Integrated Status and Effectiveness Monitoring Program -- Anadromous salmonids of the Interior Columbia River Basin

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Actual work on the project done by ~100 collaborators

BPA Project 2003-0017

ISEMP Objectives

Subbasin-scale Monitoring Design

- Programmatic coordination, design, planning and implementation
- Indicators and metric development and testing
- Protocol development, refinement and testing
- Sampling design development and testing
- Effectiveness and status and trend monitoring experimental design and implementation

Program-scale Monitoring Design

- Evaluation tools development and testing
- Data management tools development and testing

www.nwfsc.noaa.gov/research/divisions/cbd/mathbio/isemp

Common goals shared by many groups or agencies in the Northwest:

- Assess and manage salmonid populations and their aquatic habitat
- Restore human impacted aquatic habitat
- Be cost effective
- Be accountable

Common objectives not shared well by agencies in the Northwest:

- 2000 FCRPS Biop RME RPAs
- 2004 FCRPS Biop UPA
- Recovery Planning

Are these goals and objectives contradictory or mutually exclusive?

- Assessment takes data, but monitoring is expensive, so how can we be cost effective?
- Restoration takes money, but so does monitoring, so if we monitor, won't we do less restoration?
- Resource assessment monitoring doesn't address habitat restoration project impacts, so how can we be accountable?

All you have to do is design a program that balances cost, learning, management needs, restoration goals, and accountability?

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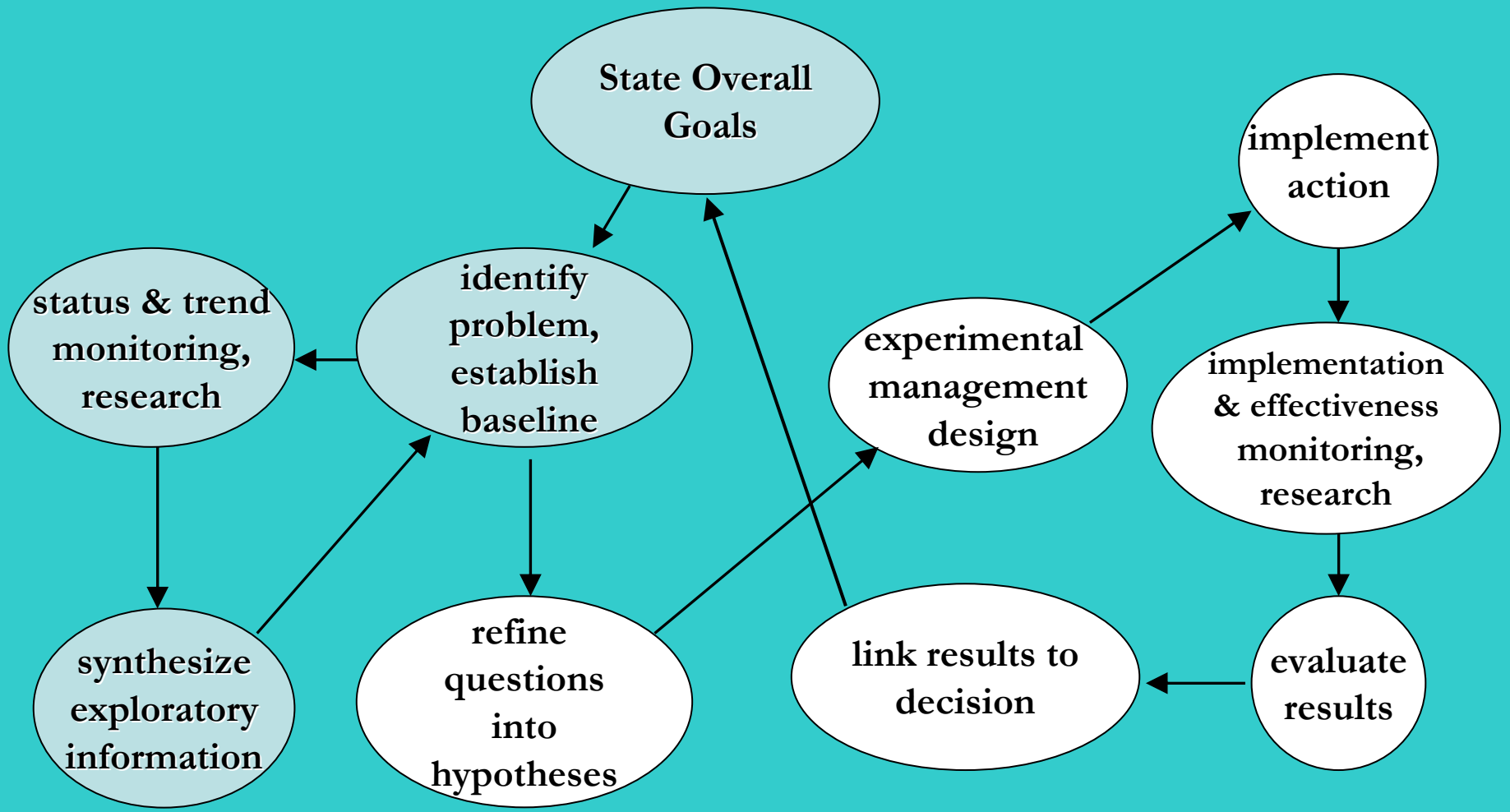
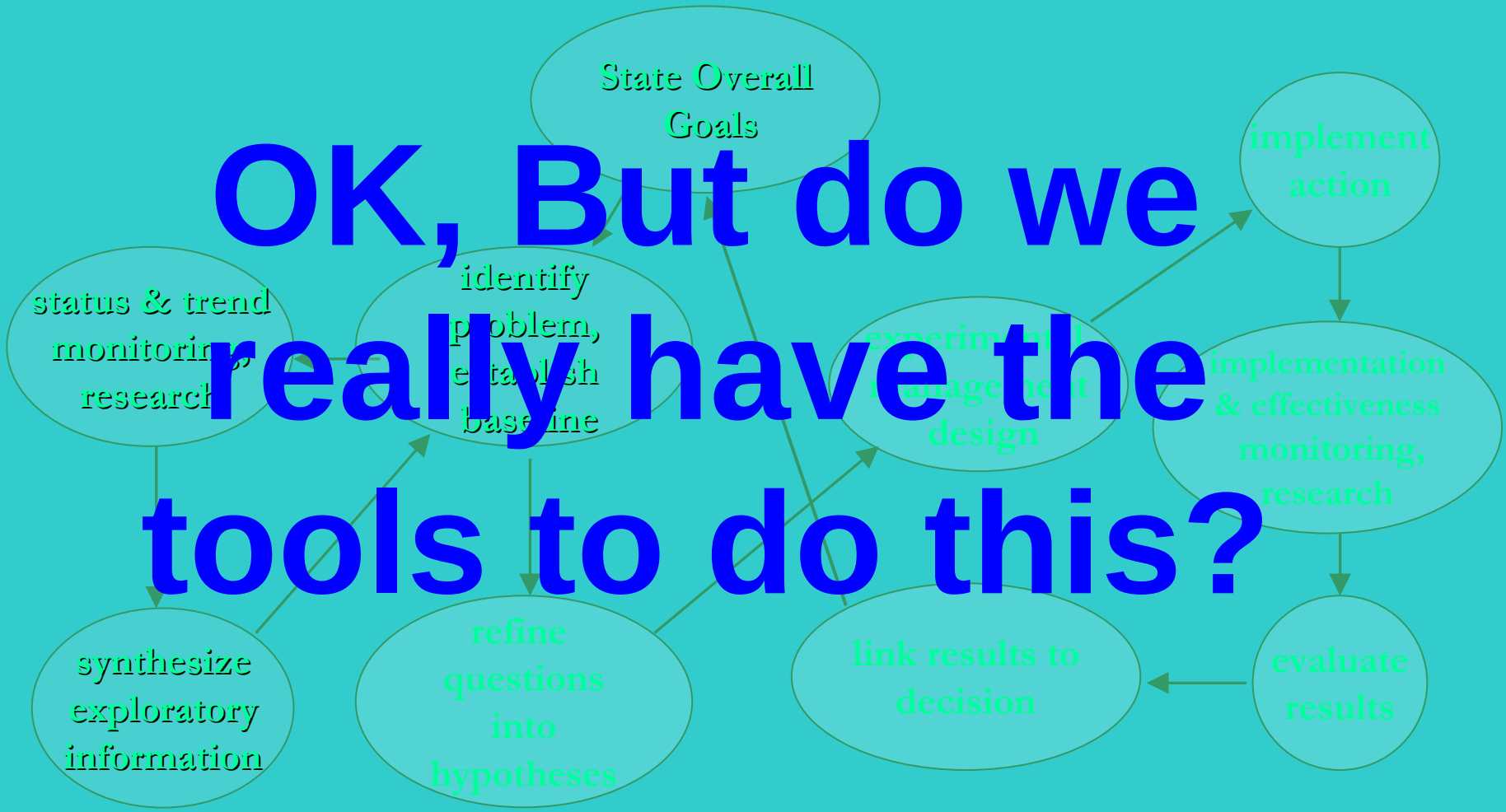


All you have to do is design a program that balances cost, learning, management needs, restoration goals, and accountability?



OK, But do we really have the tools to do this?

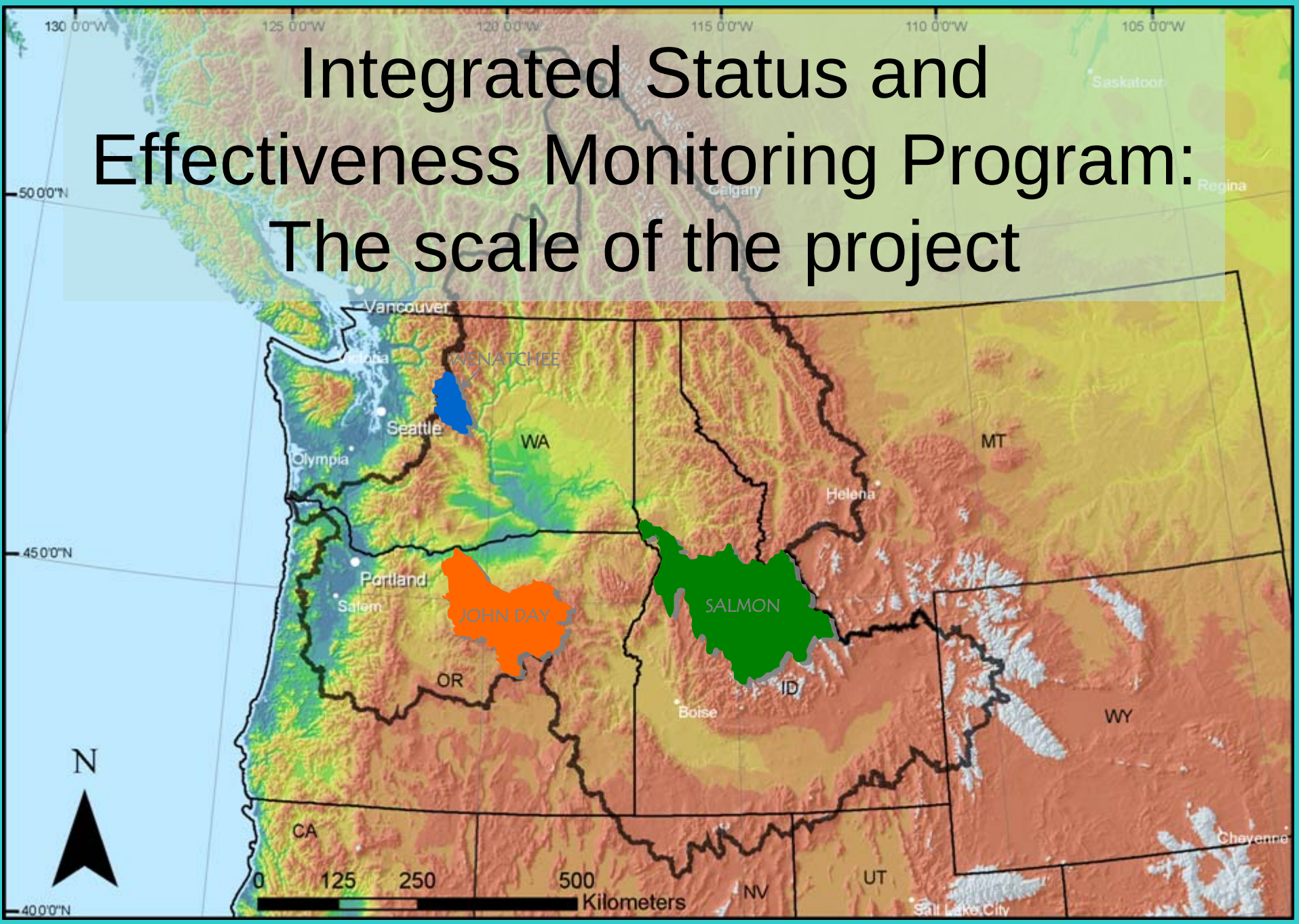
Integrated Status and Effectiveness Monitoring Program

- Test a ‘novel’ structure for RME programs that integrates across scales and programs
- Test protocols and indicators for information content (relative to ESA fish population processes)
- Test sampling designs for robustness and efficiency
- Test the community of practitioners’ willingness to try something different
- Develop tools (data management and analysis) for general distribution

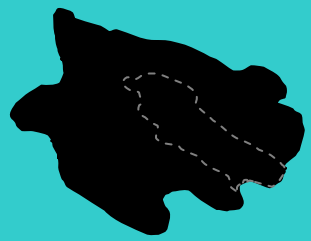
Integrated Status and Effectiveness Monitoring Program

- Deliver RME guidance that integrates across scales and programs
- Deliver assessments of protocols and indicators for information content (relative to ESA fish population processes)
- Deliver sampling design assessment for robustness, efficiency, practicality
- Demonstrate and expand the community of practitioners' willingness to try something different
- Deliver tools (data management and analysis) for general distribution and use

Integrated Status and Effectiveness Monitoring Program: The scale of the project



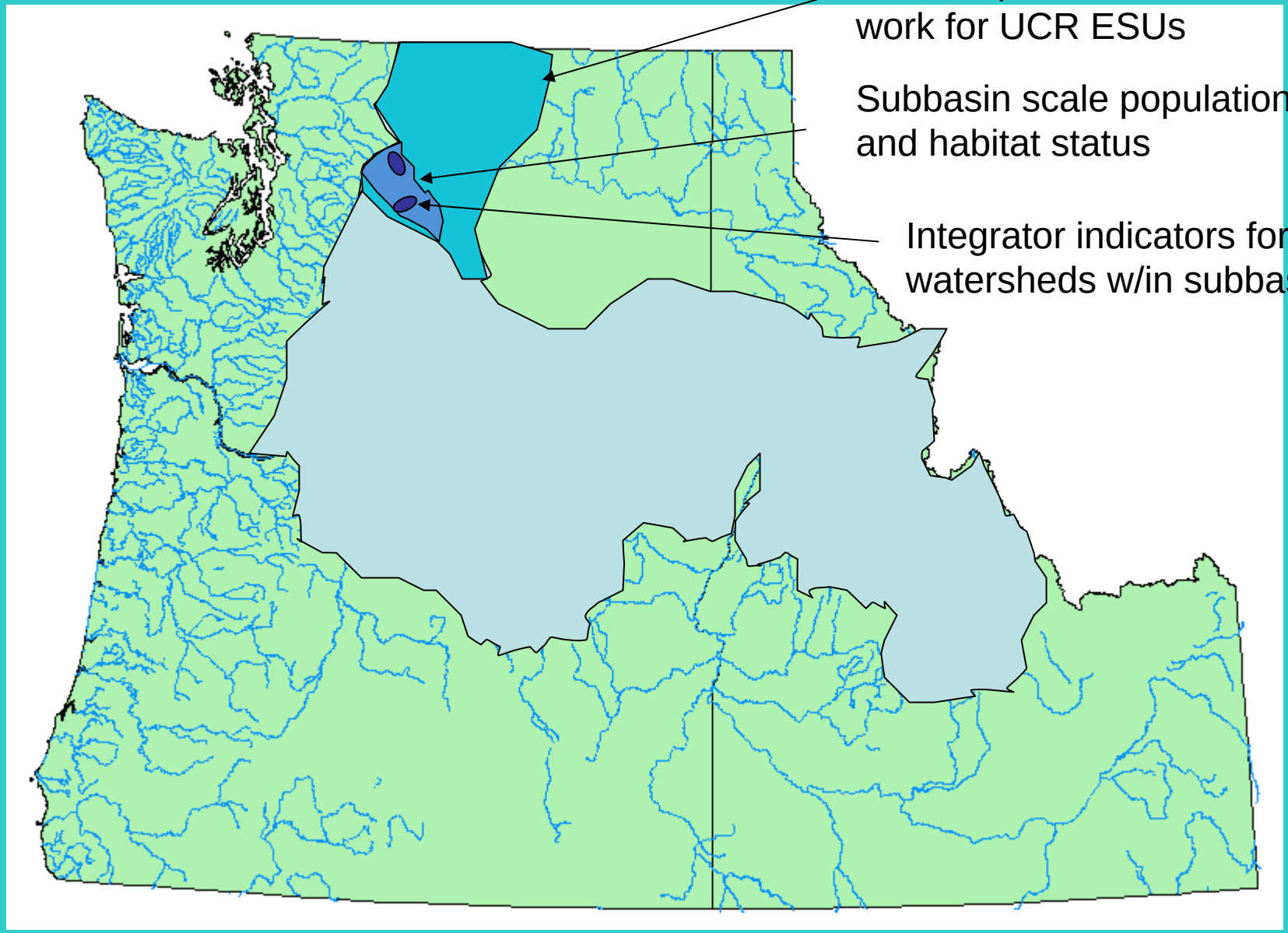
The other scale of the project…

spatial scale (m)	Scale Hierarchy	Biological Hierarchy
10^5-10^6	 basin (*John Day*)	population (*John Day spring Chinook*)
	 subbasin (*Middle Fork John Day*)	sub-population (MF *John Day spring Chinook*)
10^2-10^4	 watershed (*Long Creek*)	local groups
	 reach (*1 km of Long Creek*)	small groups or individuals
10^0-10^1	 monitoring and experimental sites	

Hierarchical monitoring program for salmonid populations, habitat and restoration actions in the Columbia River Basin

- Landscape classification – basin wide, decade scale
- Probabilistic sampling of reach scale stream habitat condition – annually at major subbasin scale
- Probabilistic sampling of juvenile density and adult spawning – annually at major subbasin scale
- Probabilistic sampling of headwaters streams as intersection between aquatic and terrestrial processes – single sampling episode (2-3 yrs) for each major ecoregion
- Watershed integration measures – continuously for several watersheds within each subbasin
  - Smolt trapping
  - Water quality/chemisty
- Oh yeah, and monitoring for restoration actions too…

Integrated Status and Effectiveness Monitoring Program



Why three pilot basins?

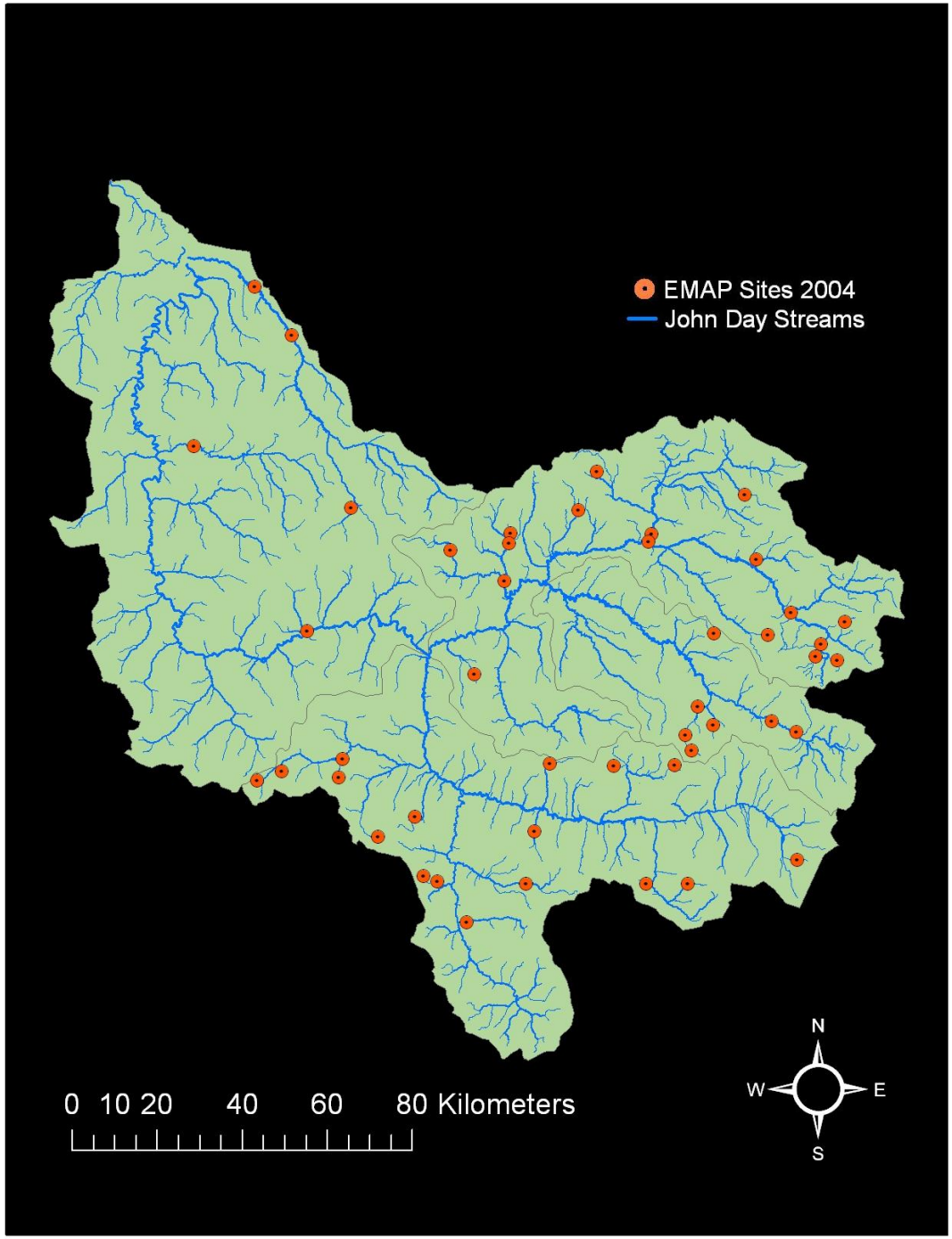
- Why such different approaches?
  - Geographic differences may dictate indicators
  - Institutional differences
    - Existing RME
    - Existing infrastructure/local management support
- Each pilot basin offers a unique set of opportunities and pathways
  - Data driven design (Wenatchee)
  - Model driven design (Salmon River)
  - Mechanism driven design (John Day River)
- But end result will be single monitoring design guidance

Integration with other projects is mutually beneficial

- Because project exists, other groups have joined in with support
  - USBoR
    - Landsat / Ikonos based LU/LC classification
    - SF John Day River population process work
  - NOAA
    - LiDAR data capture and analysis
    - Sediment process modeling in John Day River
    - PIT tag detection infrastructure
  - Chelan PUD
    - PIT tag deployment in UCR

Classification Components

- Ecological Classification of Upper Columbia ESUs. Developed GIS layers depicting those ecological classification systems in the following categories
  - ***Regional Setting Classification***
  - ***Drainage Basin Classification***
  - ***Road Classification***
  - ***Valley Segment Classification***
  - ***Strahler Stream Order***
  - ***Channel Gradient***
  - ***Channel Segment Classification***
  - ***Riparian Vegetation Classification***
  - ***Land Use / Land Cover (traditional and novel)***



Status Monitoring:

In 2004, ODFW began a monitoring program in the John Day River basin that mimicked their OCN Coho program:

- EMAP based site selection (50 sites in multiple panels)
- Stream habitat monitoring at each site
- Juvenile abundance estimates at each site
- Adult spawning surveys also based on spatial sampling program

Trying to balance: “copy your neighbor” and “we don’t know what we are doing” we are testing most aspects of the monitoring design process:

- Increasing spatial resolution.
- Duplicating indicators.
- Mixing spatial scales.
- Implementing new habitat quality assessment approaches.
- Testing ongoing data collection approach along side novel sampling trials.
- Performing “side-by-side” indicator and protocol tests for “standard” stream monitoring programs.
- Developing parallel data management and analysis.

Intensively Monitored Watersheds are a good idea: biology of fish-habitat relationships is complex

- Can best be understood by concentrating monitoring and research efforts at a few locations
- Enables enough data on physical and biological attributes of a system to be collected
- Develop a comprehensive understanding of the factors affecting salmon production in freshwater

How to use the knowledge gained through the IMW approach to support watershed scale restoration actions

- IMWs as treatments and controls (WA SRFB complexes)
- IMWs as the context for treatment and controls (Wenatchee)
- IMWs as the learning opportunity for the extrapolation or extension of mechanistic work (SF John Day)

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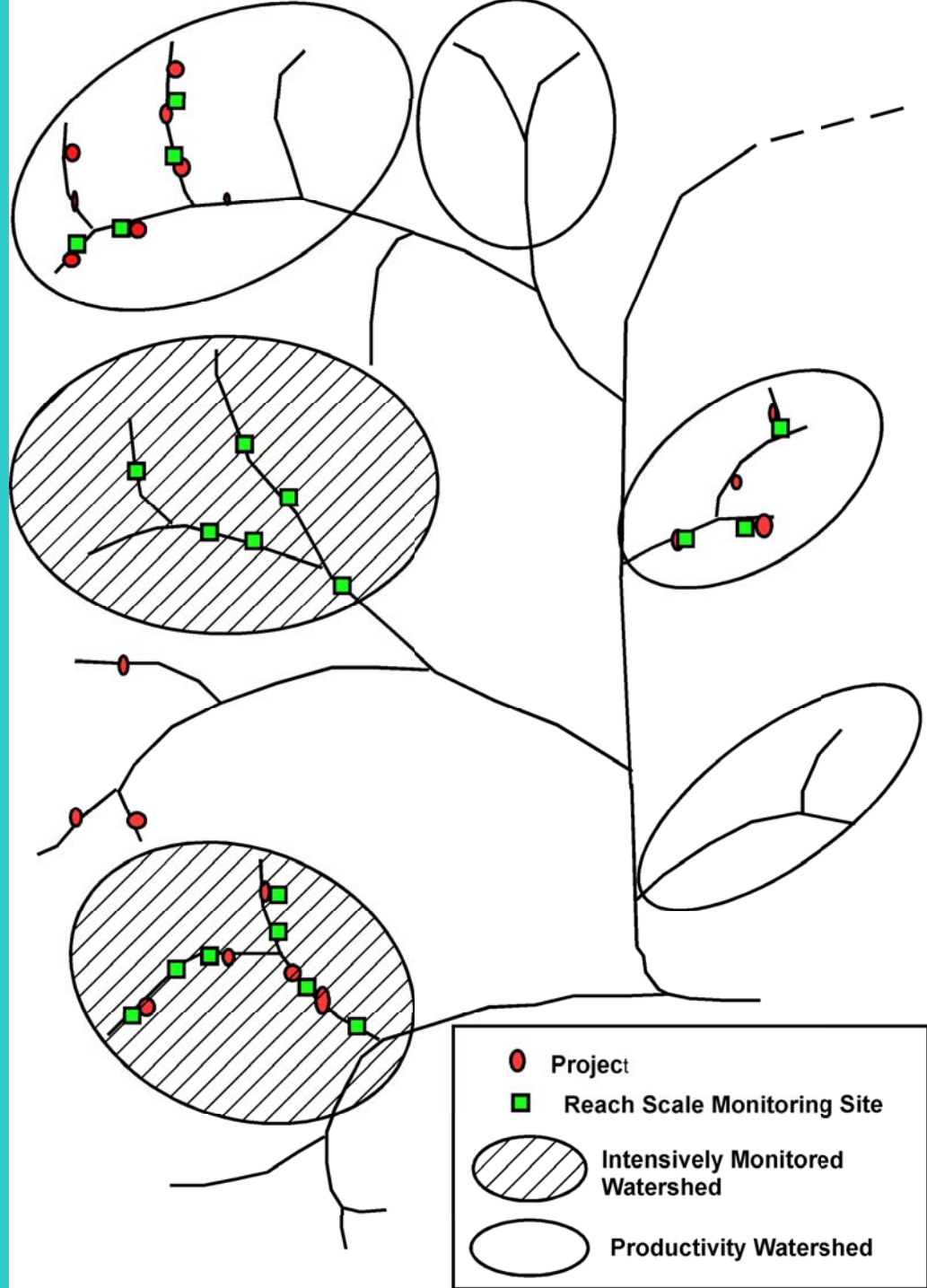
- Linking watershed scale effectiveness monitoring with status monitoring



Effectiveness monitoring at the watershed scale

- It is great that effectiveness monitoring has risen to the level of programmatic attention
- But then the stakes have risen too
  - if we are promising something that we aren't in a position to deliver, do we want to risk failing?
- We have to carefully structure effectiveness monitoring to demonstrate effect of actions
- Only possible when infrastructure for monitoring/action is present (plan for success, still won't always get there)
  - limiting factor quantified
  - engineering solution for problem
  - population level response variable
  - institutional support for actions and assessment

What will it really take to do watershed-scale restoration (with monitoring)?

- Are projects actually implemented to address watershed-scale response?

- Who is coordinating the implementation of actions at the scale of watersheds?
  - At smaller scales it is ok to separate effectiveness monitoring from action implementation
  - There can be no separation between monitoring and actions at watershed scale
  - Watershed scale restoration actions must be run by the monitoring program

What we have accomplished

- Implemented a hierarchical monitoring program that nests watershed-scale effectiveness monitoring w/in status monitoring w/in a regional context or setting.
- Developed collaborative approach where multiple stakeholders and co-managers are key partners.
- Developed an experimental environment to test the design and implementation of large-scale monitoring programs.

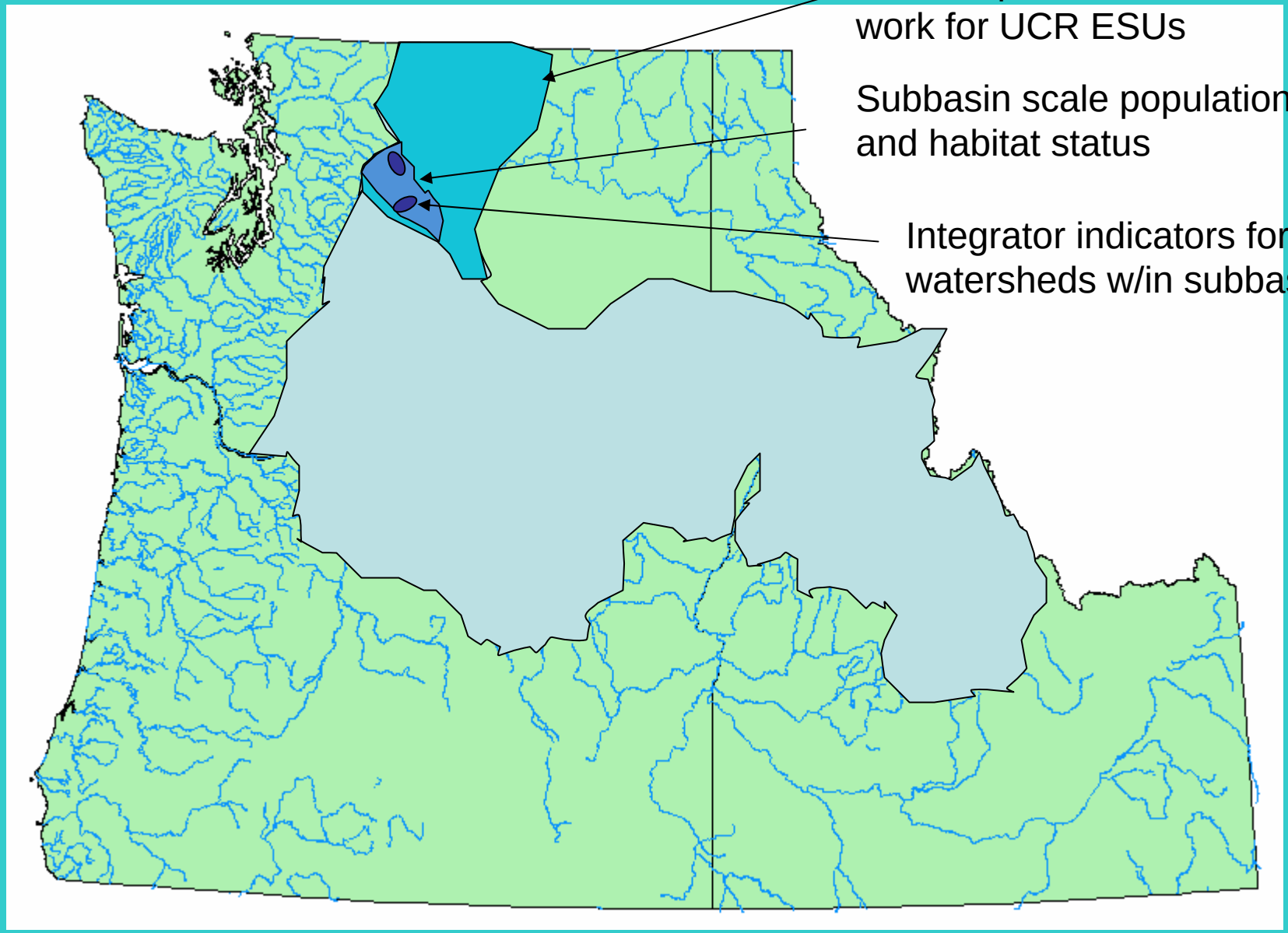
So what was so hard about that?

- Coordination, coordination, coordination.
- Even with expansion from UCR to Oregon Plateau and Snake River, it still is only a “pilot” project.
- It is still just (?just?) a monitoring project -- the monitoring world is disconnected from the restoration planning world. This is the major failing of the way the region is planning for salmon recovery -- too compartmentalized.

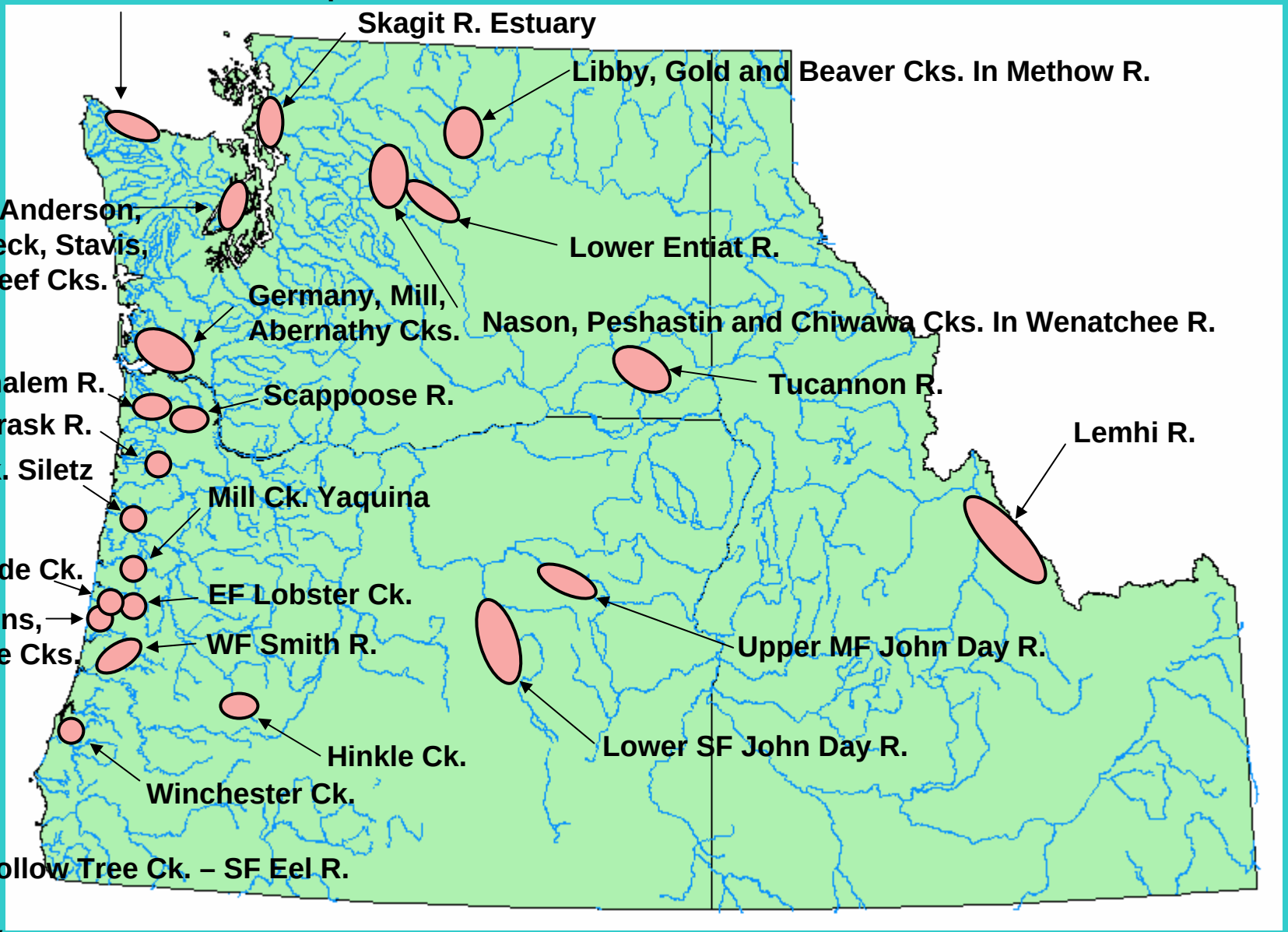
Analysis Tool Development

- Classification -- landscape context
- Mechanistic models
- Power analysis for indicator / experimental design
- Response design assessment
- Partial Mantel, Path Analysis,Graph Theory, Structural Equations (beyond LR models)
- Precision / Accuracy testing (ANOVA – random effect model to partition variance)
- Cross-walks between data/information
- Spatial scales of covariates
- Trend detection

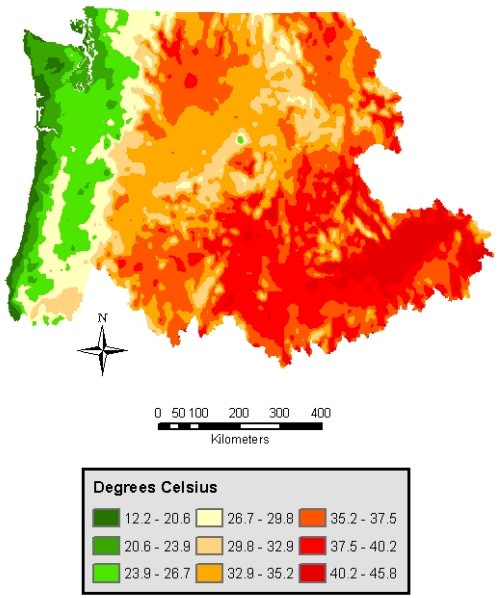
Integrated Status and Effectiveness Monitoring Program



There is a developing network of Intensively Monitored Watersheds

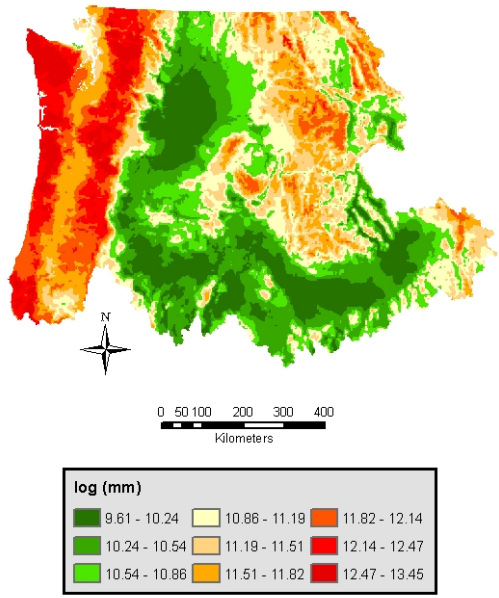


Annual Temperature Range

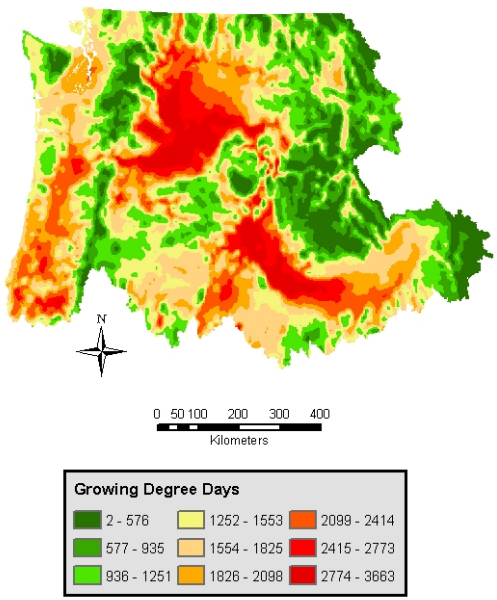


Four data layers:
6th field
watersheds with
a single values
for each input
characteristic.

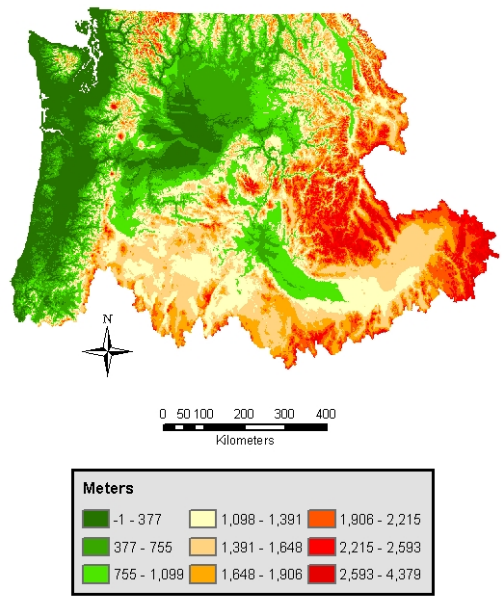
Mean Annual Precipitation



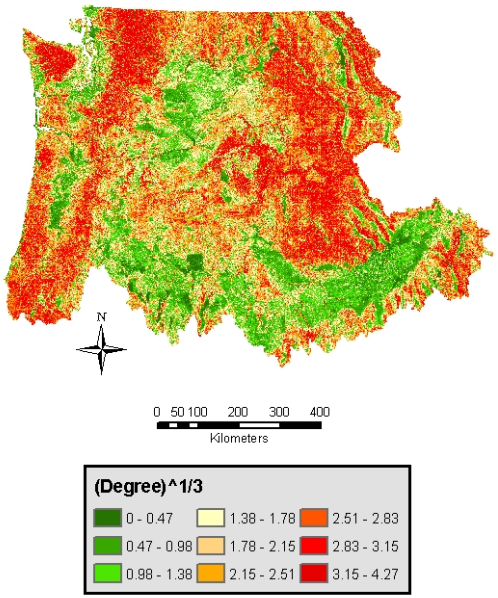
Growing Degree Day



Elevation

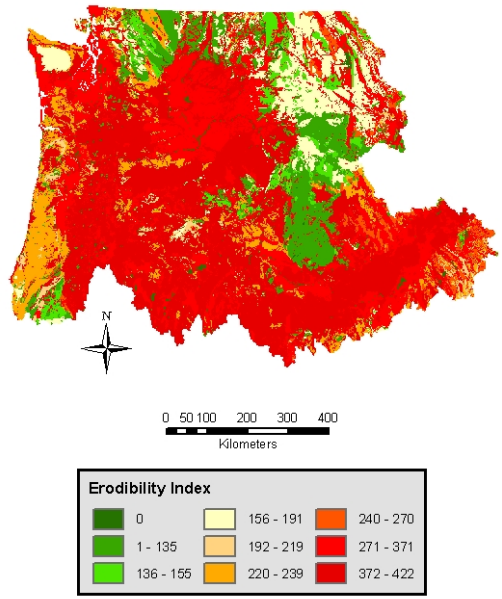


Hillslope

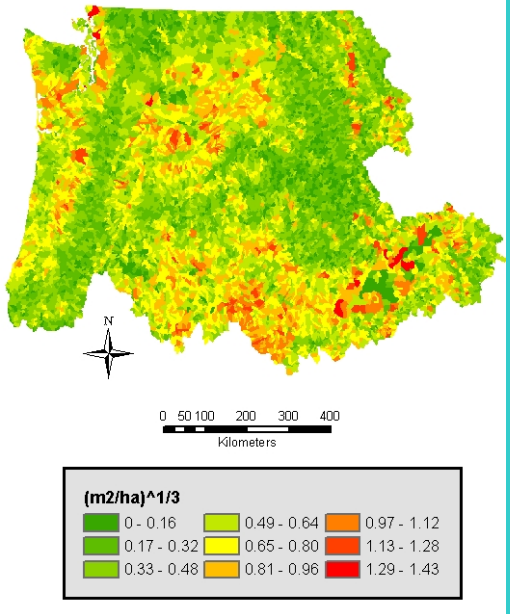


Four more data layers: 6th field watersheds with a single values for each input characteristic.

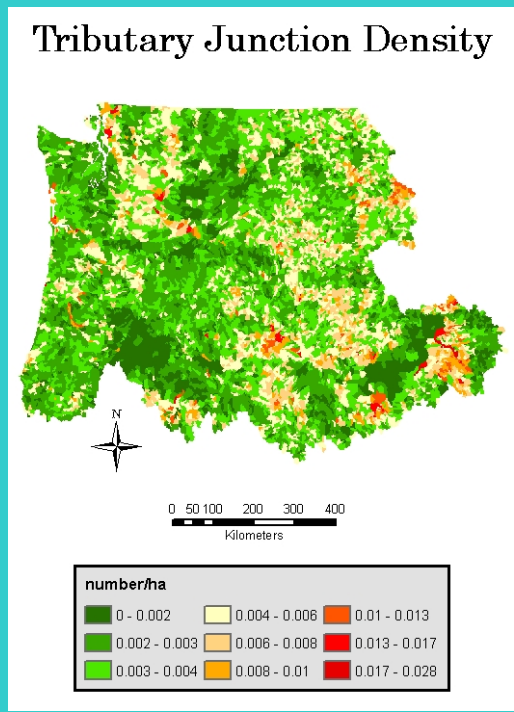
Erodible Geology



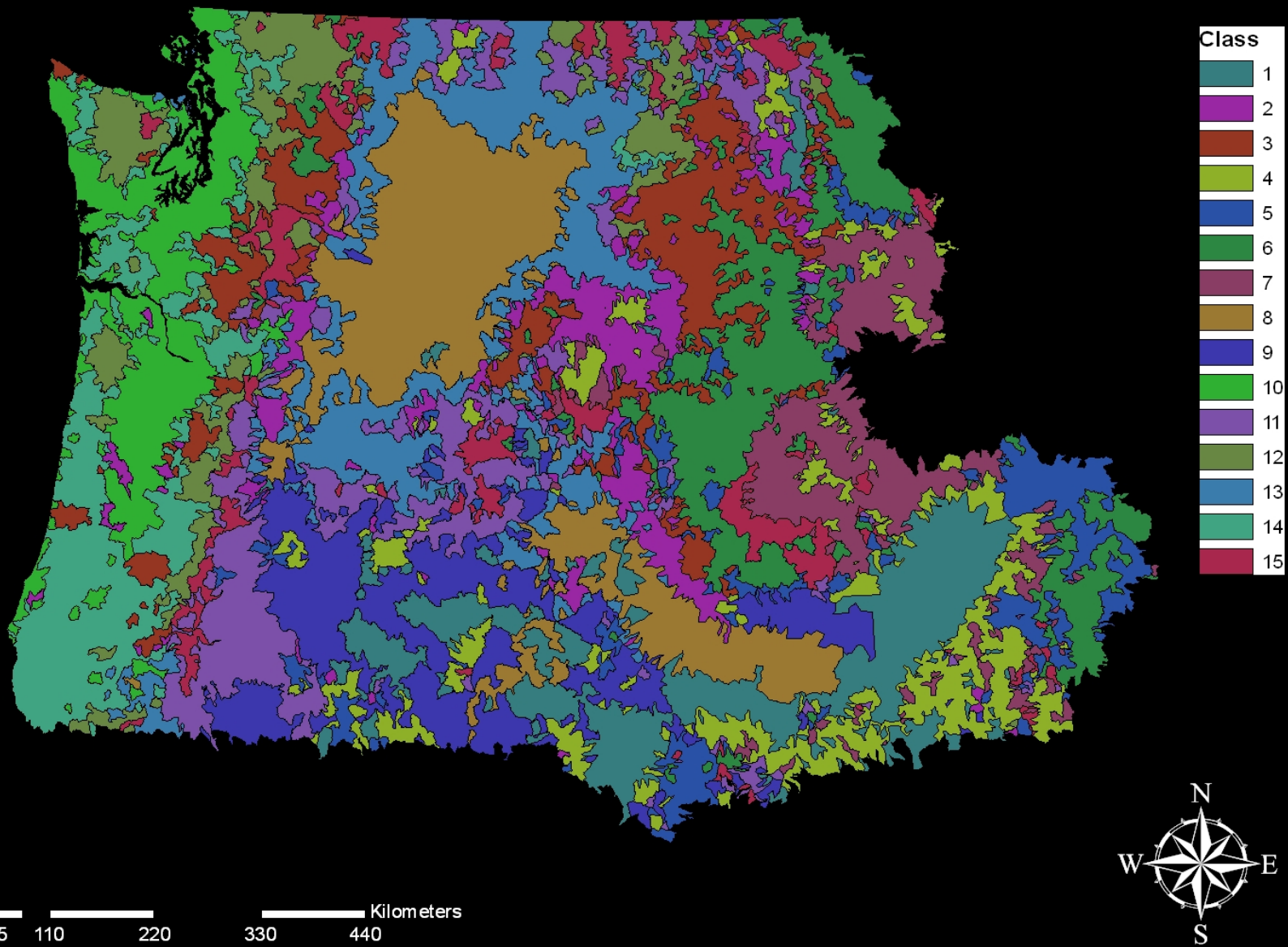
Response Reach Density



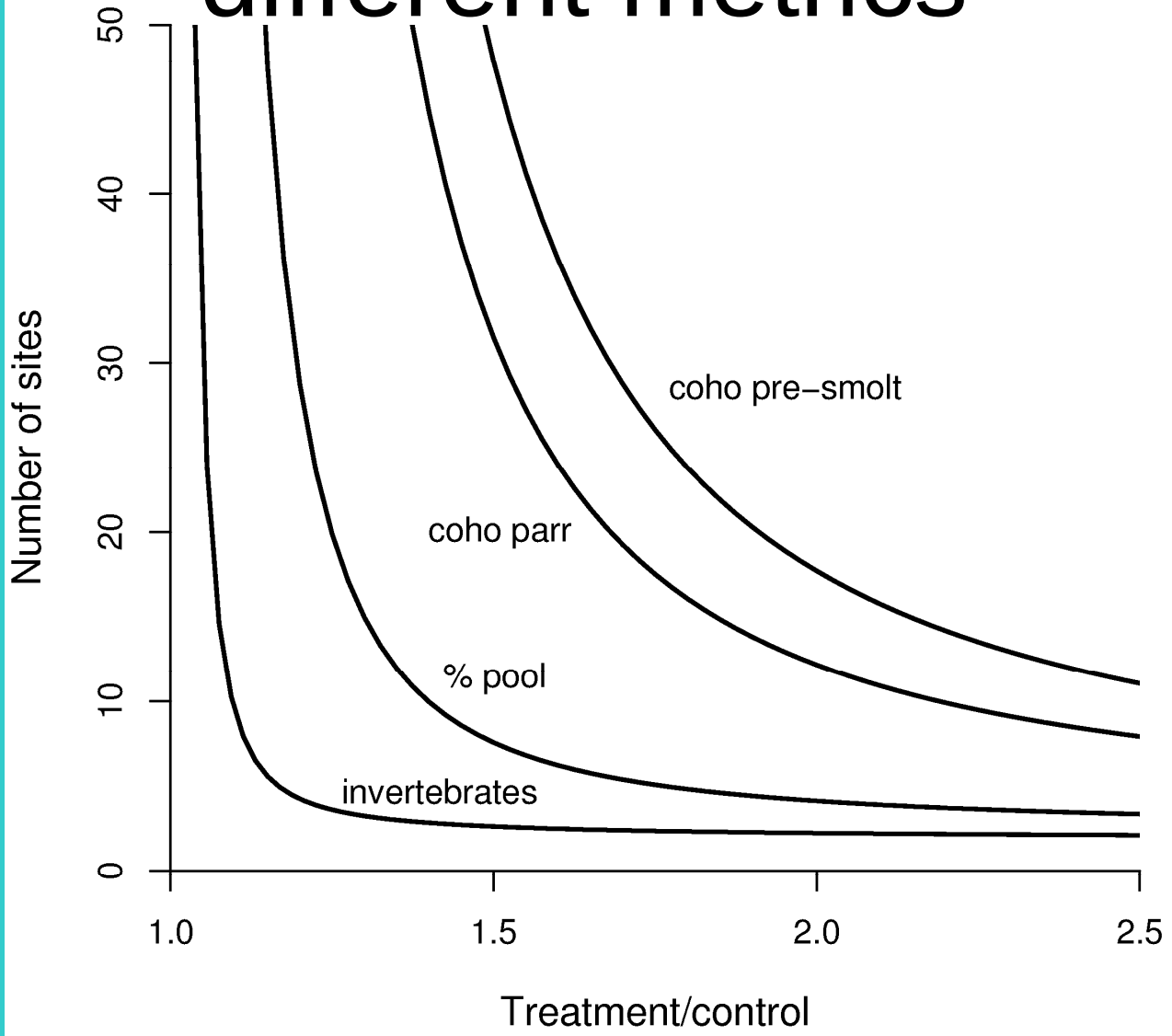
Tributary Junction Density



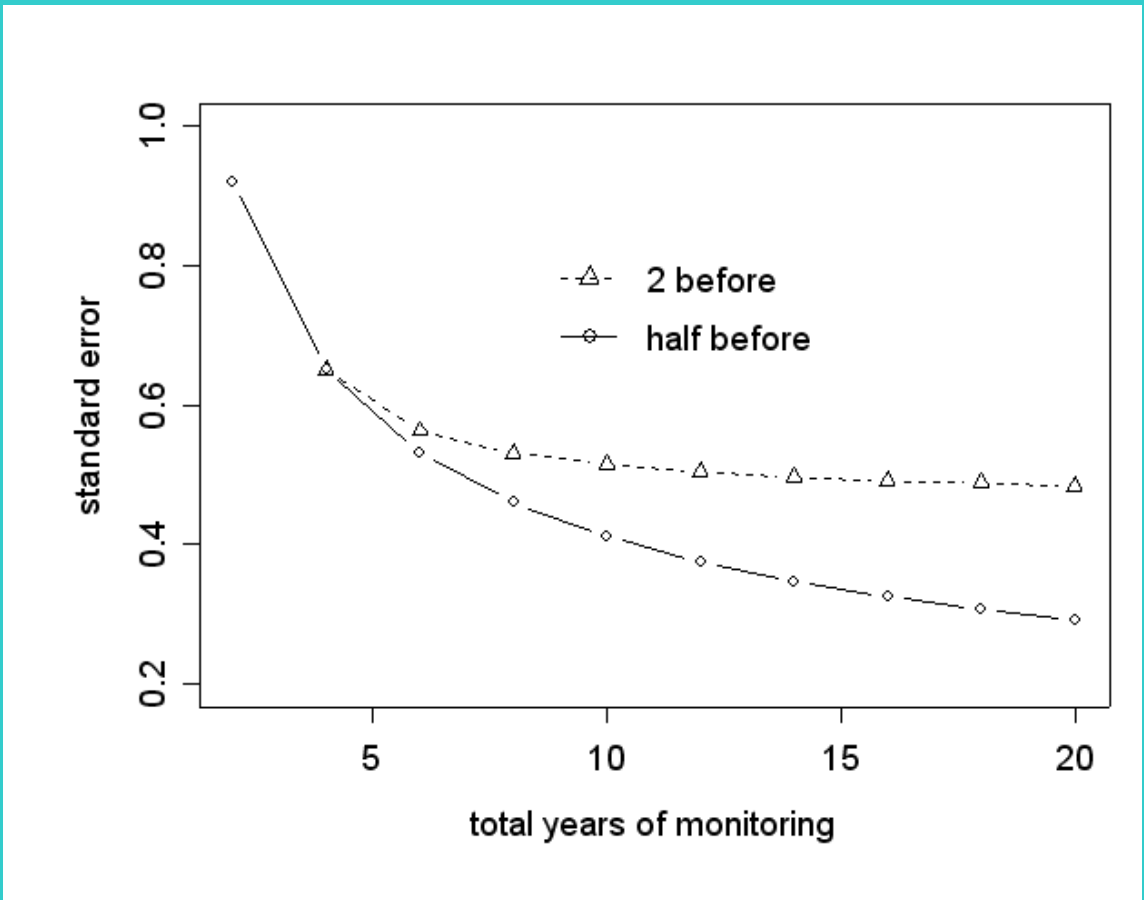
CBR Classification



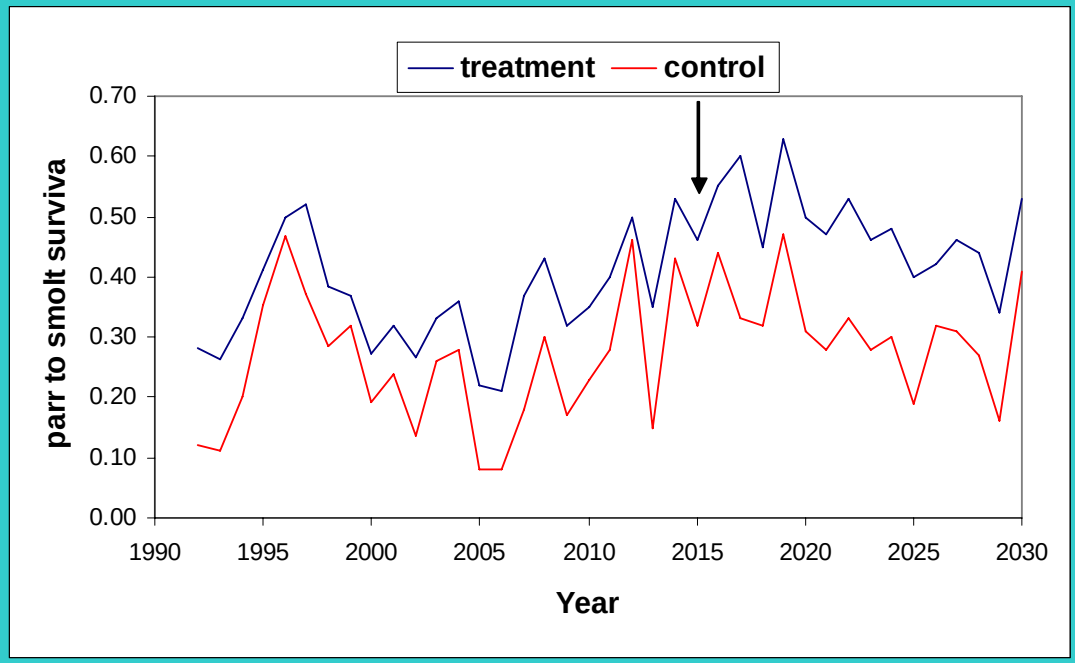
Relative response of different metrics

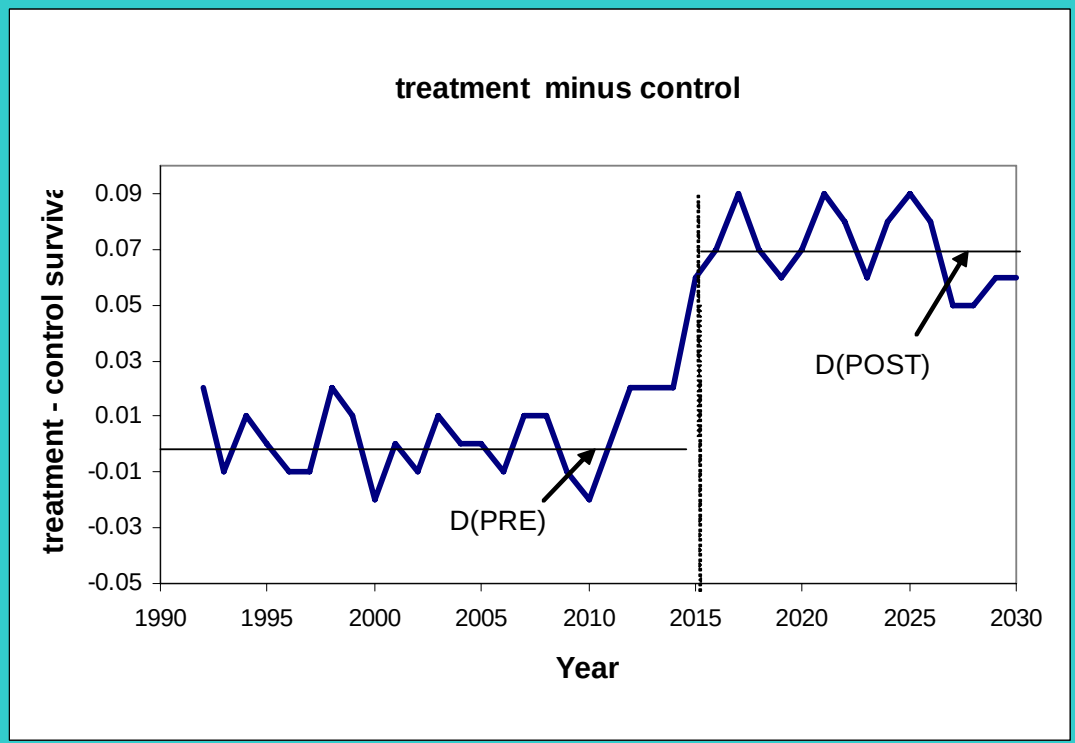


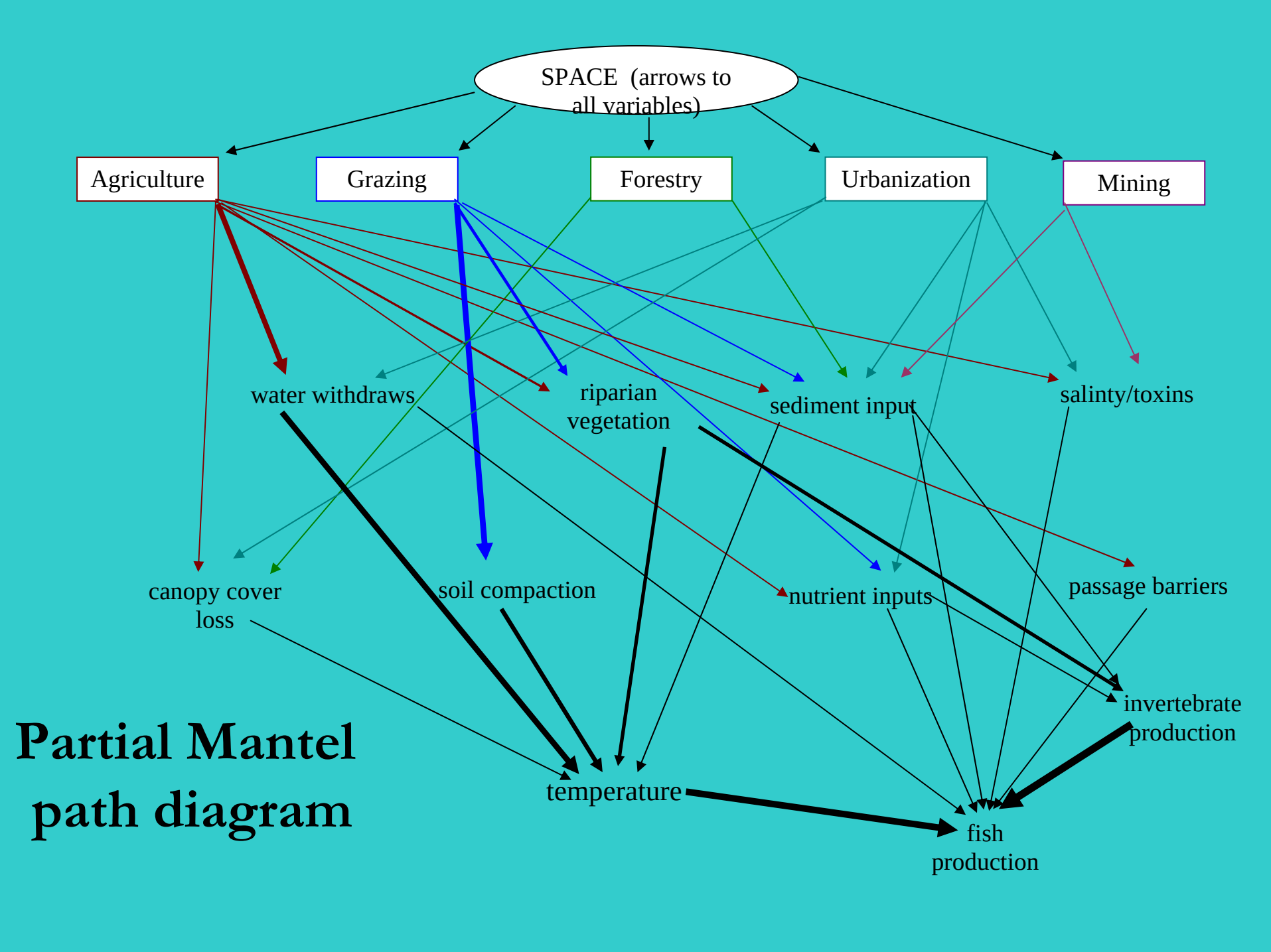
Relative response of different designs



Intervention Analysis

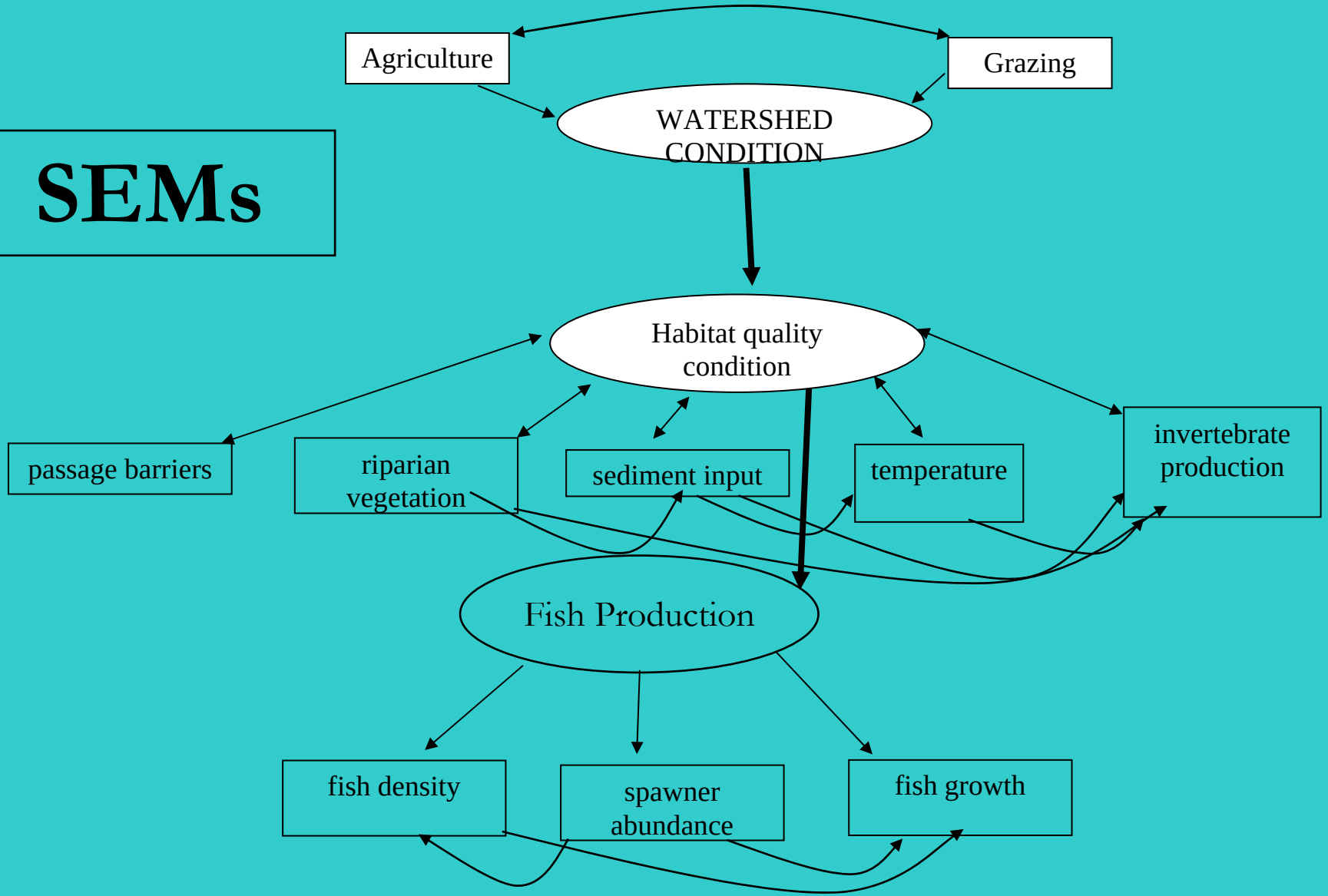






Partial Mantel path diagram

SEMs


Agriculture
Grazing
WATERSHED CONDITION
Habitat quality condition
passage barriers
riparian vegetation
sediment input
temperature
invertebrate production
Fish Production
fish density
spawner abundance
fish growth