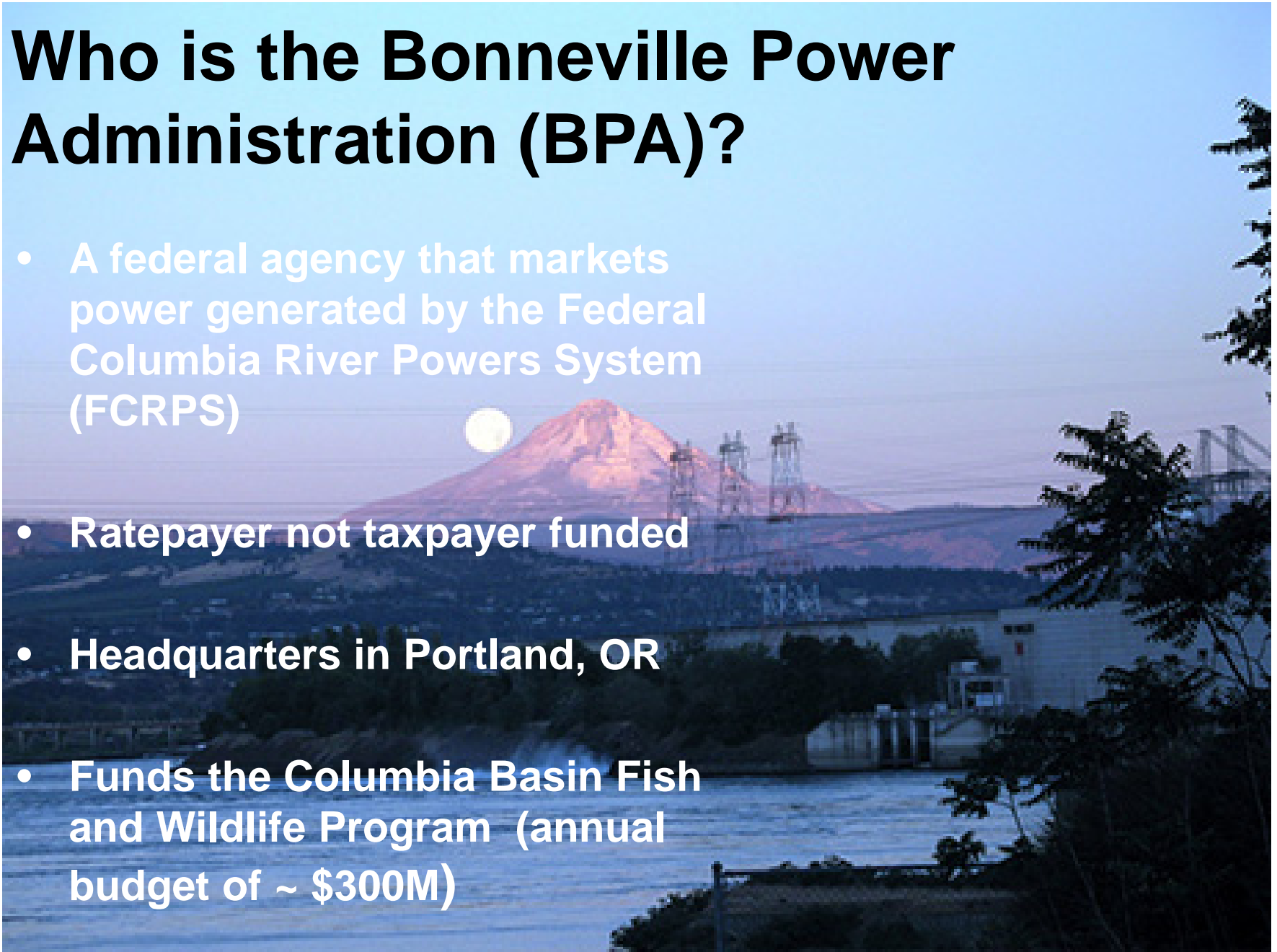


Applying Research, Monitoring, and Evaluation (RME) to Habitat Restoration in the Columbia Basin

Katie McDonald, Gary Johnson, *Ben Zelinsky*

Who is the Bonneville Power Administration (BPA)?

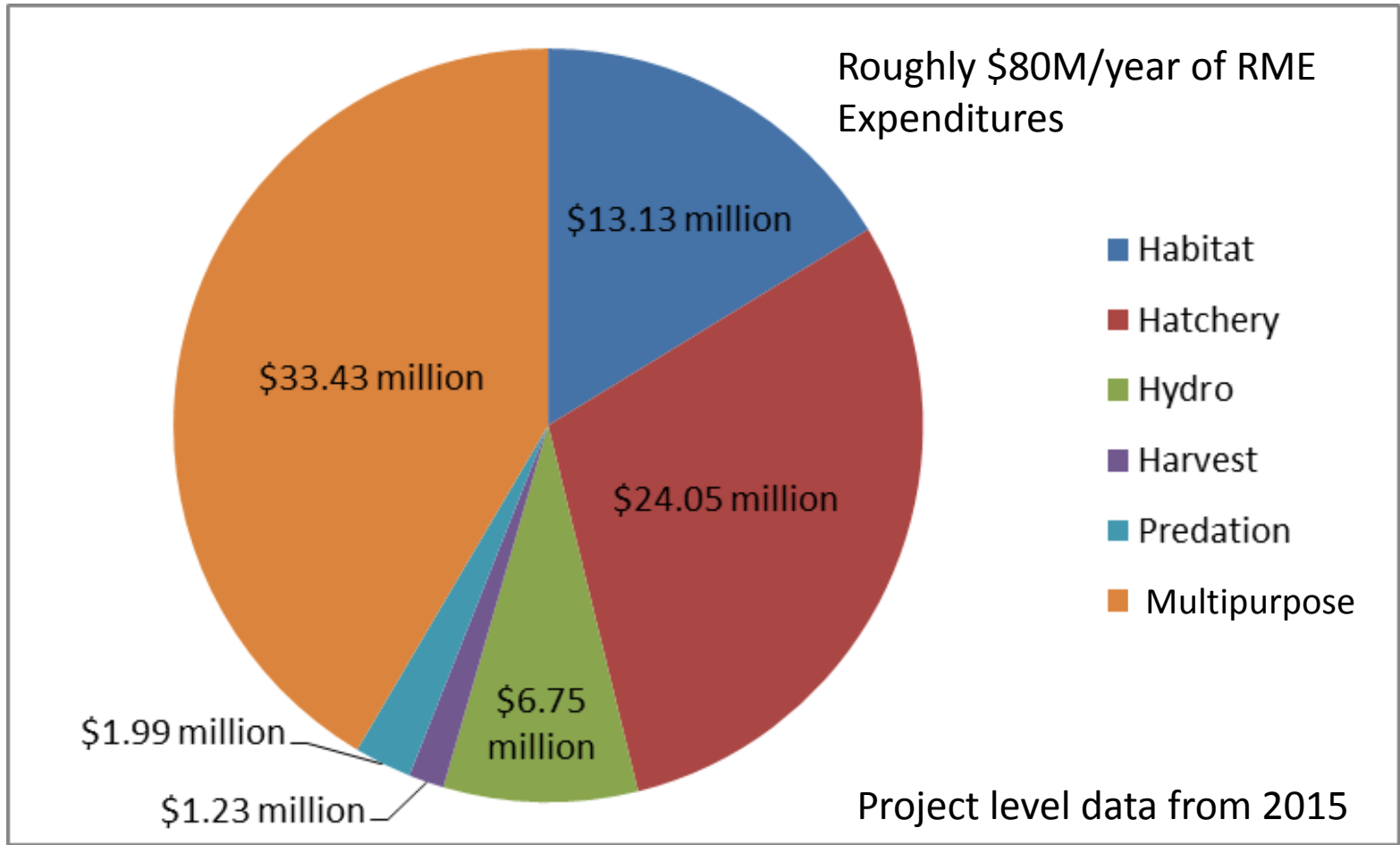
- A federal agency that markets power generated by the Federal Columbia River Powers System (FCRPS)
- Ratepayer not taxpayer funded
- Headquarters in Portland, OR
- Funds the Columbia Basin Fish and Wildlife Program (annual budget of ~ \$300M)




Why is BPA restoring habitat?

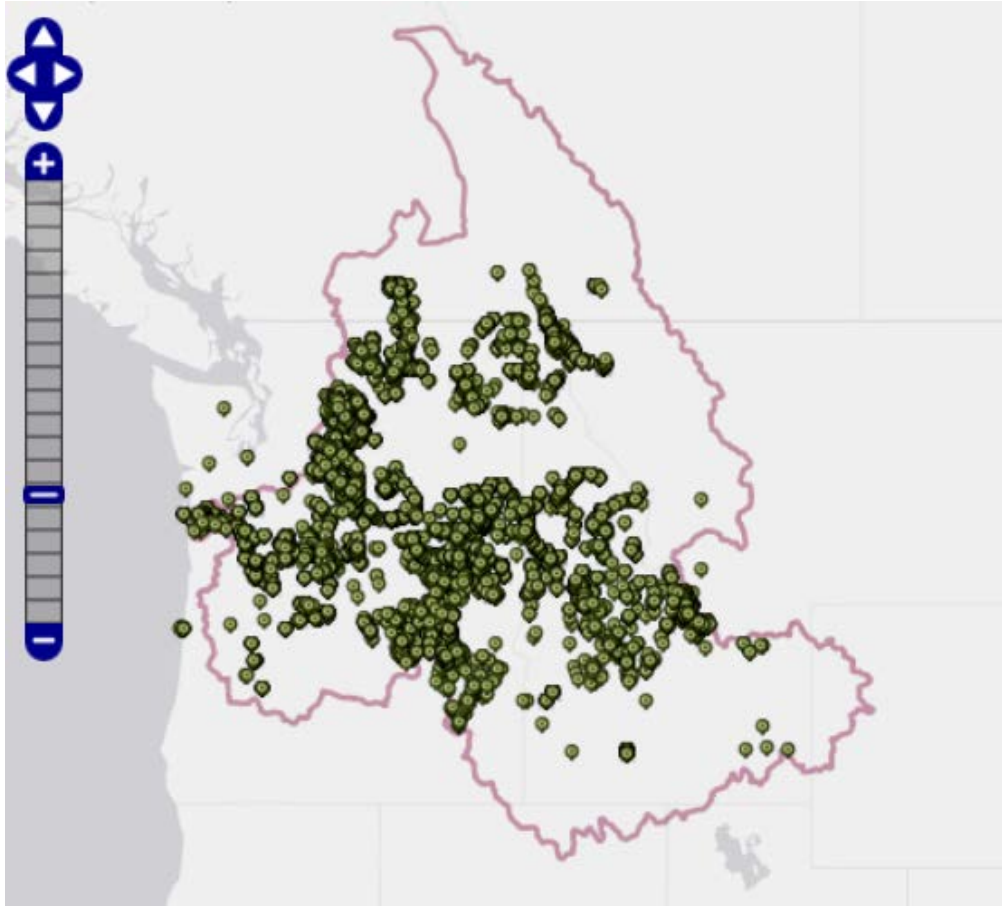
- **NOAA Biological Opinions**
- **Northwest Power Act**
- **Tribal Trust and Columbia Basin Accords**

Annual Research, Monitoring, and Evaluation Expenditures



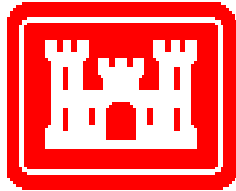
Large and complex program  *Challenges and opportunities* ₄

Complexity: Scope and Scale



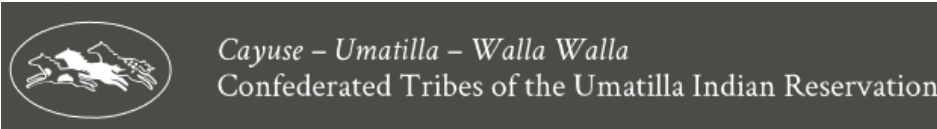
- Numerous metrics
- Collected at different:
 - scales
 - intensities
 - frequencies
 - durations
- Often uncoordinated purposes

Complexity: Partners

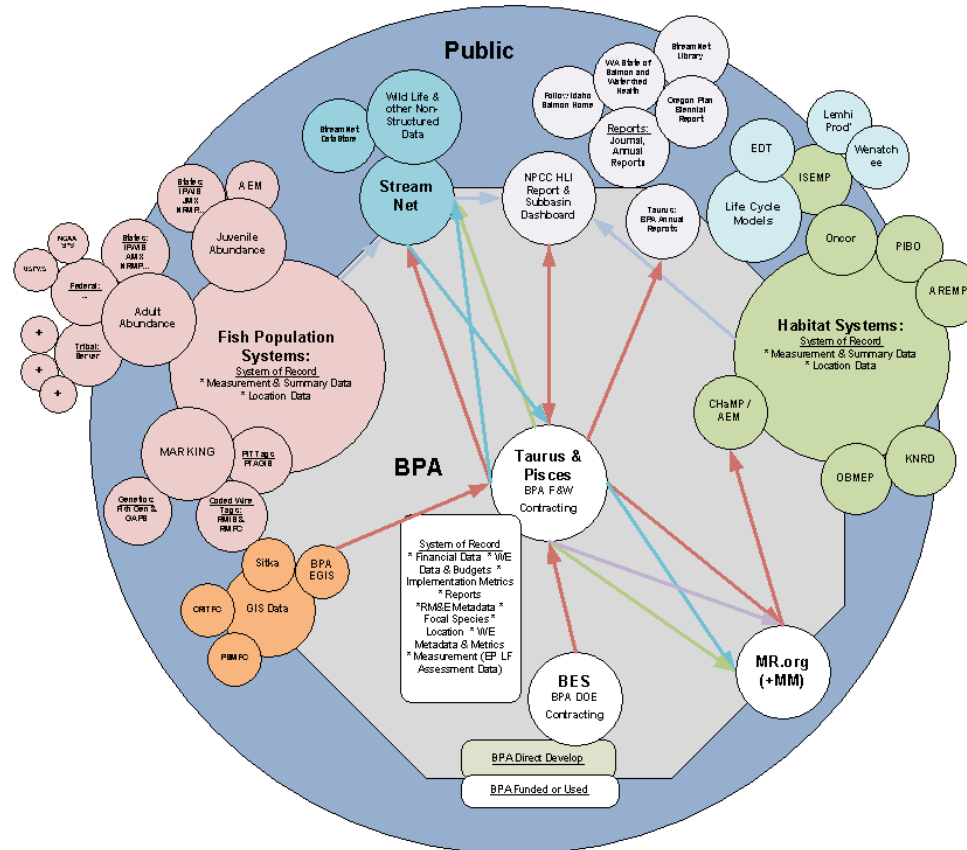


Partial list of partners collecting similar data:

- US Army Corps of Engineers (FPOM, TMT, etc.)
- NOAA Fisheries Northwest Fisheries Science Center
- Watershed Councils
- Recovery Boards
- CRITFC
- USFWS refuge system
- ODFW
- WDFW
- Idaho Office of Species Conservation IDFG
- Montana DNRC
- DEQ
- US Forest Service – regional and national
- BLM state and district habitat staff
- Colville Tribes
- Yakama Nation Fisheries
- CTUIR
- Confederated Tribes of Warm Springs
- Shoshone Bannock Tribes
- Nez Perce

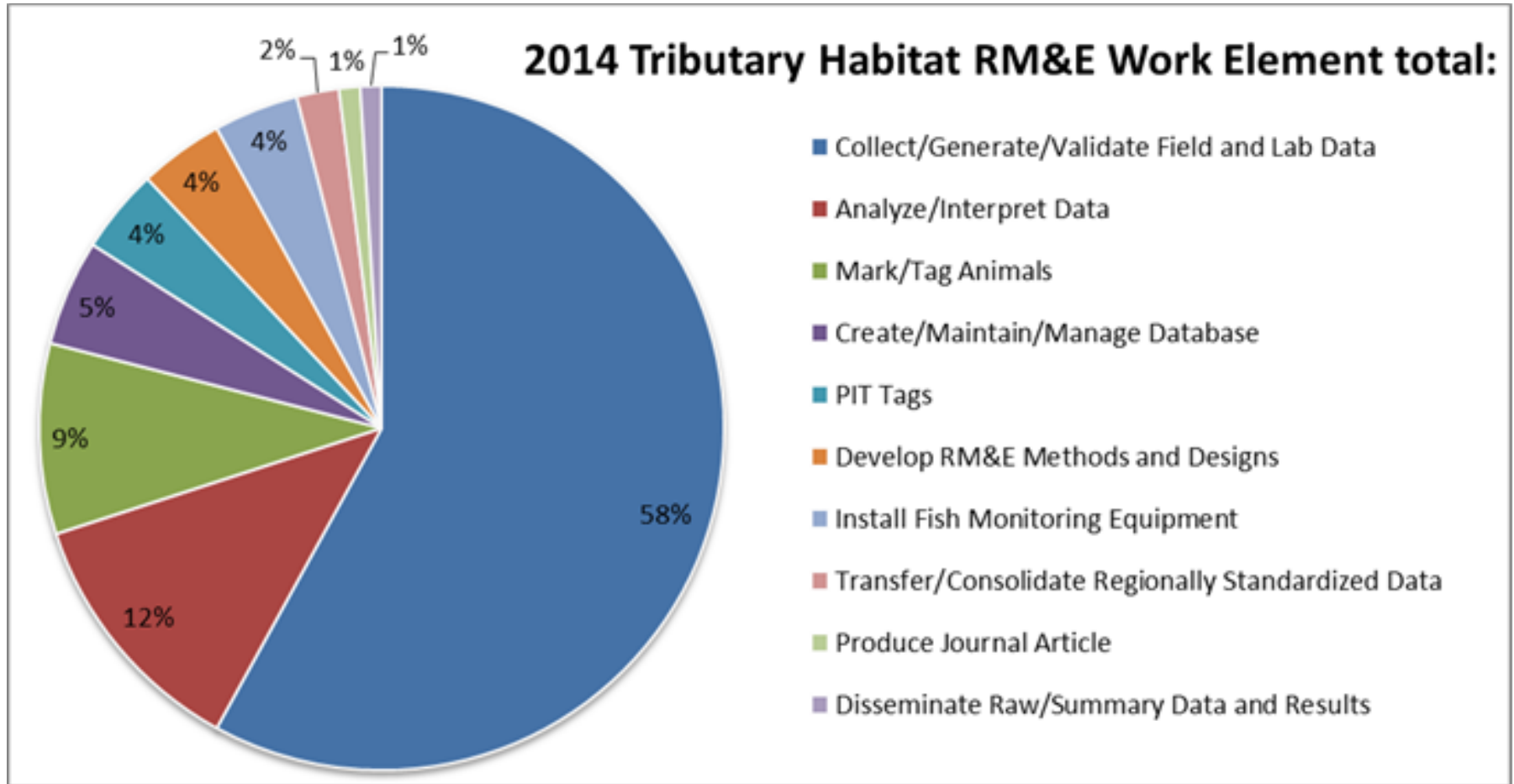


Complexity: Data Consumers and Producers



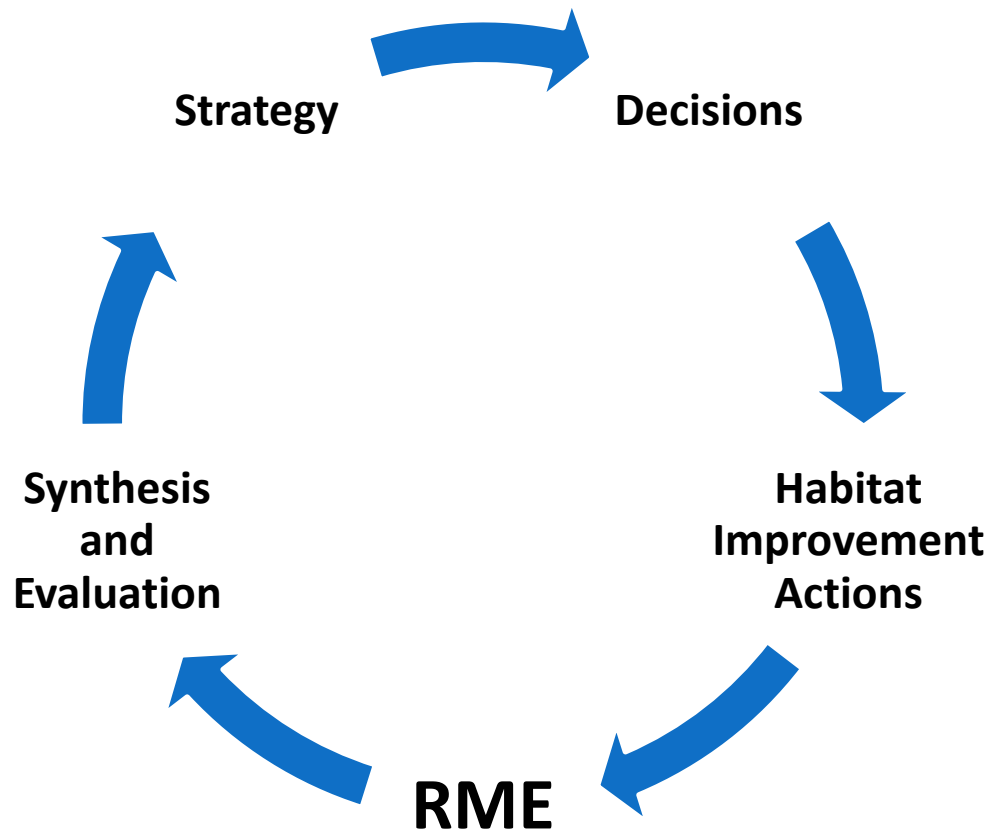
Visualization of data, data systems and users in Council fish and wildlife program

Emphasis On Data Collection



Traditionally greater emphasis on data collection, storage, and use by fish managers, rather than synthesis, analysis, display, and “lessons learned” for BPA

Applying RME to Habitat Improvement



The goal is to use RME to improve the effectiveness of habitat actions over time

The application of TRME is variable throughout the Columbia basin with some watersheds serving as excellent models of adaptive management

Periodic Syntheses

Focused on a handful of programmatic management questions:

- What is the relative effectiveness of habitat improvement actions?
 - **FISH**: How do fish respond to changes in habitat condition?
 - **HABITAT**: What are the effects of habitat improvement actions on habitat condition?

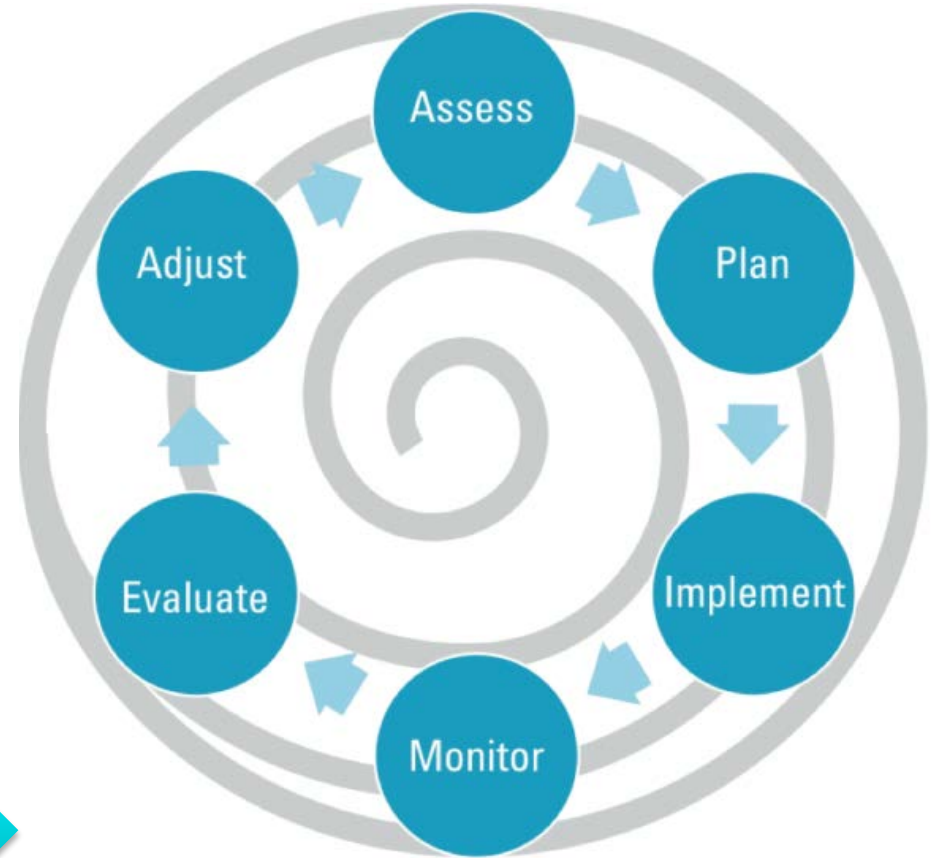
“the critical programmatic issue in the RM&E/AP review is whether the collective suite of proposed projects is adequate to monitor and evaluate the effectiveness of our habitat actions in ultimately improving the population characteristics of our key fish species” – ISRP 2011



Future syntheses can be at other scales and focus on other questions

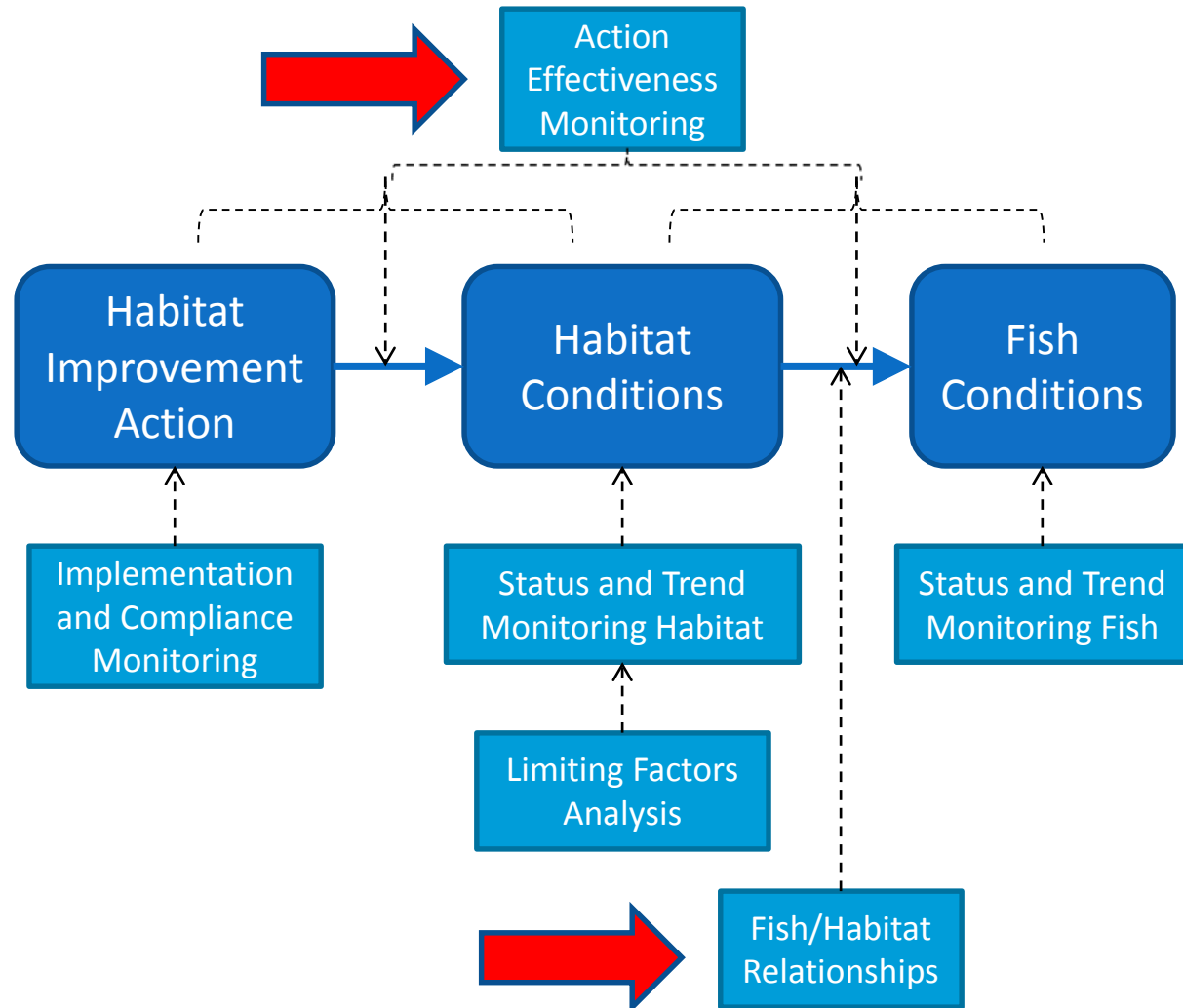
Case Studies of Adaptive Management at the Watershed Scale

- Understand common elements of successful adaptive management
- Identify best management practices for applying RME to restoration prioritization & design



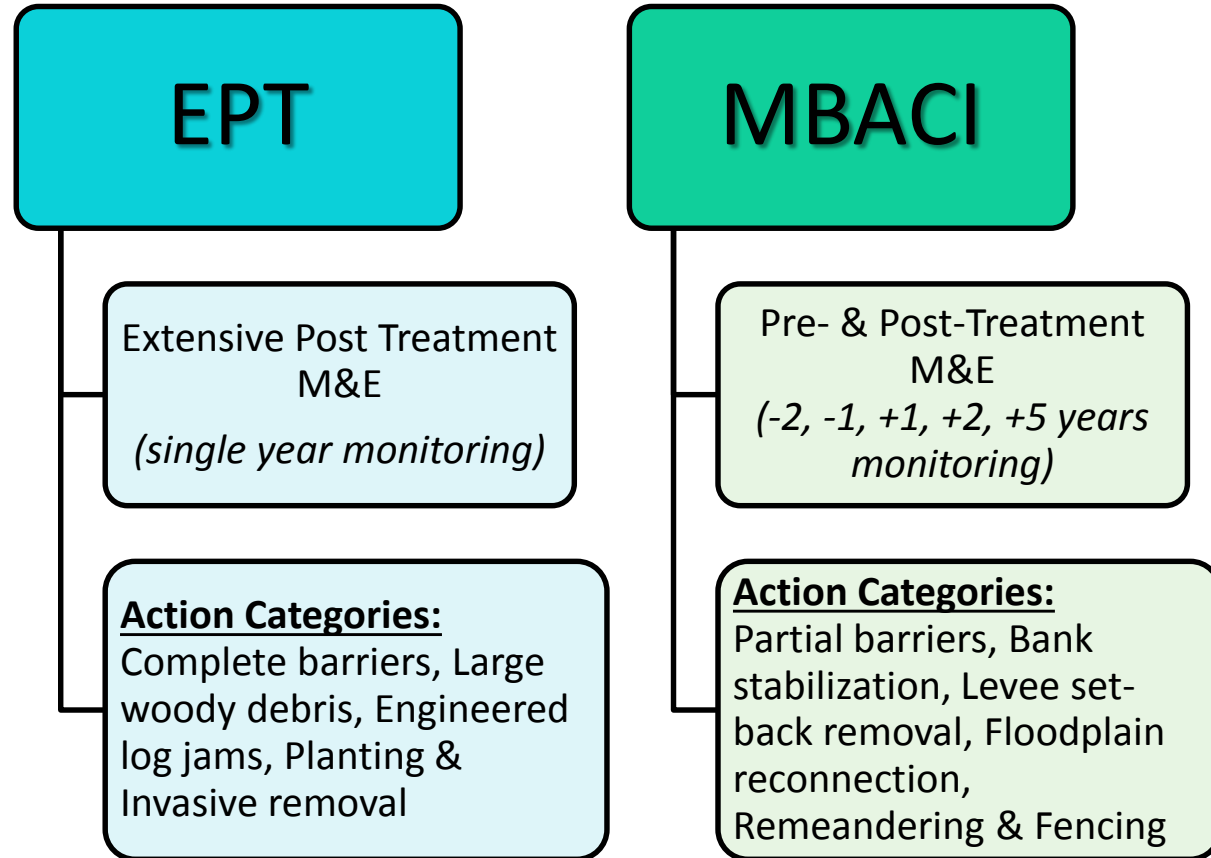
Theory of Change

- Makes assumptions explicit
- Informs management questions
- Defines metrics, methods
- Supports evaluation



Action Effectiveness Monitoring (AEM)

- A programmatic approach to evaluating the effectiveness of different action categories
- Don't need to answer the same questions over and over
- Looking for general patterns by habitat and species to inform restoration



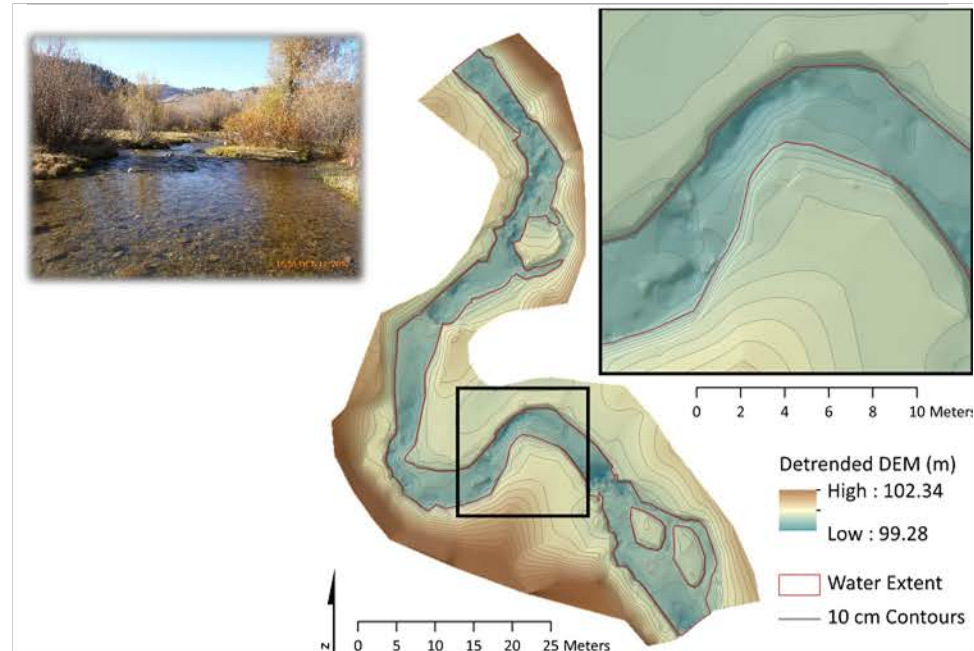
Looking for general patterns by action type, species, and geography to inform restoration

Integrated Status and Effectiveness Monitoring Program (ISEMP) and Columbia Basin Habitat Monitoring Program (CHaMP)

Fish (ISEMP)

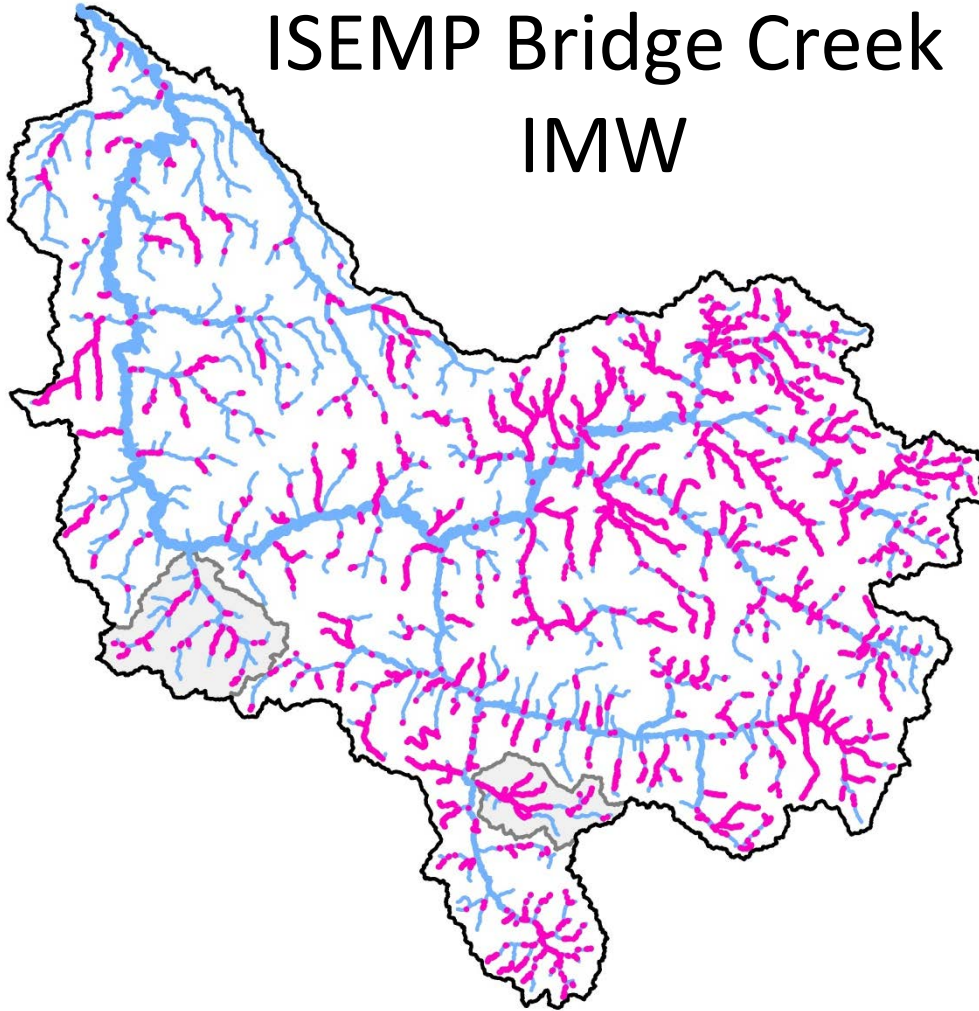


Habitat (CHaMP)



Evaluating the relationship between habitat restoration and changes in juvenile salmonid density, abundance, and productivity

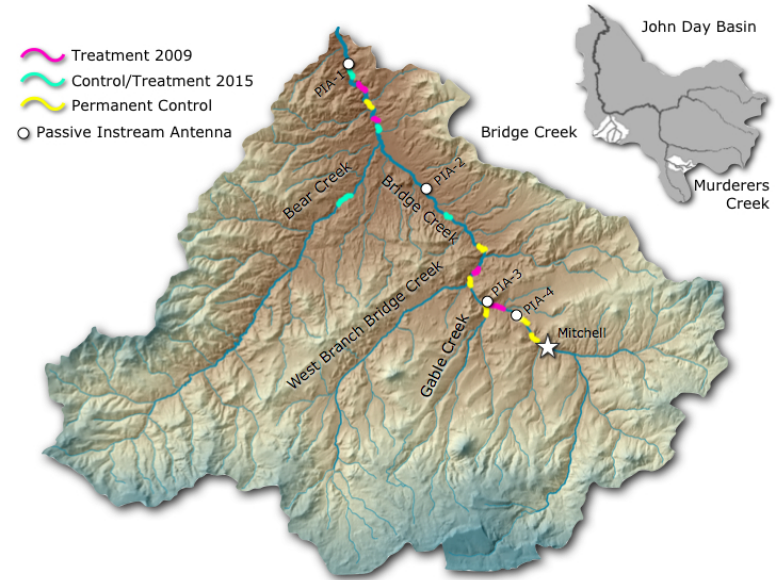
ISEMP Bridge Creek IMW



Beaver Restoration Assessment Tool (BRAT)

- Steelhead distribution 4479 km
- Medium / high beaver potential 1273 km

Restoration: 121 Beaver Dam Anologs installed in 2009



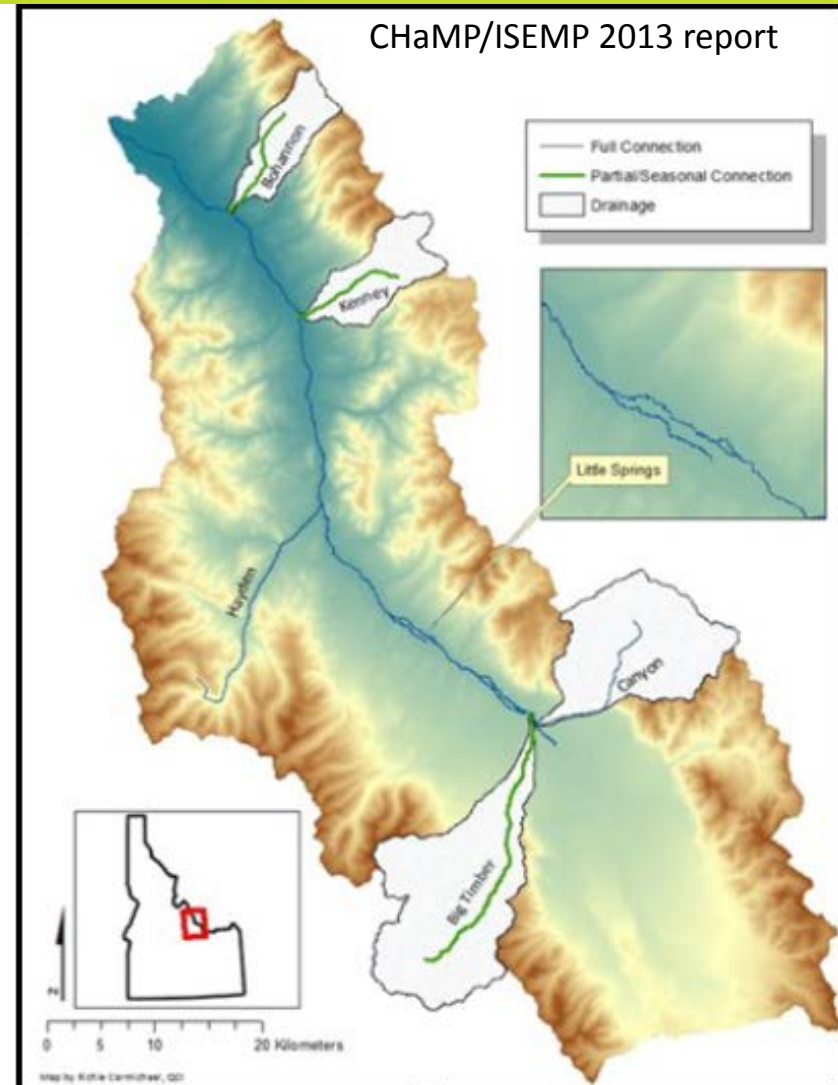
Results

- Increased natural beaver dams 550% throughout Bridge Creek
- Relative to the control watershed, Murderers Creek, increased juvenile Steelhead:
 - Abundance 139%
 - Survival 52%
 - Production 175%

ISEMP/CHaMP

Preliminary Results: Lemhi

- Improving fish passage and instream flow conditions on Little Springs increases habitat capacity for Chinook salmon and steelhead
- 3% percent increase in juvenile Chinook productivity
- 10% percent increase in juvenile Steelhead productivity
- Evaluating how the tools and approaches developed here can be used throughout the basin



Baseline

Wetted area: 1.27 km²

Pool area: 0.37 km²

Tributary reconnection

Wetted area: 1.55 km² (22%)

Pool area: 0.44 km² (19%)

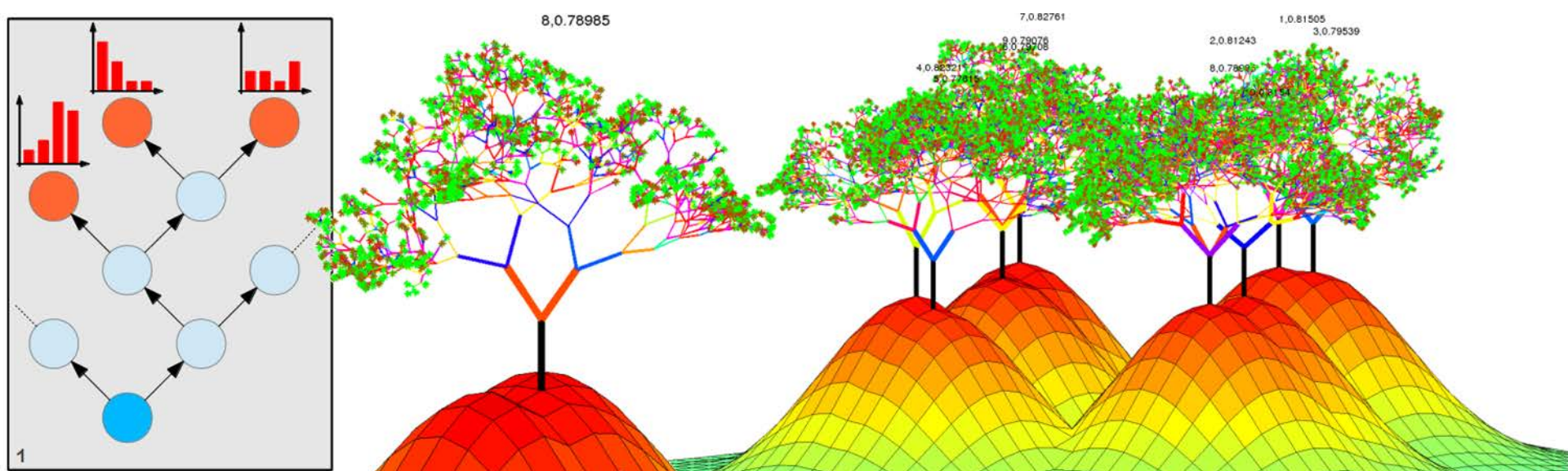
Steelhead

164 smolts/adult (10% increase)

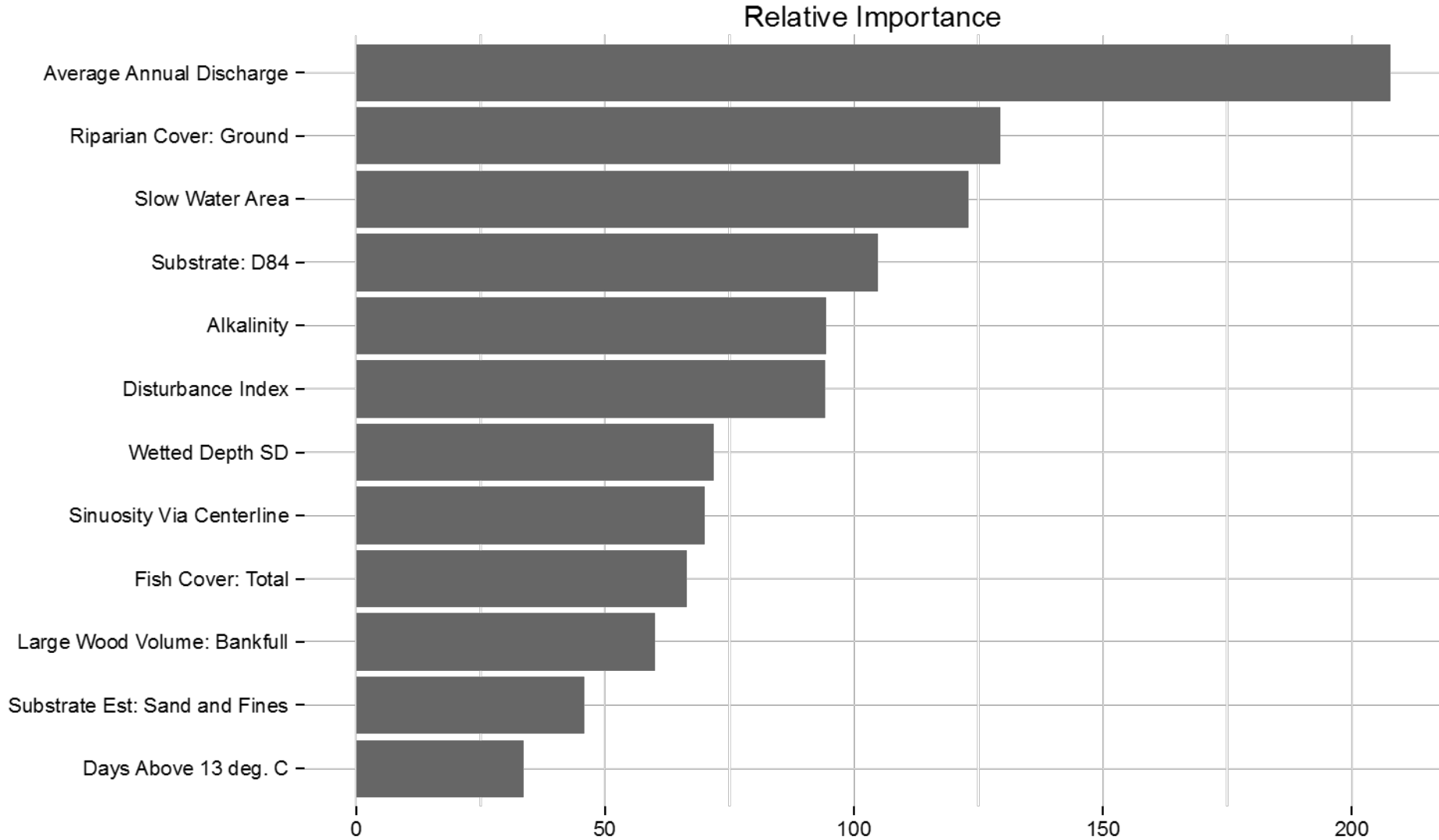
Chinook

19.3 smolts/adult (3% increase)

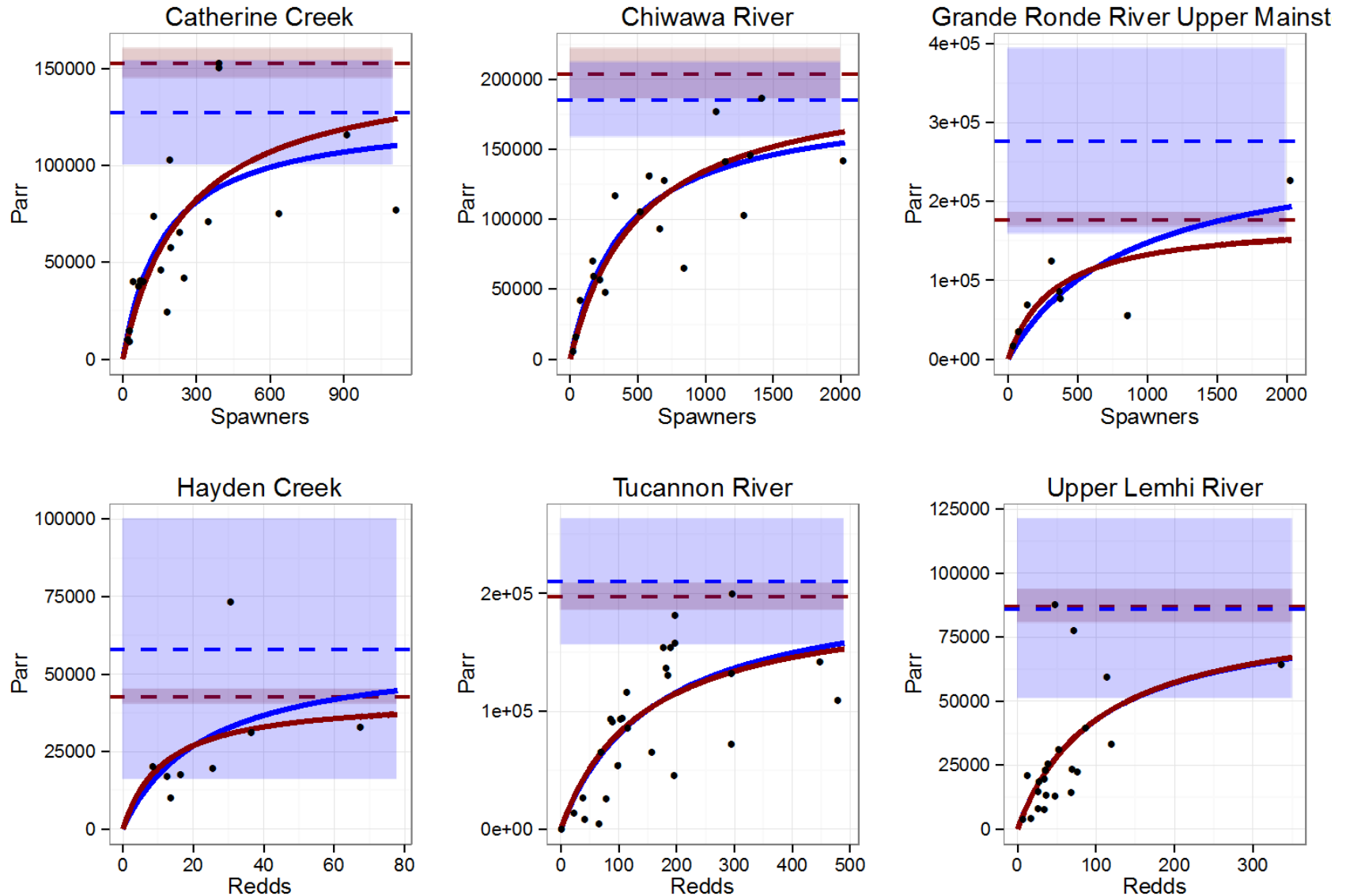
- Quantile Regression Forest (QRF)
 - random forest model
 - quantile regression
- What is a Random Forest model?
 - machine-learning
 - ultimately used to determine order and strength of relationships among many predictor variables.
- Estimates habitat capacity based on 12 physical habitat metrics



Quantile Regression Forest - Predictors

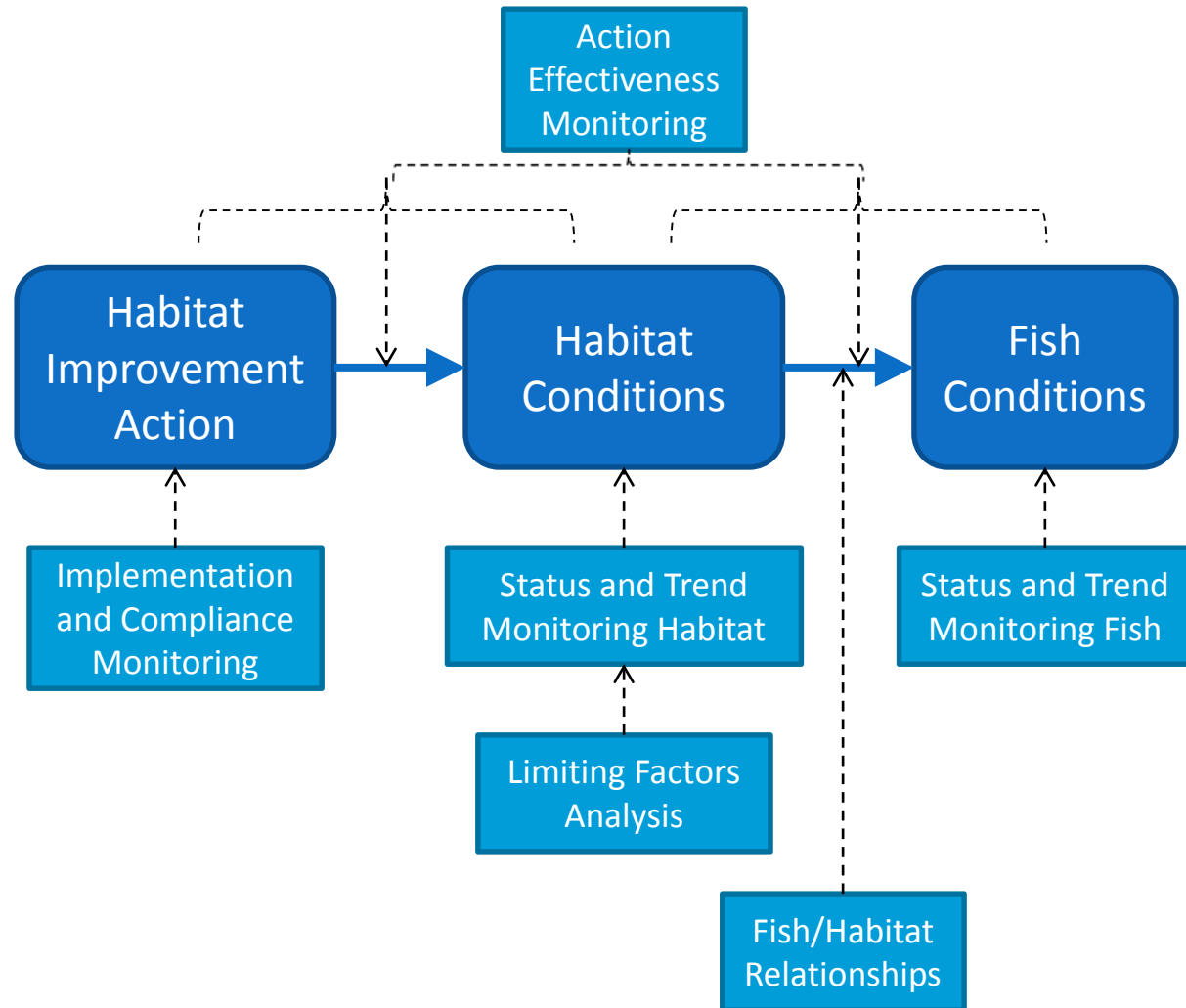


QRF predicts habitat capacity for a number of watersheds across the Columbia basin (for Chinook parr)

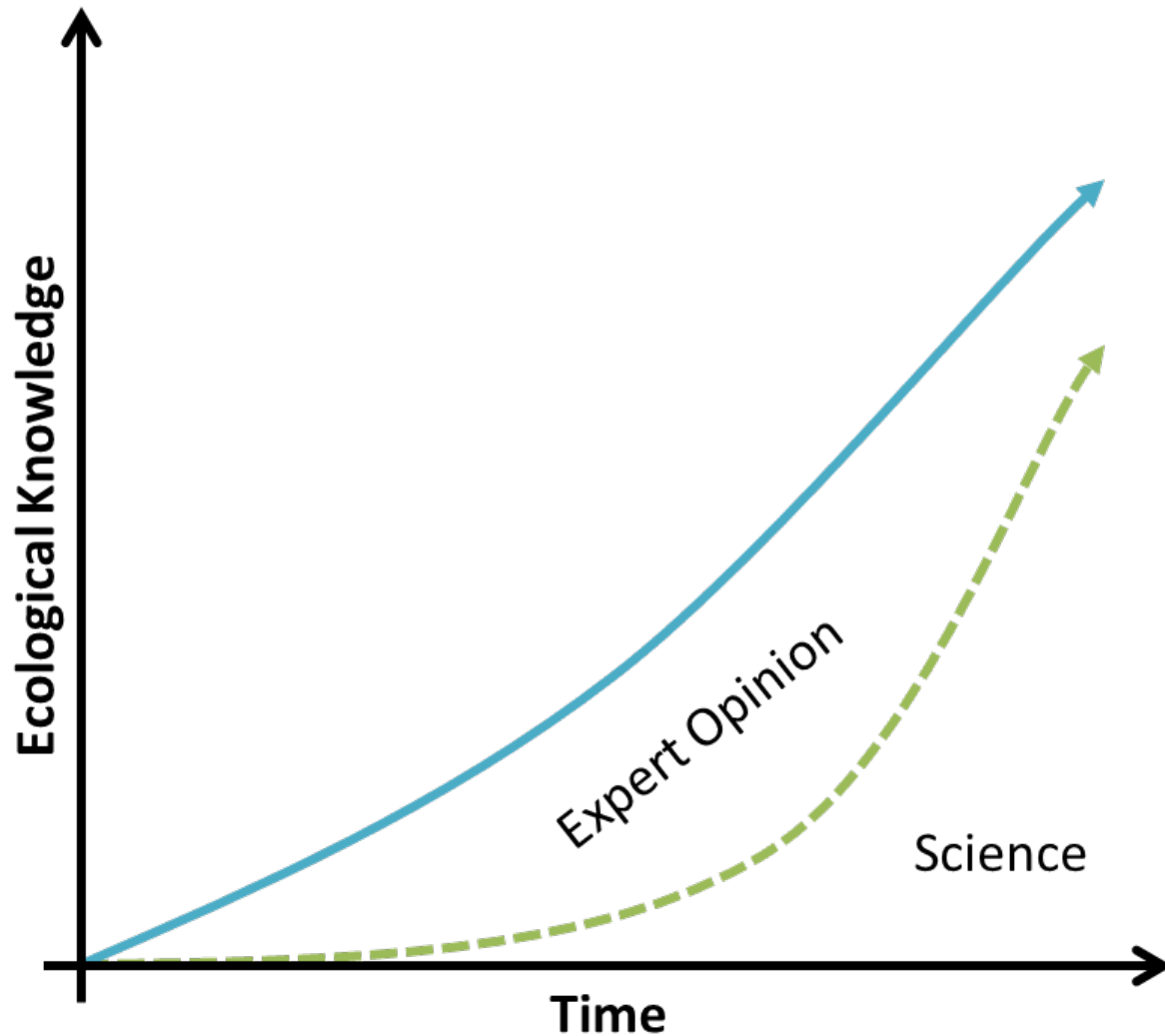


Theory of Change

- Makes assumptions explicit
- Informs management questions
- Defines metrics, methods
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Evaluating the benefits of habitat projects

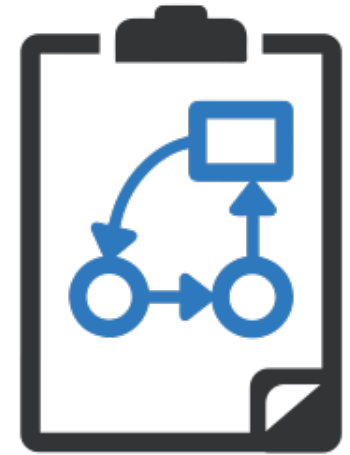


Looking forward



Access

- Data management
- Visualization
- Project annual reporting
- Periodic syntheses
- Standardized metrics to support HLIs



Application

- Integrated with habitat planning and design
- Functional balance between Research and Monitoring
- Balance between basin and watershed scales
- Strategically incorporating emerging technologies