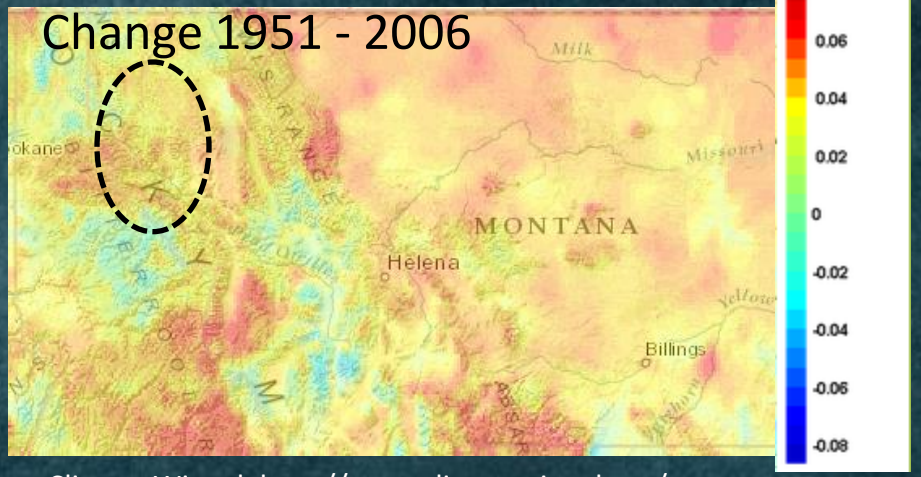
Watershed Restoration Goal

Sustaining Ecologic Integrity



Climate Change: Temperature

Maximum air temperatures have increased by 1.3°C between 1970-2006
(Littel et al. 2010)



Climate Wizard: http://www.climatewizard.org/

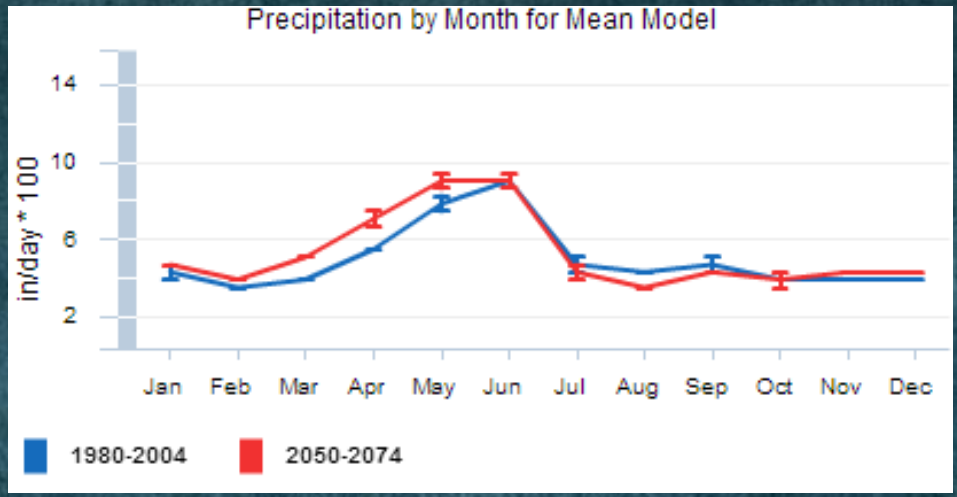
Projected average annual increase of 1.8°C by 2040
(CIG 2008)

Climate Change: Precipitation

Precipitation variable, but reduced snow fall (Peacock 2011)

Shift away from snowmelt-dominant regime (Mantua, Tohver & Hamlet 2010; Wu et al. 2012)

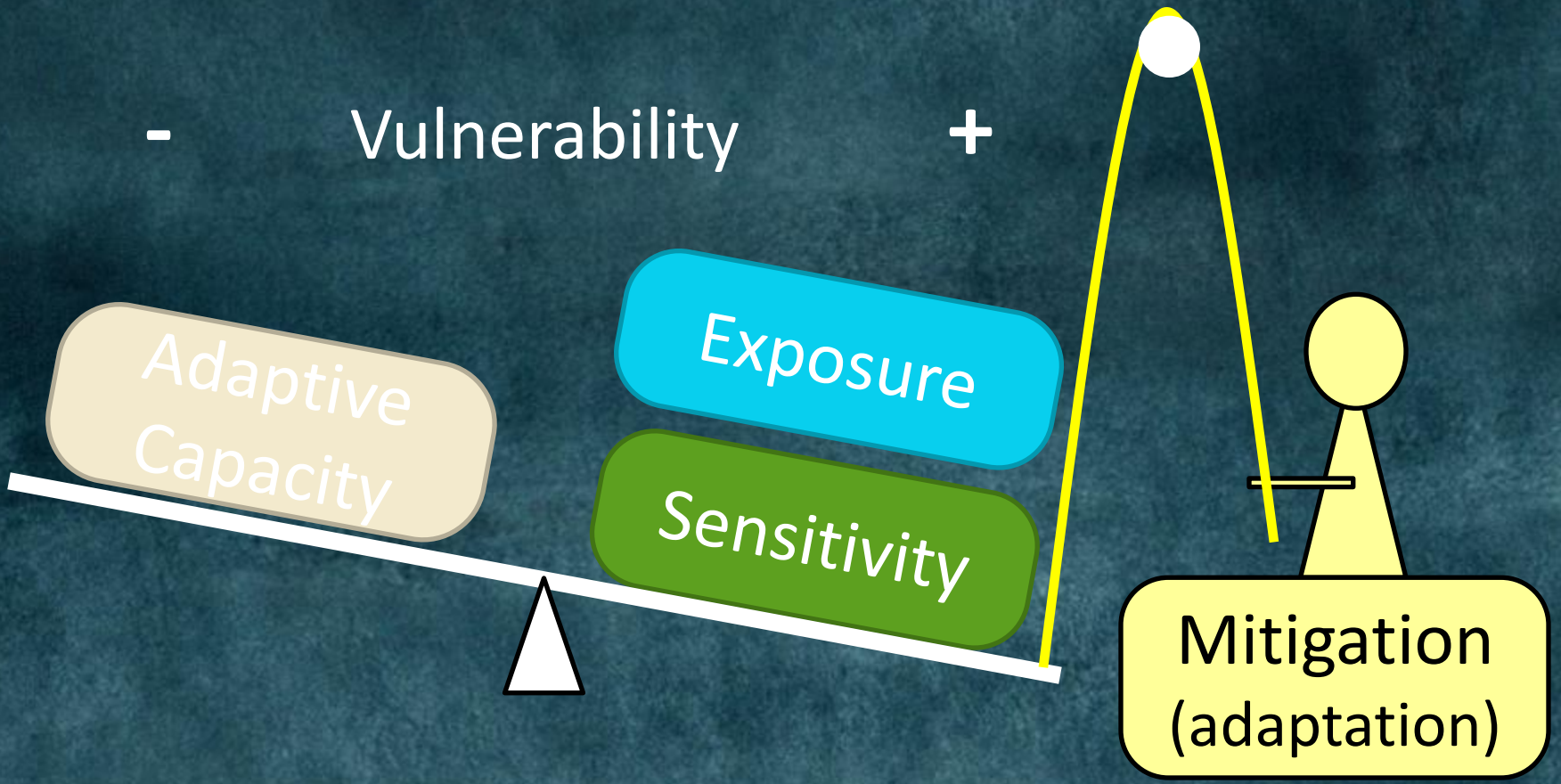
Earlier flow peaks, reduced summer flows (IPCC AR5; USGS)



USGS data viewer; AR5 RCP 8.5 ensemble mean; http://www.usgs.gov/climate_landuse/clu_rd/apps/nex-dcp30_viewer.asp

Vulnerability ~ f(Exposure, Sensitivity, Adaptive Capacity)

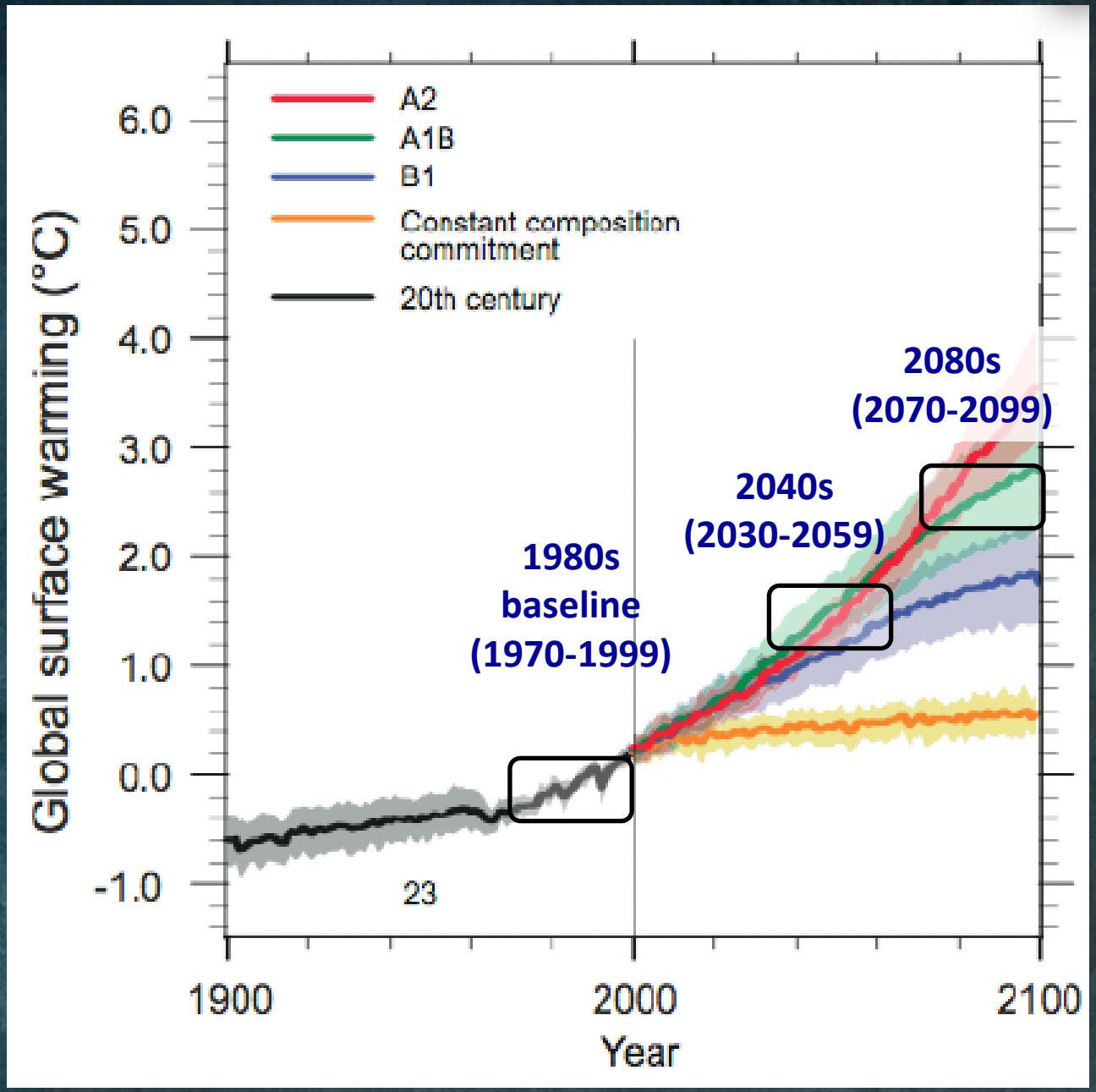
(IPCC 2007)



Temporal uncertainty: a future for cold-water fish?

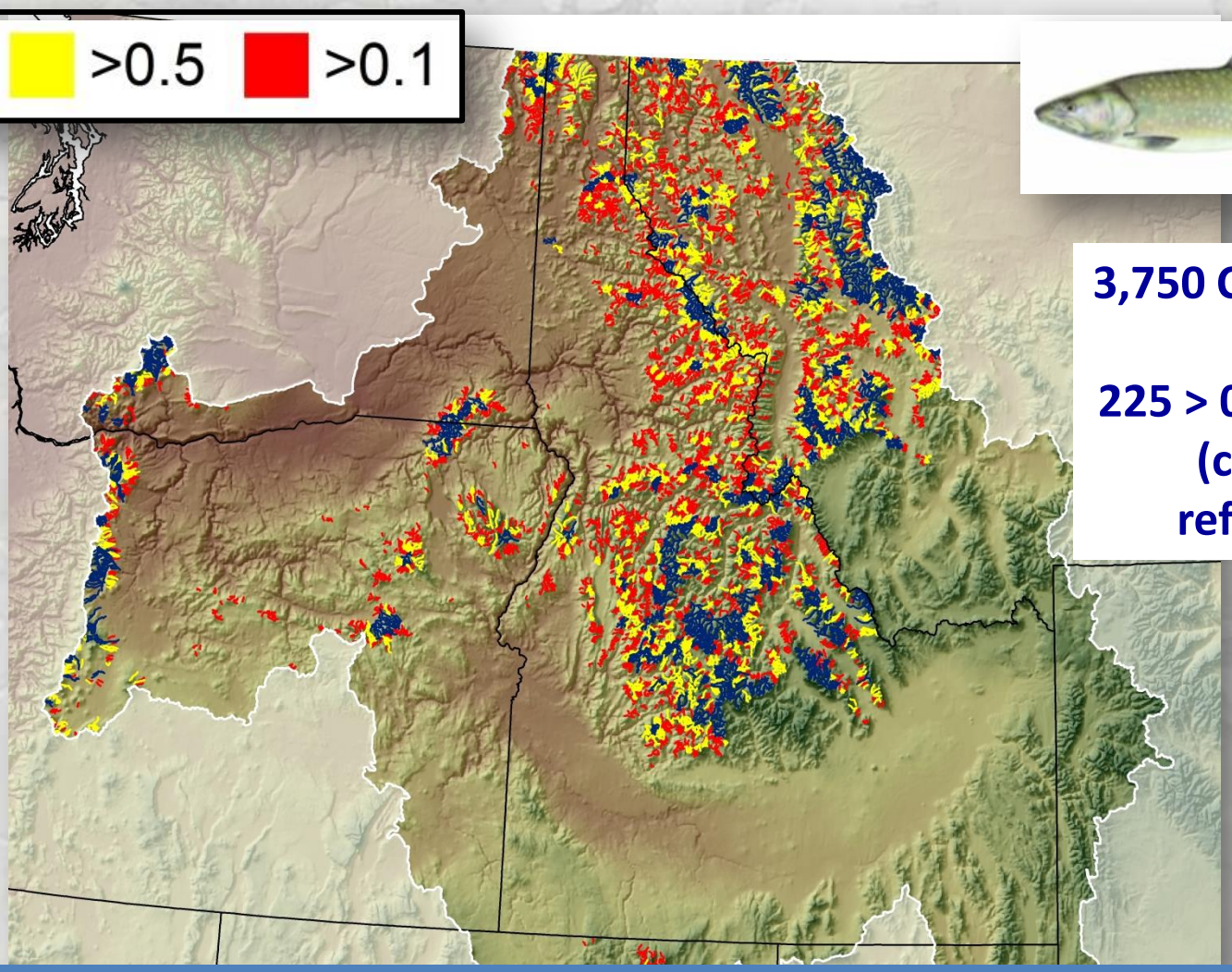
- Most projections:
  - 20—100% declines
    - Eaton & Schaller 1996
    - Reusch et al. 2012
    - Rahel et al. 1996
    - Mohseni et al. 2003
    - Flebbe et al. 2006
    - Rieman et al. 2007
    - Kennedy et al. 2008
    - Williams et al. 2009
    - Wenger et al. 2011
    - Almodovar et al. 2011
    - etc.
- Variable predictions
  - Emissions
  - GCMs
- Dates as surrogates
- 2040s = moderate change
- 2080s = extreme change

Hamlet al. 2013



Occurrence Probability Map – 1980s (existing)

Bull Trout



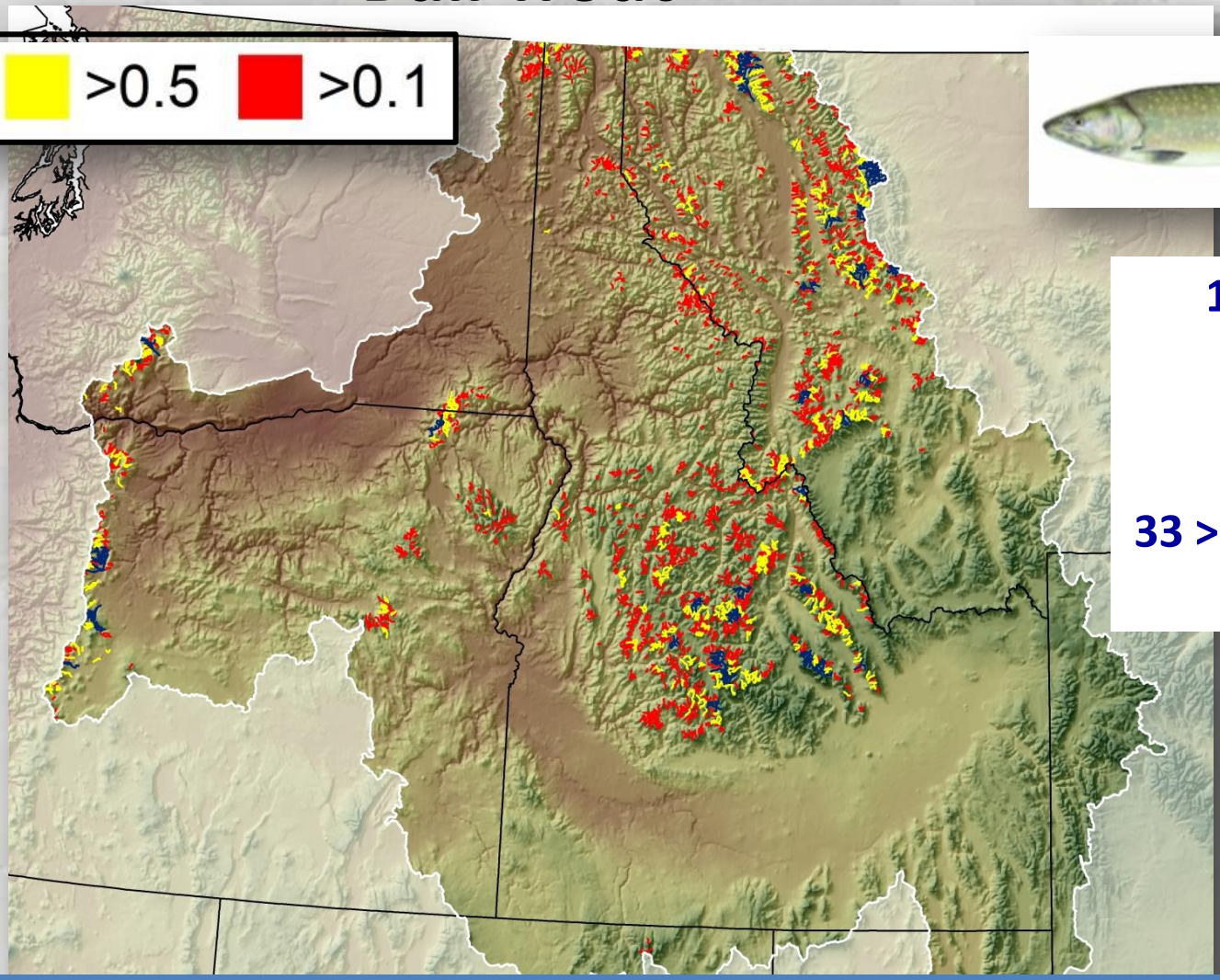
3,750 CW habitats

225 > 0.9 habitats (climate refugia??)

Isaak, D., M. Young, D. Nagel, D. Horan, and M. Groce. 2015. The cold-water climate shield: Delineating refugia for preserving salmonid fishes through the 21st Century. Global Change Biology 21 doi:10.1111/gcb.12879

Occurrence Probability Map – 2080 (future)

Bull Trout



1,973 CW habitats (⇩47%)

33 > 0.9 habitats (⇩85%)

Isaak, D., M. Young, D. Nagel, D. Horan, and M. Groce. 2015. The cold-water climate shield: Delineating refugia for preserving salmonid fishes through the 21st Century. Global Change Biology 21 doi:10.1111/gcb.12879

Implications & adaptation for the future

- Prospects
- Actions (in situ)

Bull Trout	Cutthroat Trout
Severe habitat losses & range contraction	Substantial habitat losses & range shrinkage
Extinction debts & risky investments	Still widely distributed
Still some resilient habitats	Many suitable habitats, but many at risk from nonnative species
Prioritize cons/restoration	Prioritize cons restoration
Community conservation	**Remove nonnatives**
	Isolate habitats?

Feature:
FISHERIES MANAGEMENT

Native Fish Conservation Areas: A Vision for Large-Scale Conservation of Native Fish Communities

Jack E. Williams, Richard N. Williams, Russell F.

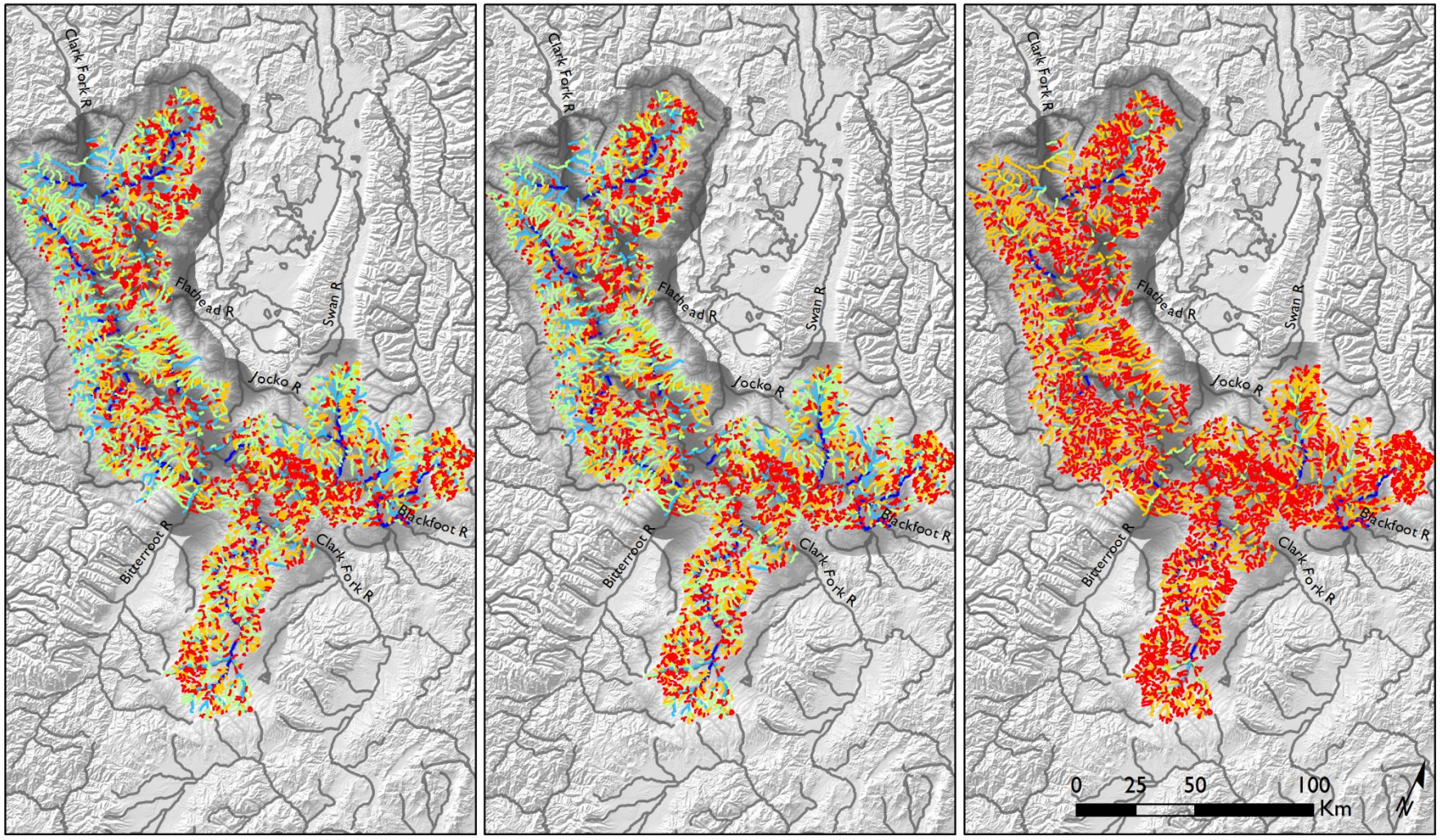
Áreas para la Conservación de Peces

Lolo National Forest Watershed Vulnerability Assessment

Modeled Mean Summer Flow (MS)

Mean Summer Flow (cfs)

- 0.0 - 0.5
- 0.6 - 1.0
- 1.1 - 5.0
- 5.1 - 50.0
- 50.1 - 428.6

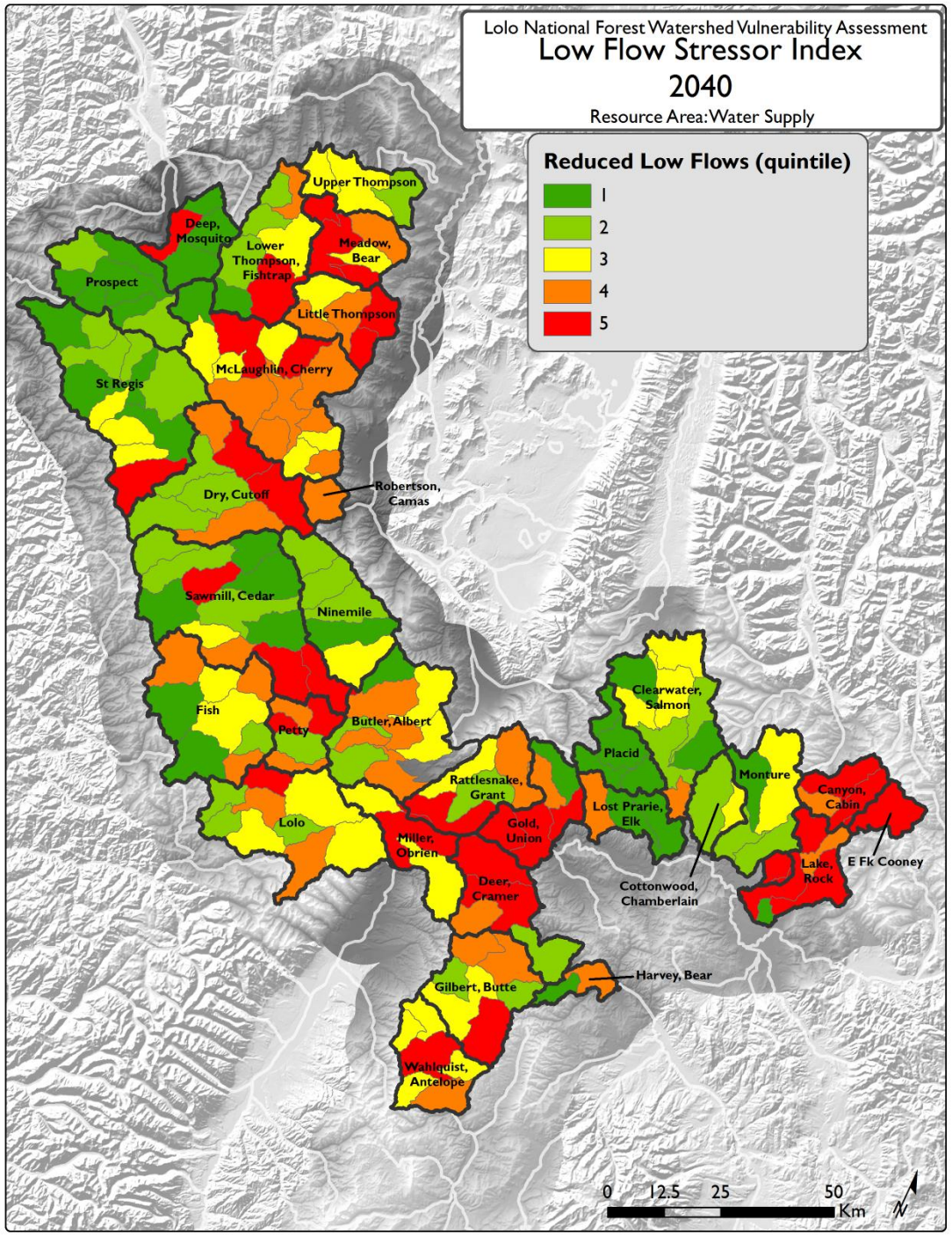


Resource Area:
Water Supply

What does these mean to our diversions?

Do different diversion locations and number of water rights affect strategies?

Red = highest stress (sensitivity)

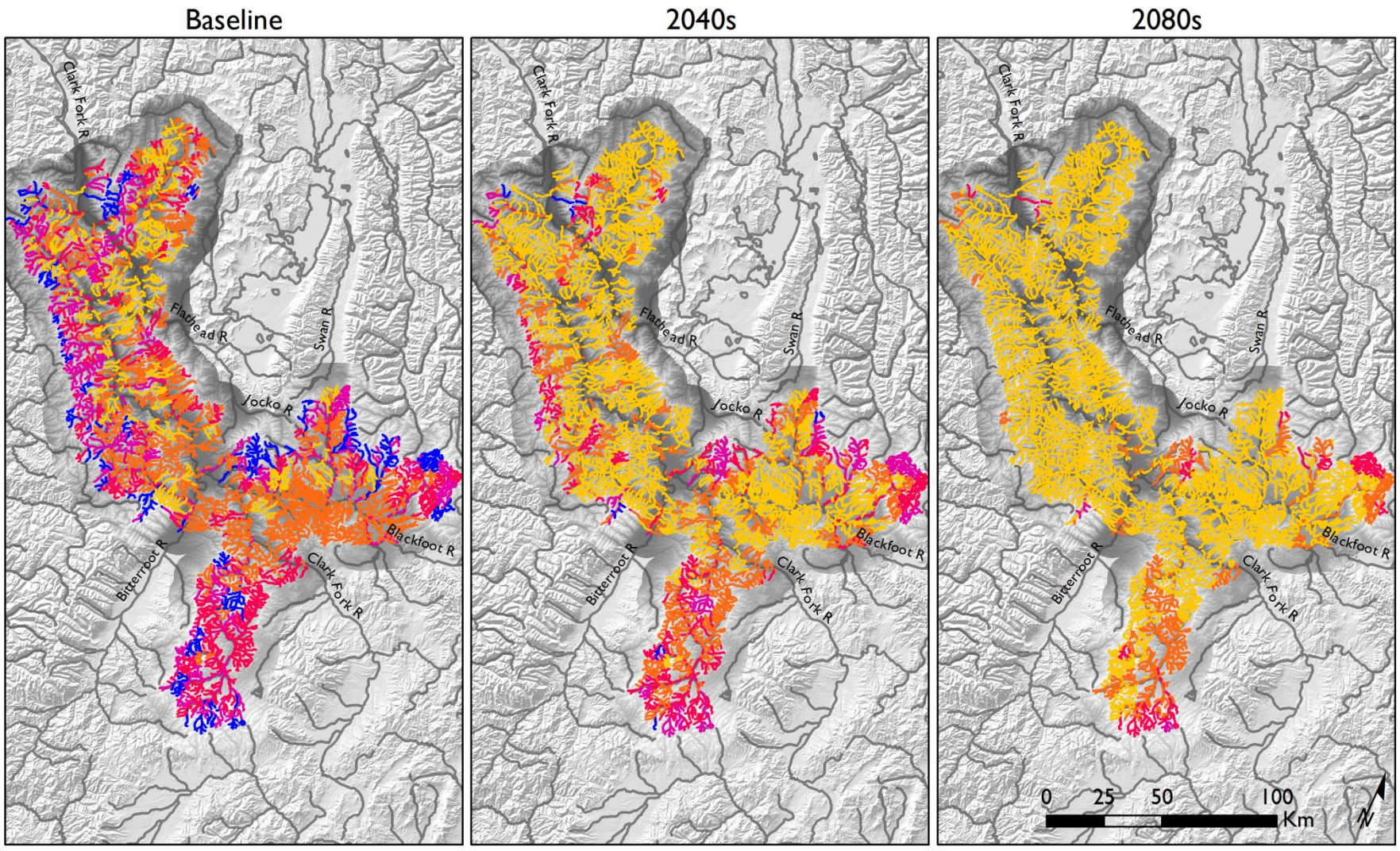


Lolo National Forest Watershed Vulnerability Assessment

Modeled Flow Timing (CFM)

Center of Flow (day of the year)

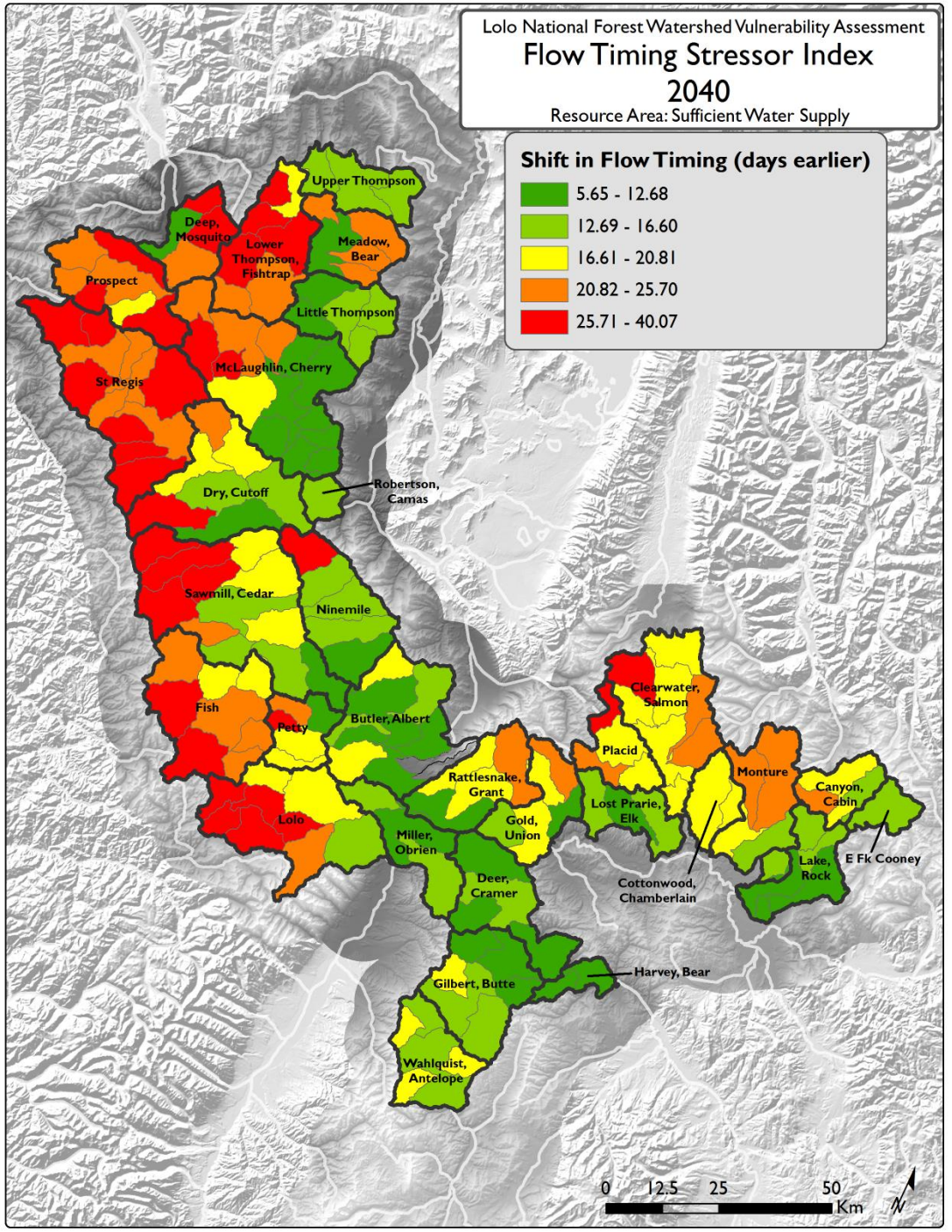
- 147 - 178 (earlier)
- 179 - 193
- 194 - 210
- 211 - 227
- 228 - 255 (later)



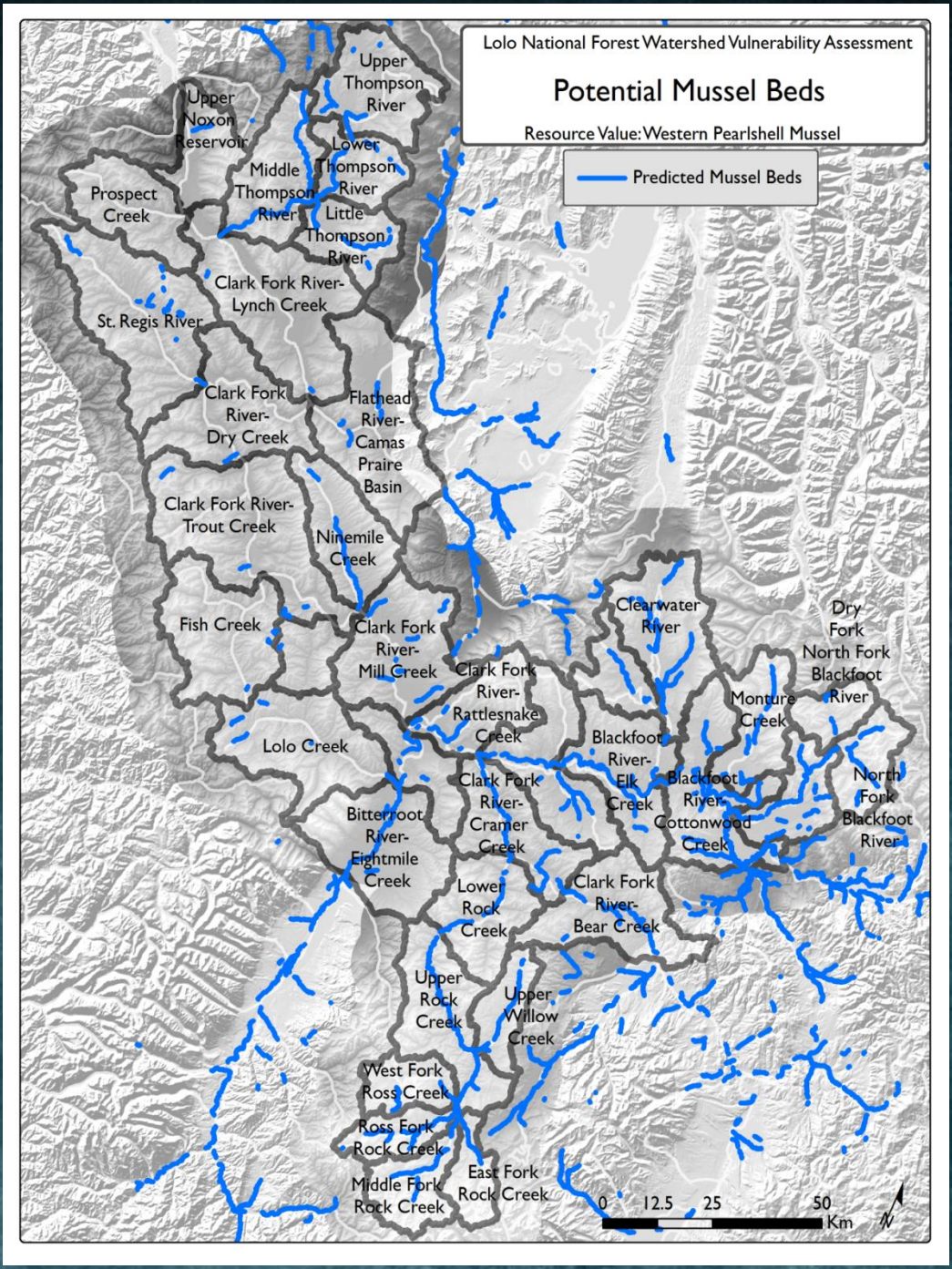
Flow Timing Changes

Reservoir operations – we are writing language now in leases, will it work in the future, do we build in flexibility?

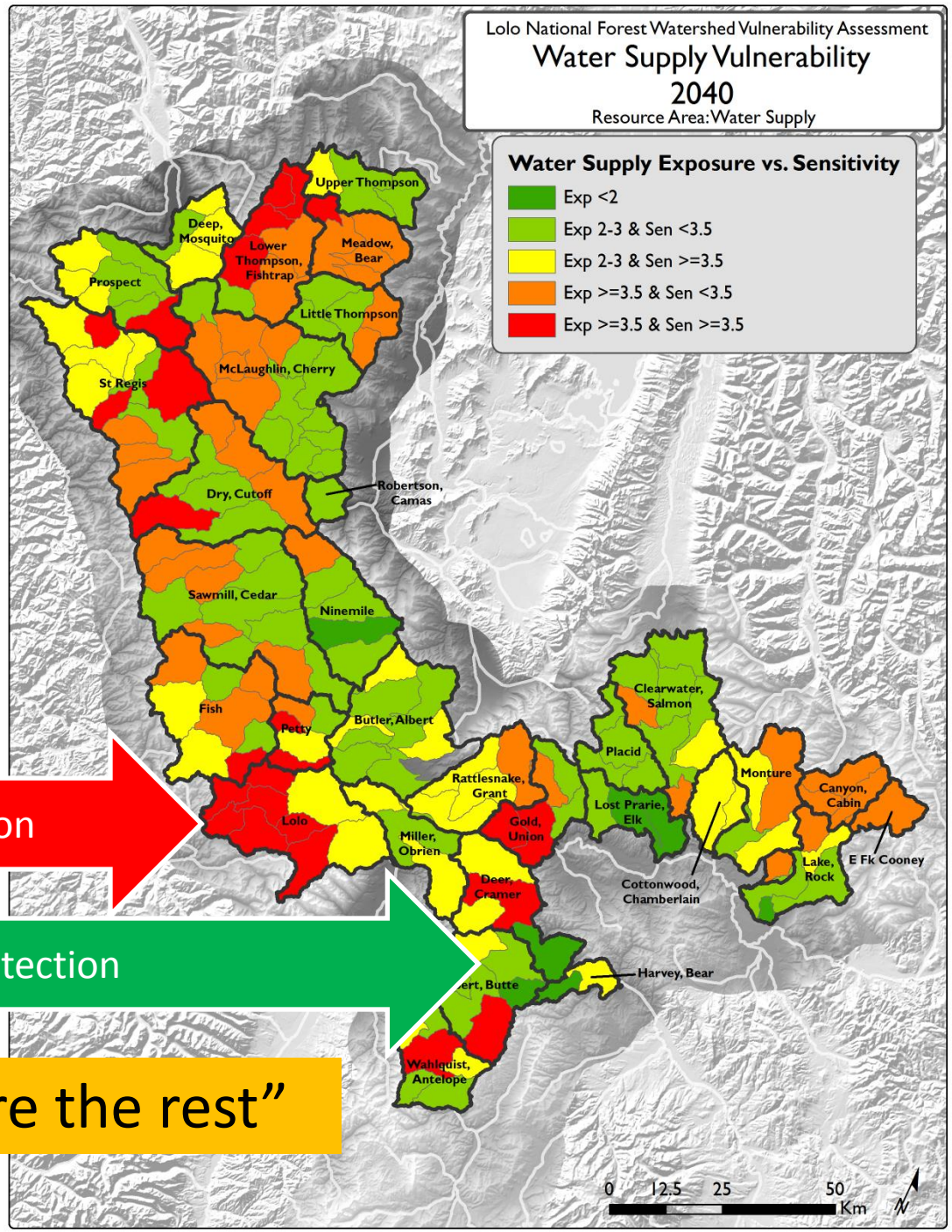
Other timing considerations?



Pearshell Mussel?



Resource Area:
Water Supply

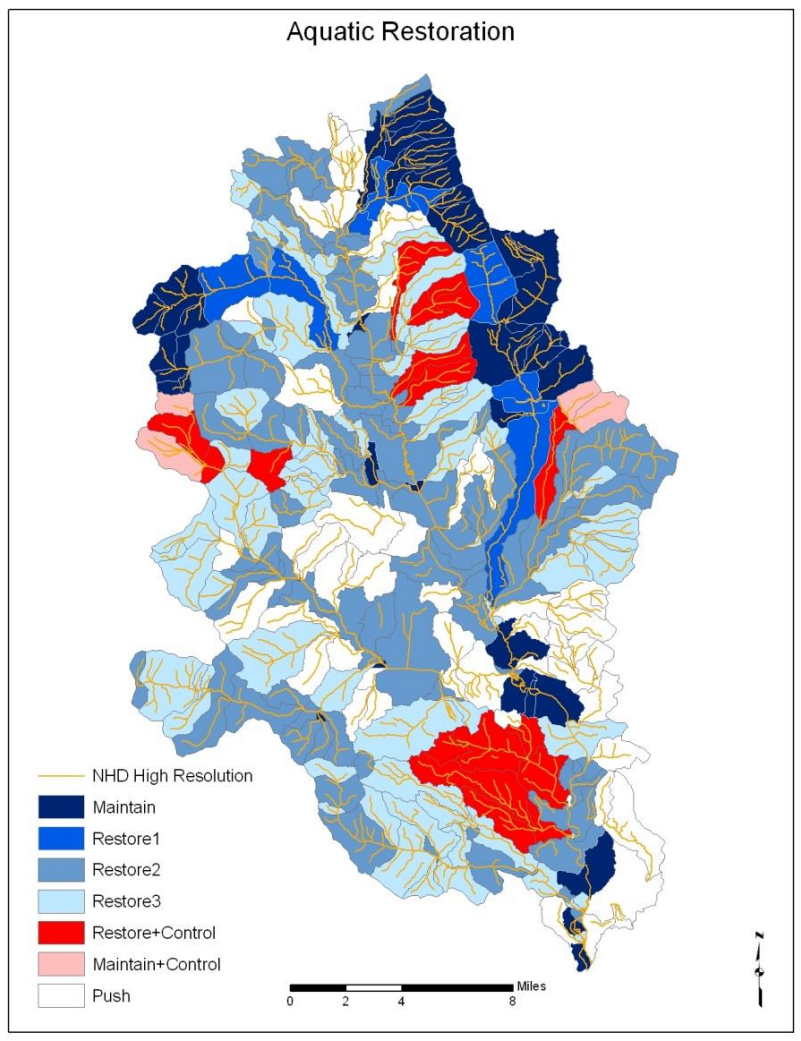


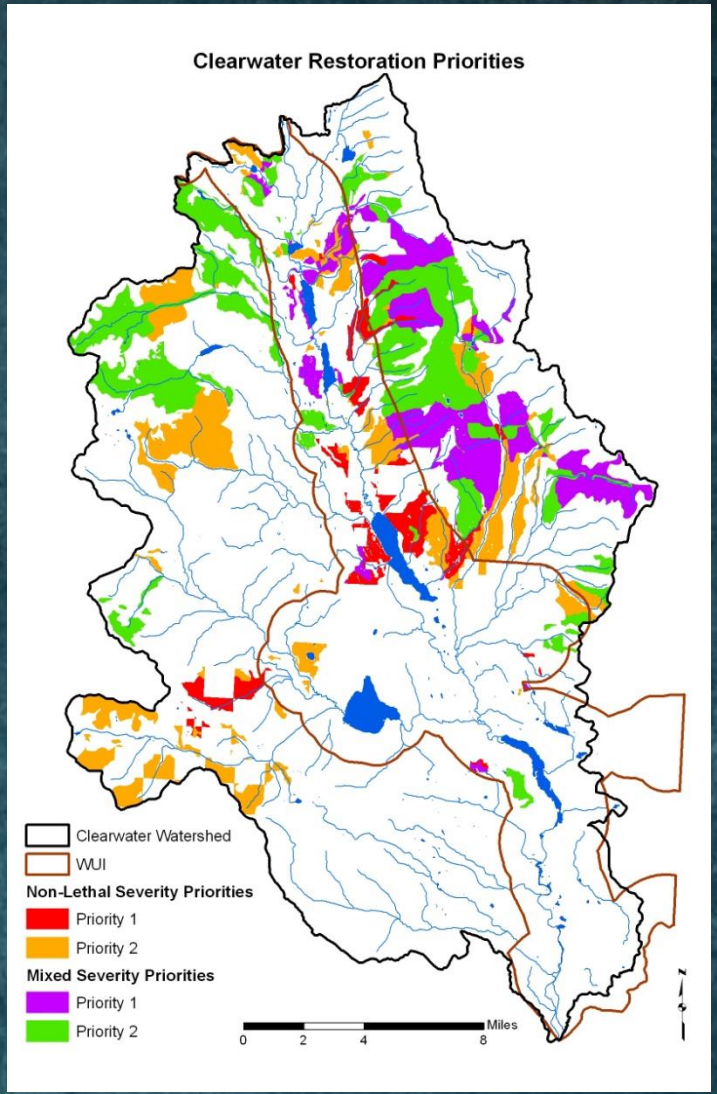
Potential priority mitigation action

Potential priority protection

"Protect the best, restore the rest"

Managing Forests and Water

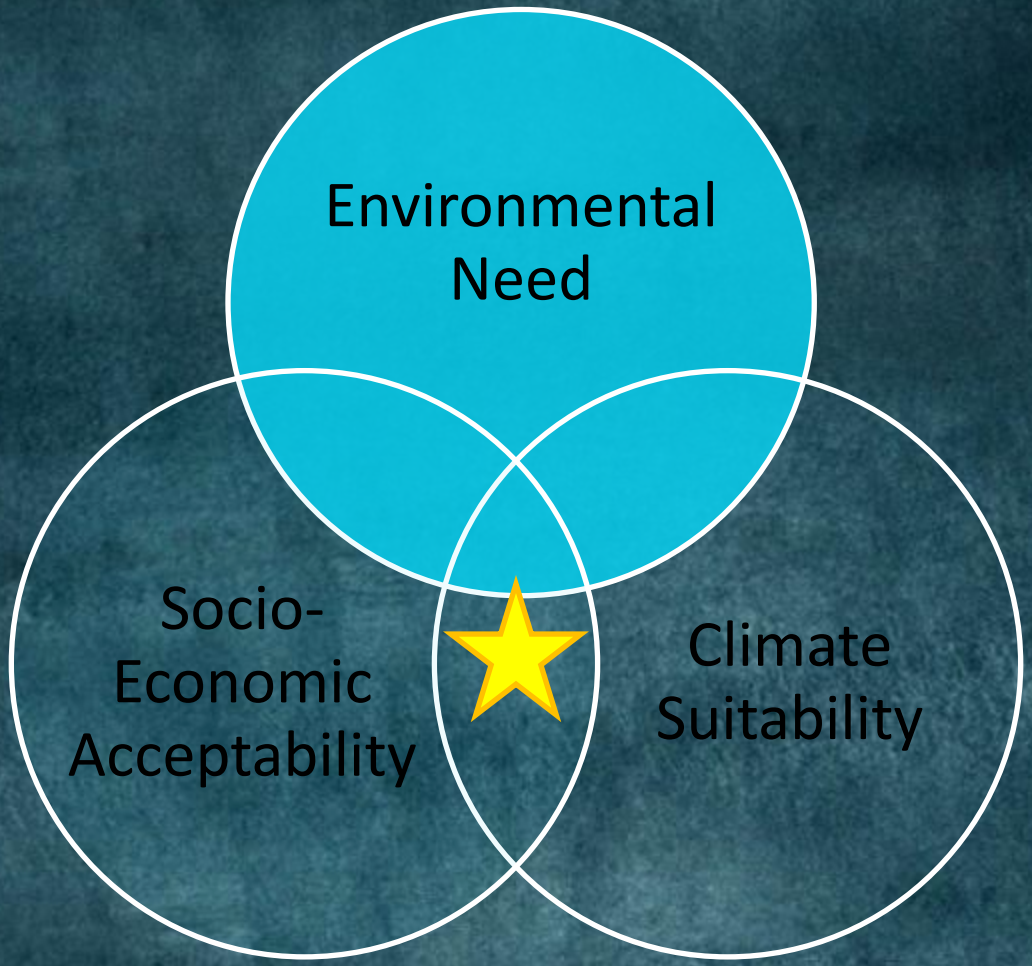


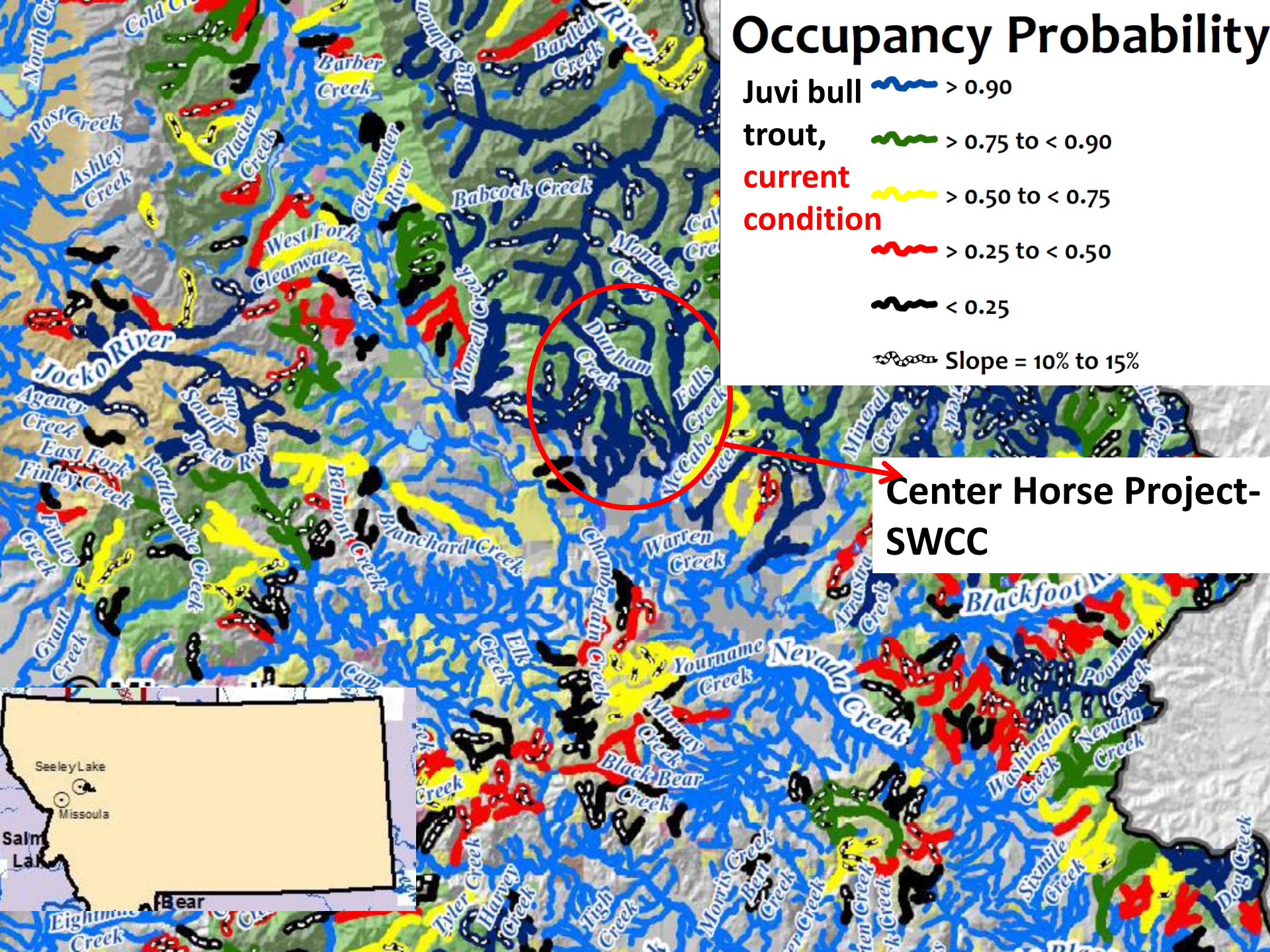


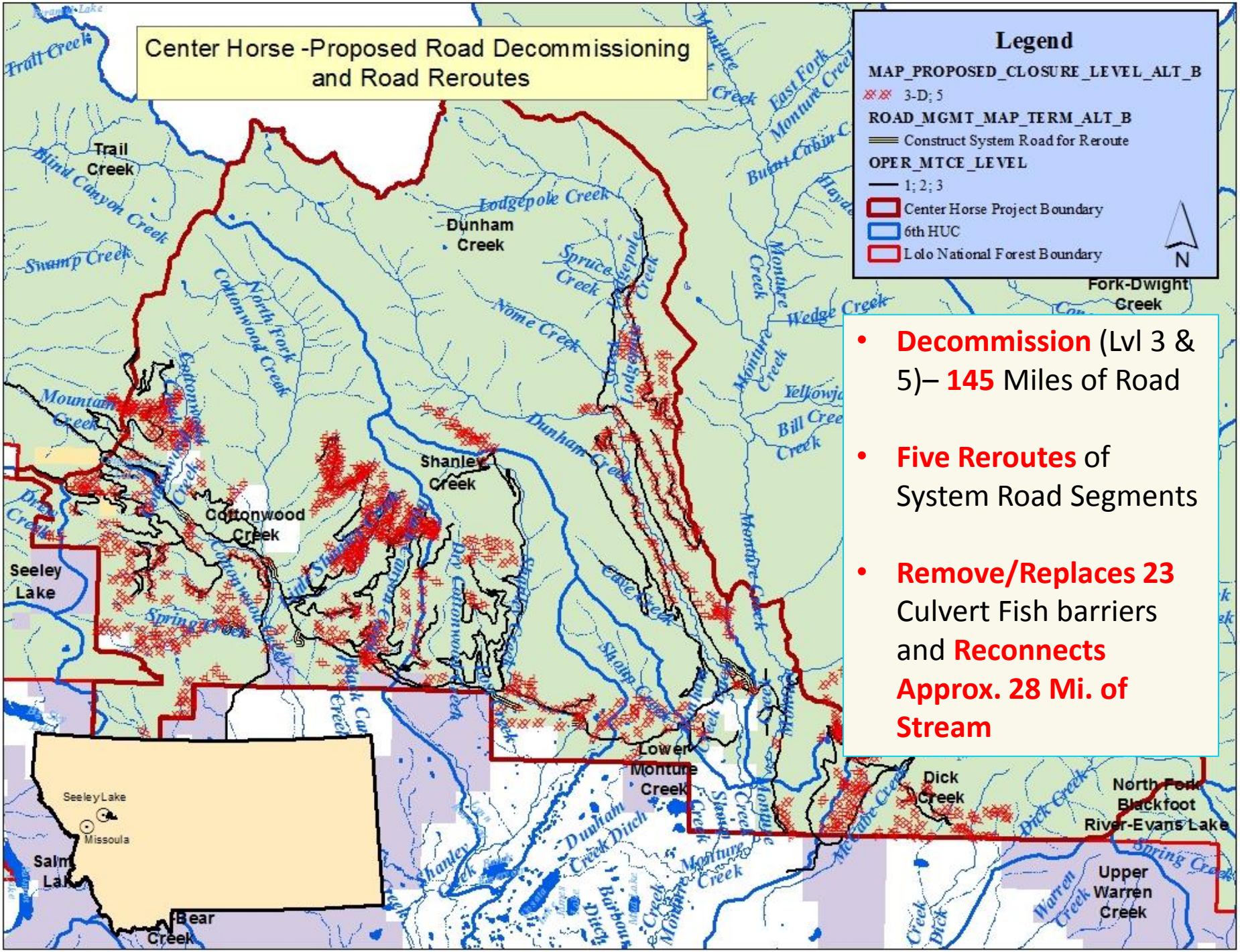
Different Resources have varying priority areas. Comparing priority and significance is critically important

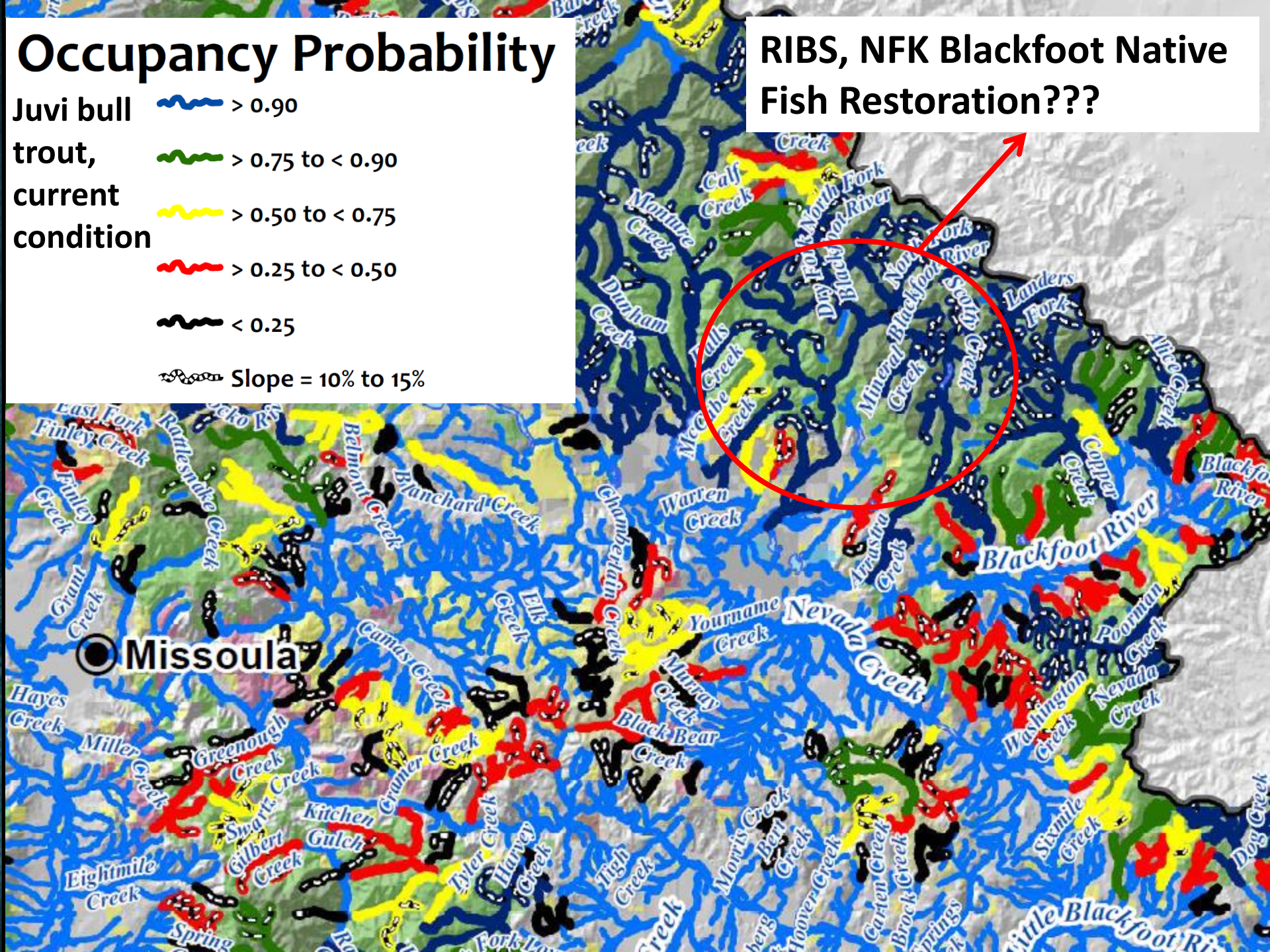
Watershed Restoration Goal

Sustaining Ecologic Integrity




Occupancy Probability
Juvi bull trout, current condition
> 0.90
> 0.75 to < 0.90
> 0.50 to < 0.75
> 0.25 to < 0.50
< 0.25
Slope = 10% to 15%
Center Horse Project-SWCC
Seeley Lake
Missoula
Bear
Jocko River
Clearwater River
West Fork Clearwater River
Blackfoot
Nevada Creek
Barber Creek
Glacier Creek
Babcock Creek
Morrell Creek
Dunham Creek
Falls Creek
McCabe Creek
Mineral Creek
Warren Creek
Blanchard Creek
Belmont Creek
Rattlesnake Creek
Chamberlain Creek
Yourname Creek
Murray Creek
Black Bear Creek
Elk Creek
Grant Creek
Finley Creek
East Fork Finley Creek
Agency Creek
South Fork Jocko River
Ashley Creek
Post Creek
Bartlett Creek
Big Creek
Arrastra Creek
Poorman Creek
Washington Creek
Sixmile Creek
Dog Creek
Morris Creek
Bert Creek
Harvey Creek
Tyler Creek
Tigh Creek


Center Horse -Proposed Road Decommissioning and Road Reroutes
Legend
MAP_PROPOSED_CLOSURE_LEVEL_ALT_B
3-D; 5
ROAD_MGMT_MAP_TERM_ALT_B
Construct System Road for Reroute
OPER_MTCE_LEVEL
1; 2; 3
Center Horse Project Boundary
6th HUC
Lolo National Forest Boundary
N
Trail Creek
Dunham Creek
Shanley Creek
Cottonwood Creek
Seeley Lake
Lower Monture Creek
Dick Creek
North Fork Blackfoot River-Evans Lake
Upper Warren Creek
Bear Creek
Missoula
Fork-Dwight Creek
• Decommission (Lvl 3 & 5)– 145 Miles of Road
• Five Reroutes of System Road Segments
• Remove/Replaces 23 Culvert Fish barriers and Reconnects Approx. 28 Mi. of Stream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> 0.25 to < 0.50
< 0.25
Slope = 10% to 15%
RIBS, NFK Blackfoot Native Fish Restoration???
Missoula
Blackfoot River
Nevada Creek
Monture Creek
Calf Creek
Dunham Creek
Falls Creek
McCabe Creek
Mineral Creek
Scotty Creek
Landers Fork
Copper Creek
Warren Creek
Arrastra Creek
Yourname Creek
Murray Creek
Black Bear Creek
Poorman Creek
Washington Creek
Sixmile Creek
Dog Creek
Little Blackfoot River
Rattlesnake Creek
Belmont Creek
Blanchard Creek
Chamberlain Creek
Elk Creek
Camas Creek
Cramer Creek
Kitchen Gulch
Tyler Creek
Harvey Creek
Tigh Creek
Morris Creek
Bert Creek
Hoover Creek
Garden Creek
Brock Creek
Grant Creek
Hayes Creek
Miller Creek
Greenough Creek
Swartz Creek
Gilbert Creek
Eightmile Creek
Finley Creek
East Fork Finley Creek

Native Trout Restoration in the upper North Fork of the Blackfoot River

- 100 square mile drainage.
- 18 perennial streams (116 miles, 45 miles fish bearing).
- Large natural barrier at the bottom.
- The upper North Fork is remote, high elevation, pristine setting with a complex inter-connected system of streams and lakes.
- Historic lake plants of *Oncorhynchus* hybrids (70-98% rainbow) are now present in low abundance throughout the system.
- Pure WCT and bull trout nearest neighbors could provide donor stocks.

LWD Reintroduction?

Cedar Creek, Lolo NF

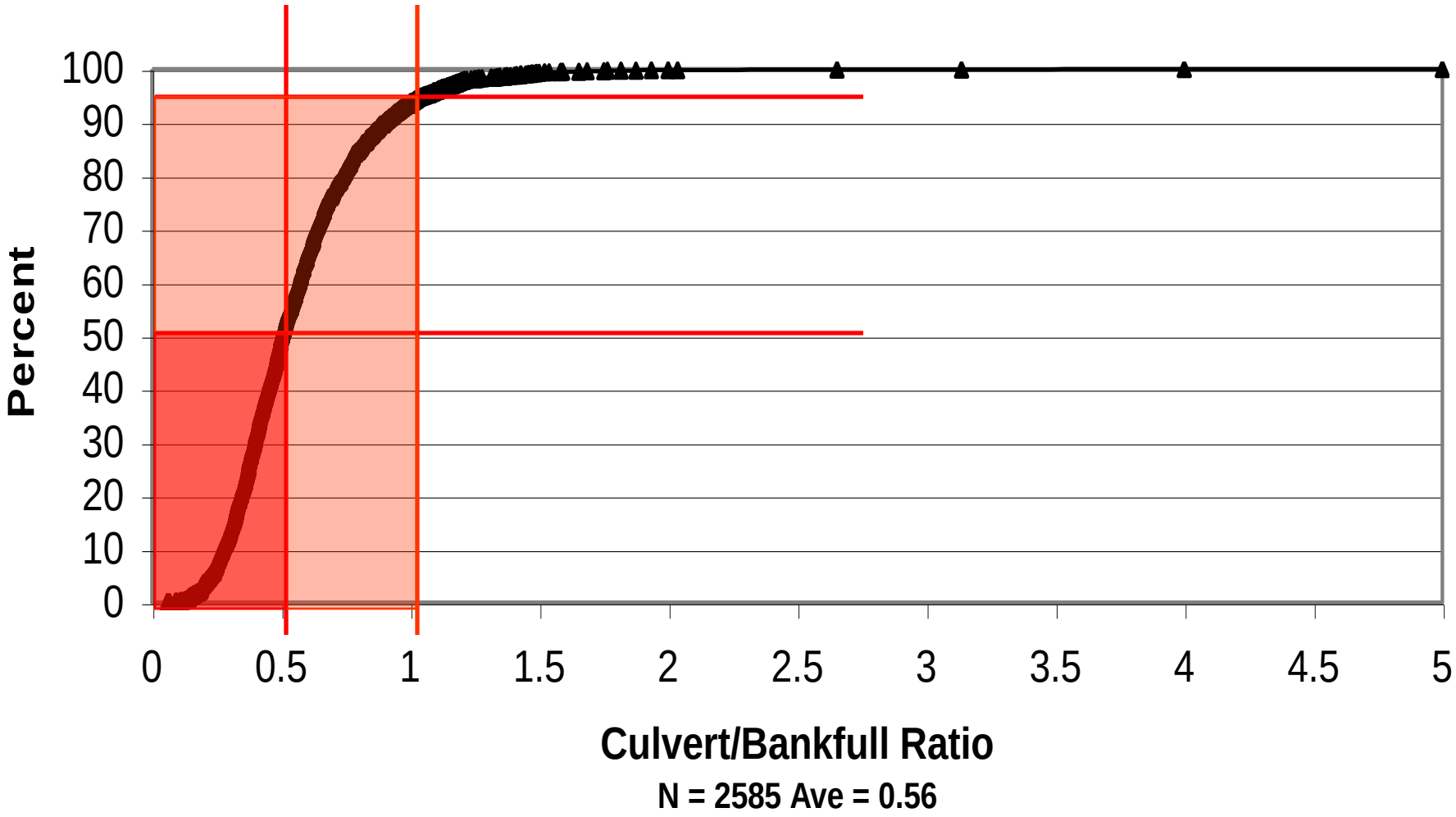
- Instream wood recovery may be limited by near-stream roads
- Sites <30m from a road had 26% fewer pieces of total wood
- Significant legacy effect by road presence equating to long recruitment delays or preclusion

(Christy Meredith, Brett Roper, and Eric Archer (2014) Reductions in Instream Wood in Streams near Roads in the Interior Columbia River Basin, North American Journal of Fisheries Management, 34:3, 493-506)

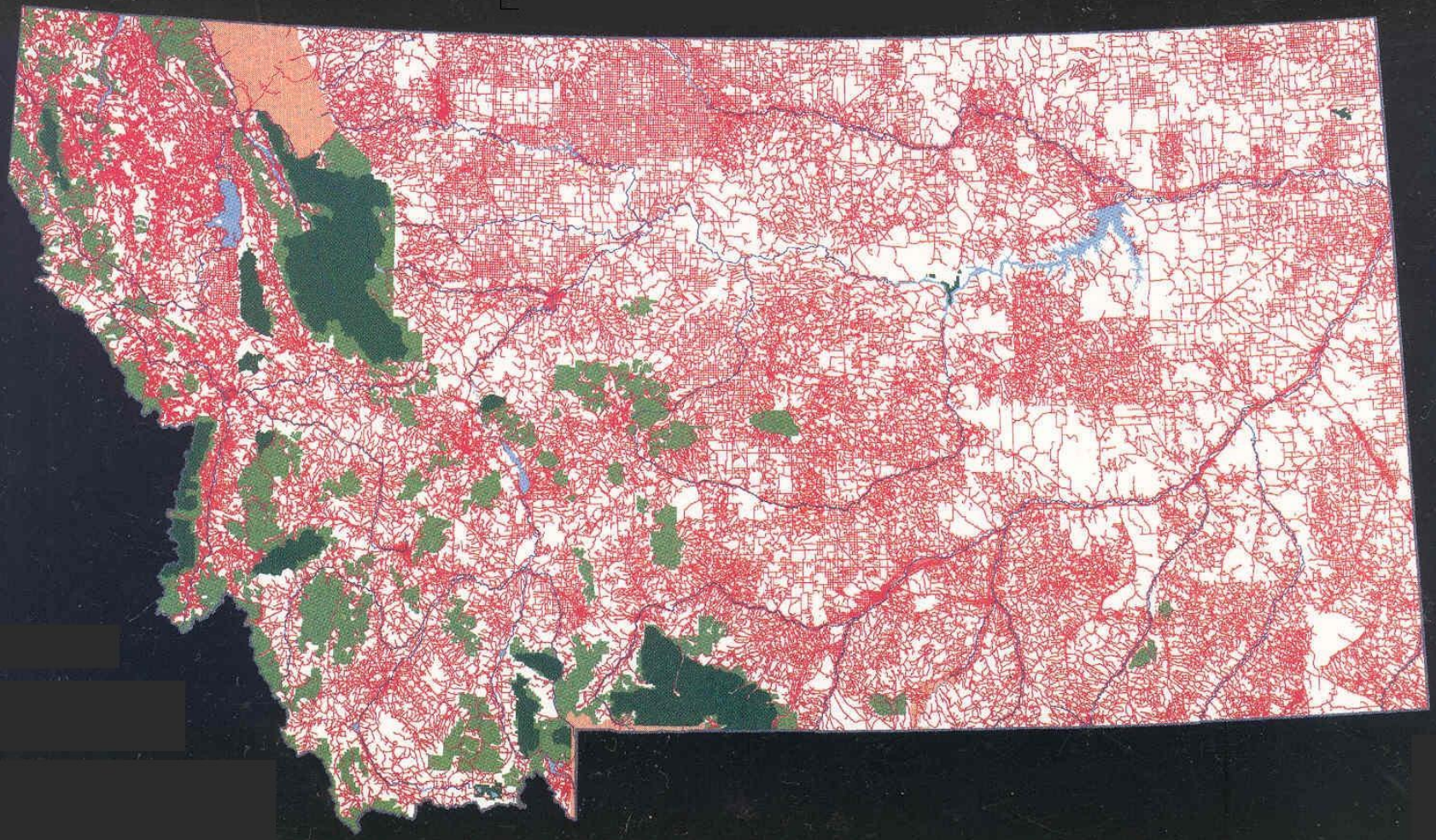
Johnson Creek Bridge, Bitterroot NF

Johnson Creek is tributary to the upper West Fork Bitterroot River. Its headwaters form part of the “climate shield” of cold water refugia in the Bitterroot River basin. Historically, Johnson Creek provided 3+ miles of spawning and rearing habitat for bull trout and westslope cutthroat trout. Access to that habitat is impaired because of a double culvert crossing at the mouth of Johnson Creek (photo on the left) that is at least a partial barrier to the upstream movement of fish. This project would remove those barrier culverts and replace them with a new bridge, similar to the one shown in the photo below.

Cumulative Precent Distribution of Surveyed Culvert/Bankfull Ratios for the Northern Region - 5/12/2005



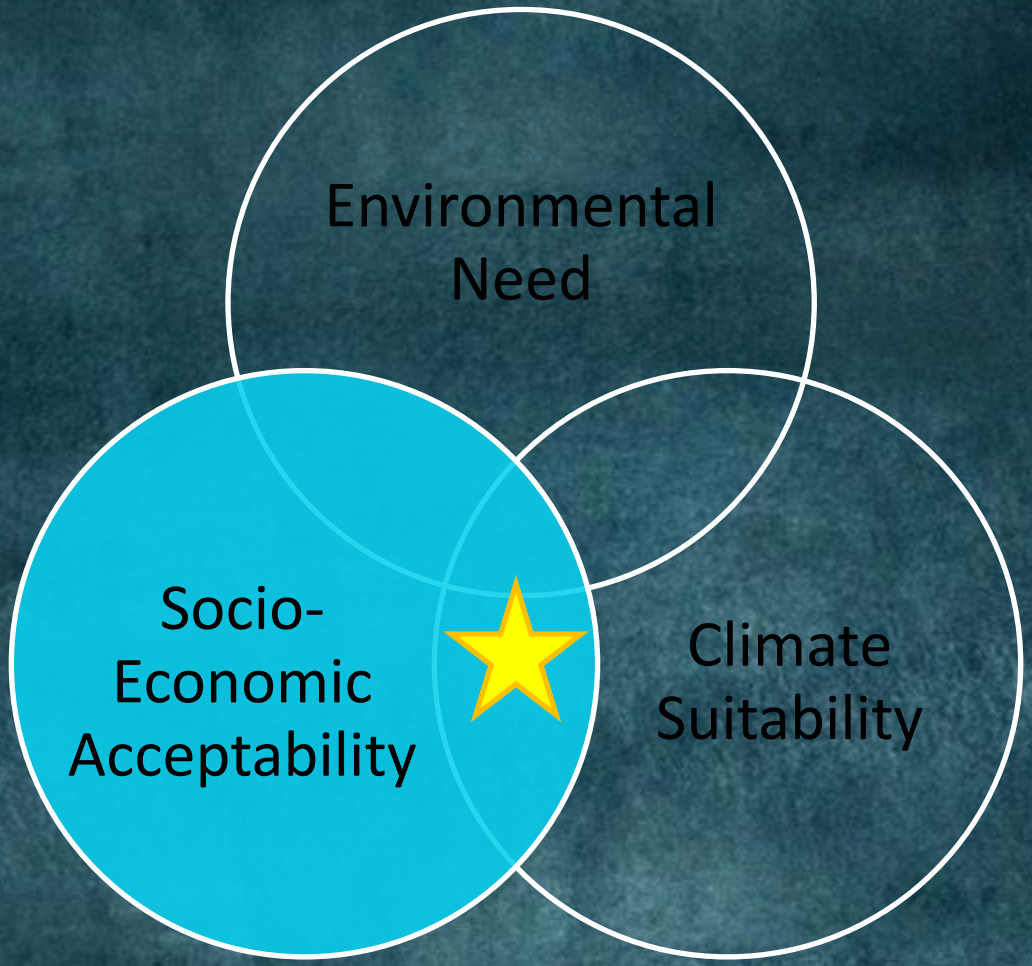
Got Roads? Inventory? Priorities?



How do we address Pre- and Post-Wildfire conditions?

Watershed Restoration Goal

Sustaining Ecologic Integrity



Socio-Economics

- Social Ecosystem: culturally defined geographic area within which people manage their lives and resources

Socio-Economic Well-Being

Permanence & Diversity

Lifestyle, economic options, stability, predictability, control, participation

Productive Harmony

Human-Physical, Ecosystem Balance

Physical Environment Well-Being

Permanence & Diversity

Sustainability, multiple use, genetic diversity

(Preister and Kent, 1997)

Socio-Economics/Collaboration

Proposed categories of performance measures to think about:

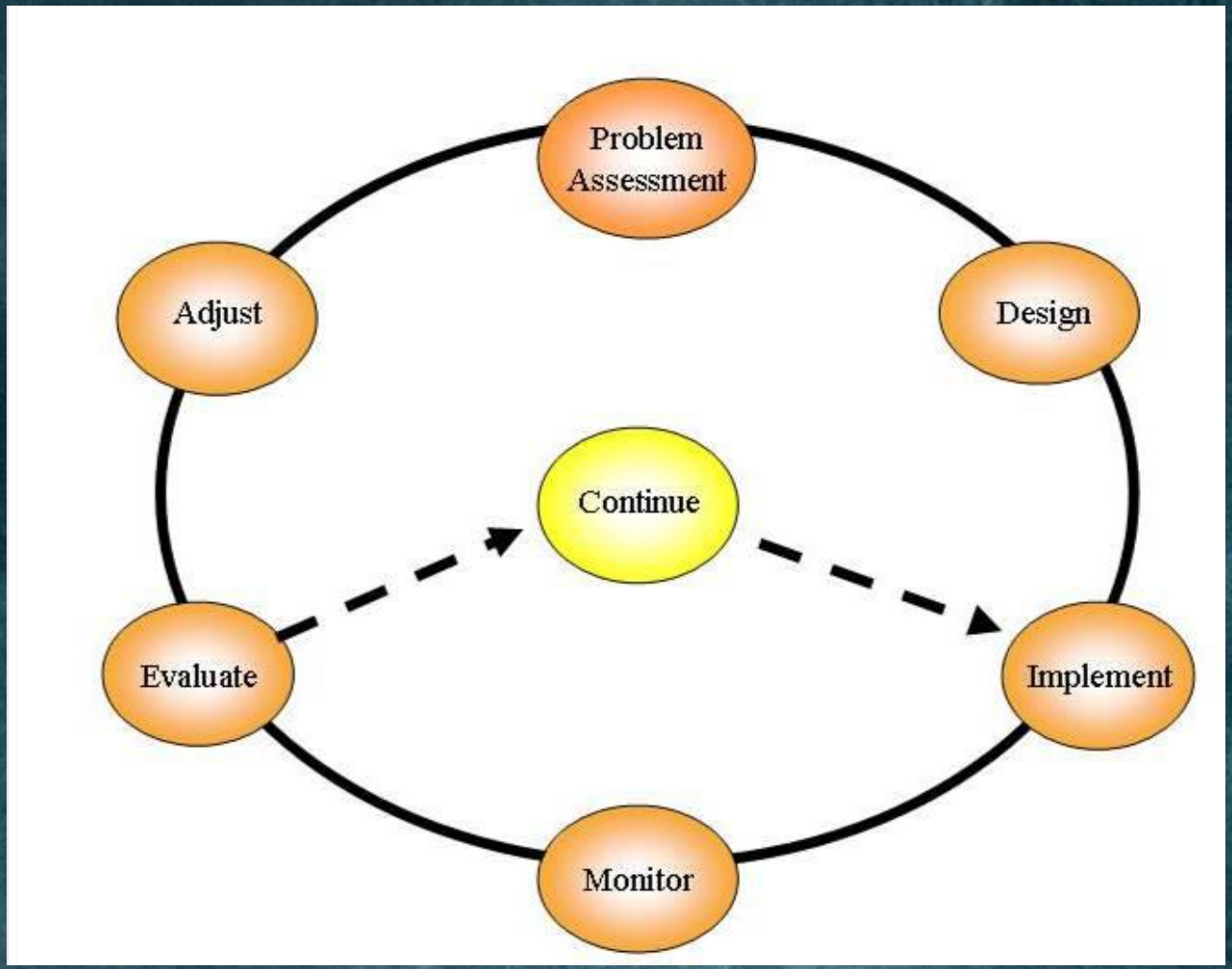
1. Adaptive capacity
- Collaboration and process
- Community capacity
- Local business capacity

CASSANDRA MOSELEY, EMILY JANE DAVIS, AND MICHELLE MEDLEY-DANIEL (2012)

2. Economic benefits
- Jobs created or retained (or changed)
- Support of “high” job quality

3. Social equity
- Local business opportunities
- Tribal engagement
- Investments in socially vulnerable watersheds? Do we?

The Final "W": What The?
Adaptive Management



Adaptive Management

- Adaptive management is an organized and documented undertaking of goal-directed actions while evaluating their results to determine future actions.

- Simply stated, adaptive management is doing, while learning in the face of uncertain outcomes.

- Not one size fits all

- Must find ways to do it….feasibility

Summary

- In our Rush of Restoration, will our approaches serve future generations?
- Are we performing “Random Acts of Restoration” and how can we avoid our projects becoming Relics of the Past?
- How can help assure sustainability and address the uncertainty?