Effectiveness of habitat restoration in the Columbia Basin:
An update on BPA's AEM Program

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Action Effectiveness Monitoring (AEM): A brief history

Pacific Northwest Salmon Habitat Project Database Locations

Project Action Type
- Acquisition and Protection
- Fish Passage
- Flow Augmentation
- Instream Structures
- Off-Channel/ Floodplain Habitat
- Riparian Improvement
- Sediment Reduction/Addition
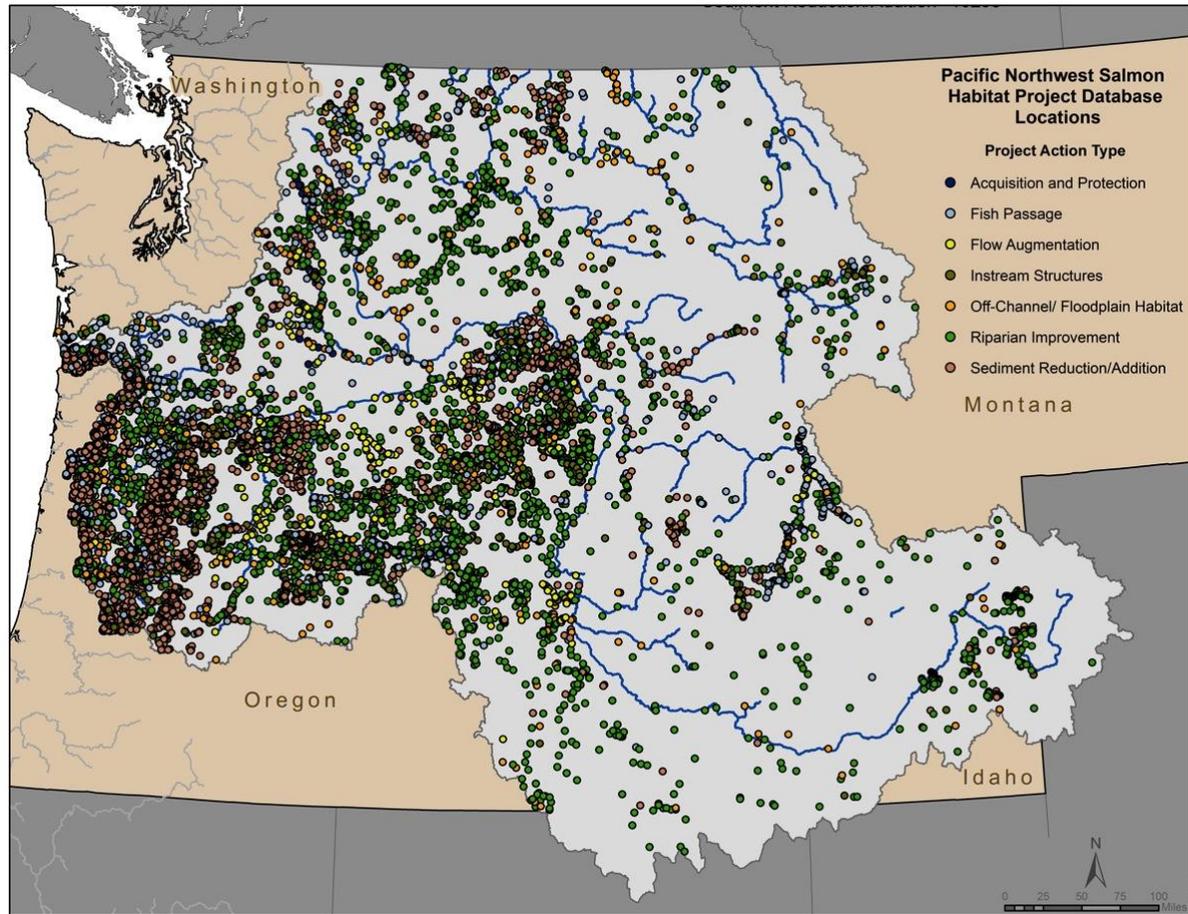
- \> 5,000 habitat projects since 2005

- Prior to 2014 done inconsistent and little info on effectiveness

- Recommendations for programmatic approach by NWPCC, ISRP, etc.

- Developed in 2013, initiated in 2014
  - Roni et al. (2014, 2015)

- Two separate contracts

AEM Goals

- Determine reach-scale physical & biological effectiveness of common habitat improvement (restoration) techniques in interior Columbia Basin

- Help guide future restoration efforts for BPA Fish and Wildlife Program

- Cost-effective approach that doesn't require monitoring every project

- New (>2014) and completed projects (<2014)

- *Compatible with SRFB*, CHaMP*, some data collection by partners*

    *Important constraints

AEM Overarching Questions/Hypotheses

- What is the effect of different action categories on habitat and fish at the reach scale?

- Within an action category, why are some projects more successful than others in producing physical and biological improvements?

- Are there differences among geographic areas (ESUs) in physical and biological success of action types?

AEM Study Design

Project planned for after 2014

- Multiple-before-after control-impact (MBACI)
- 12-15 projects per restoration action type
- Monitoring in years -2, -1, and +1, +3, +5

Project completed before 2014

- Extensive post-treatment (EPT)
- 30+ projects w/ paired treatment & controls
- Treatment and control selection critical
- Sampling once well after restoration

MBACI	EPT
Partial Barriers	Complete Barriers
Floodplain (3 subtypes)	LWD, ELJs etc.
Bank Stabilization	Riparian Planting & Invasive Removal
Riparian Fencing	
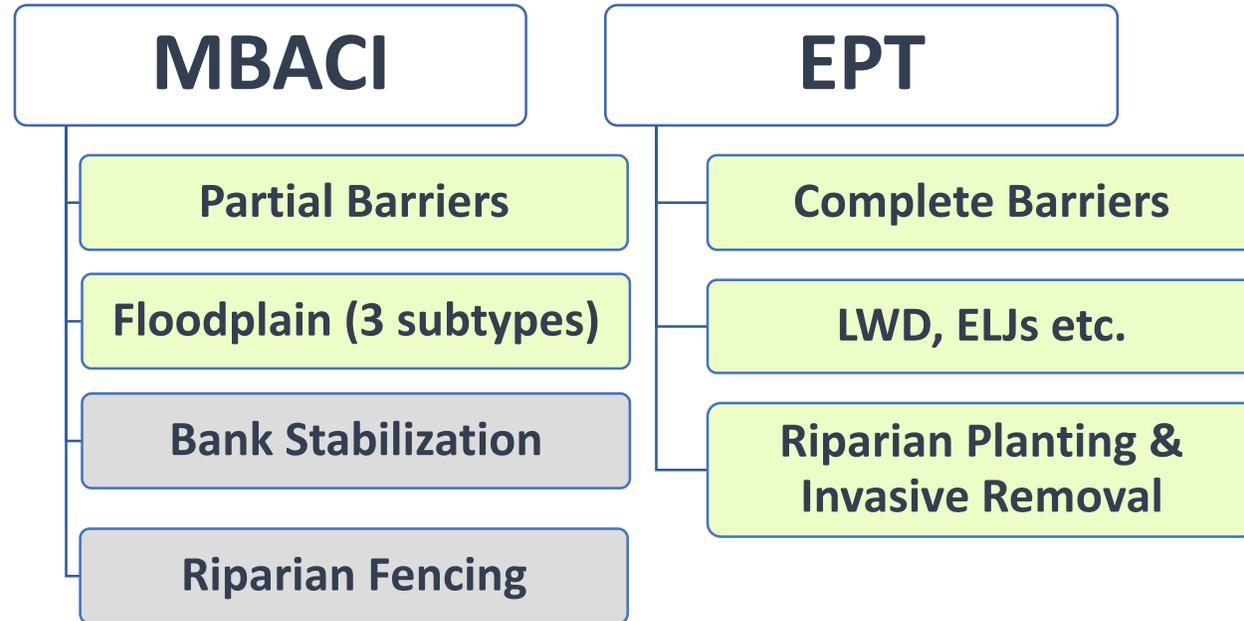
Results to Date - EPT

Complete Barriers

LWD

Riparian Planting

# Complete Barrier Removal Project

- Of 100 BPA projects since 2004, 32 with suitable treatment and control reaches*

- Sampled fish and habitat above and below former barrier (culvert)
  - 3-pass electrofishing
  - Long-profile habitat survey
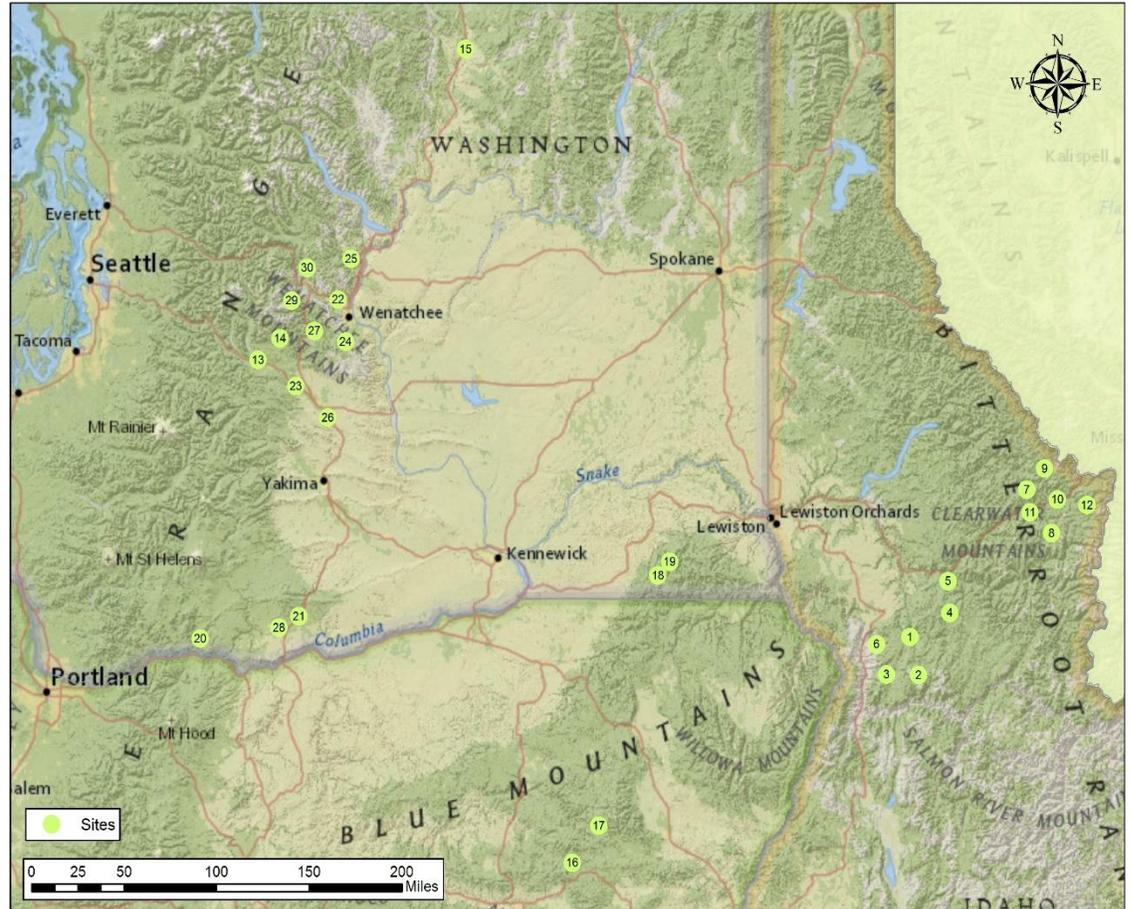
* 4 sites in the Yakima Basin

# No difference in # of fish above and below former barriers

Chinook, coho and steelhead

■ Above culvert ■ Below culvert

No. of juvenile fish

Antoine, DCG, Granite, Indian, Jack, Badger 1, Badger 2, Cabin, Camp, Corral, Doe, Hepner, Mare, Mertin, Mule, Wendover L, Wendover U, Butler, Cahail, Indian, Ireland…, Jenkins, Little Camas, North Road, Orr, Reecer, Sand 1, Sand 2, Taenum, Tillicum, Whitney
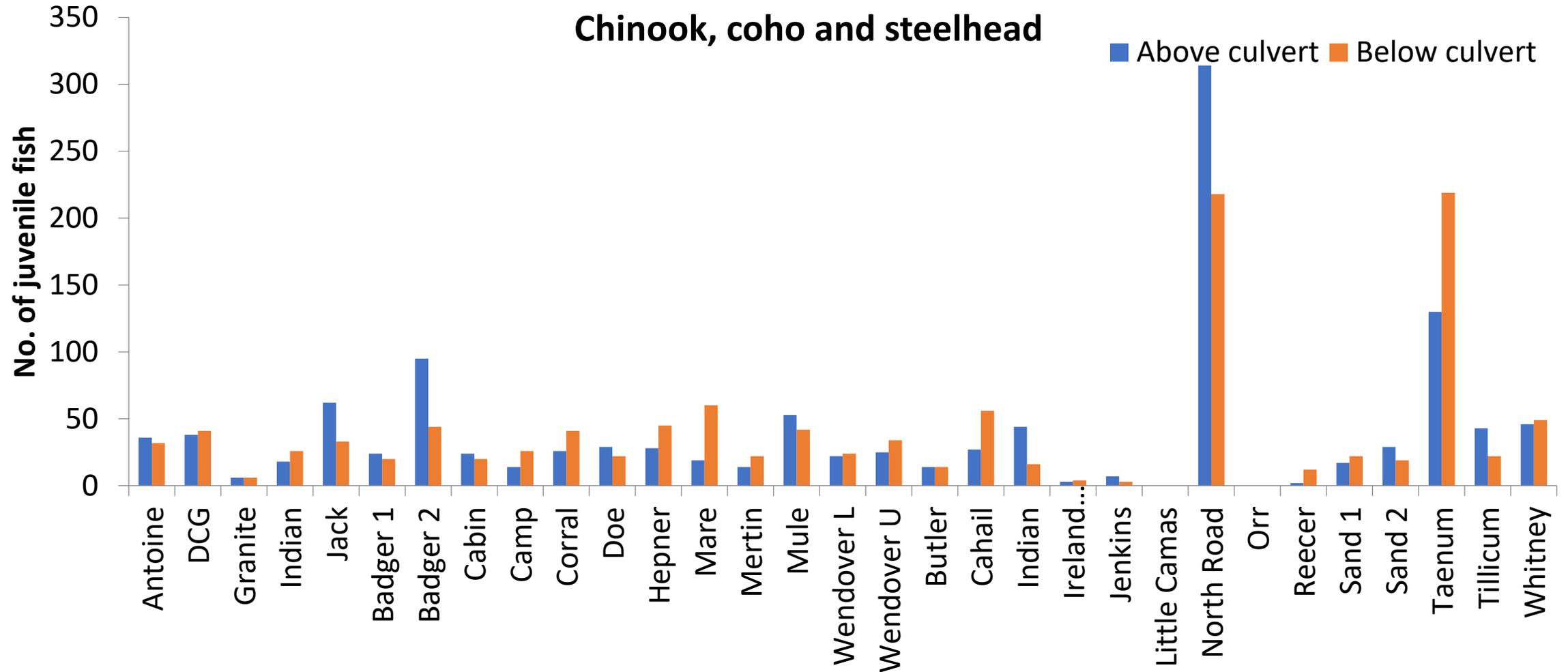
* No difference is good thing for barrier removal !!

EPT Results - LWD

- Of 227 completed projects, identified and sampled 29 with suitable treatment and controls*

- Sampled fish and habitat in treatment and control reaches
  - Snorkel surveys
  - Long-profile habitat surveys
  - Large wood surveys
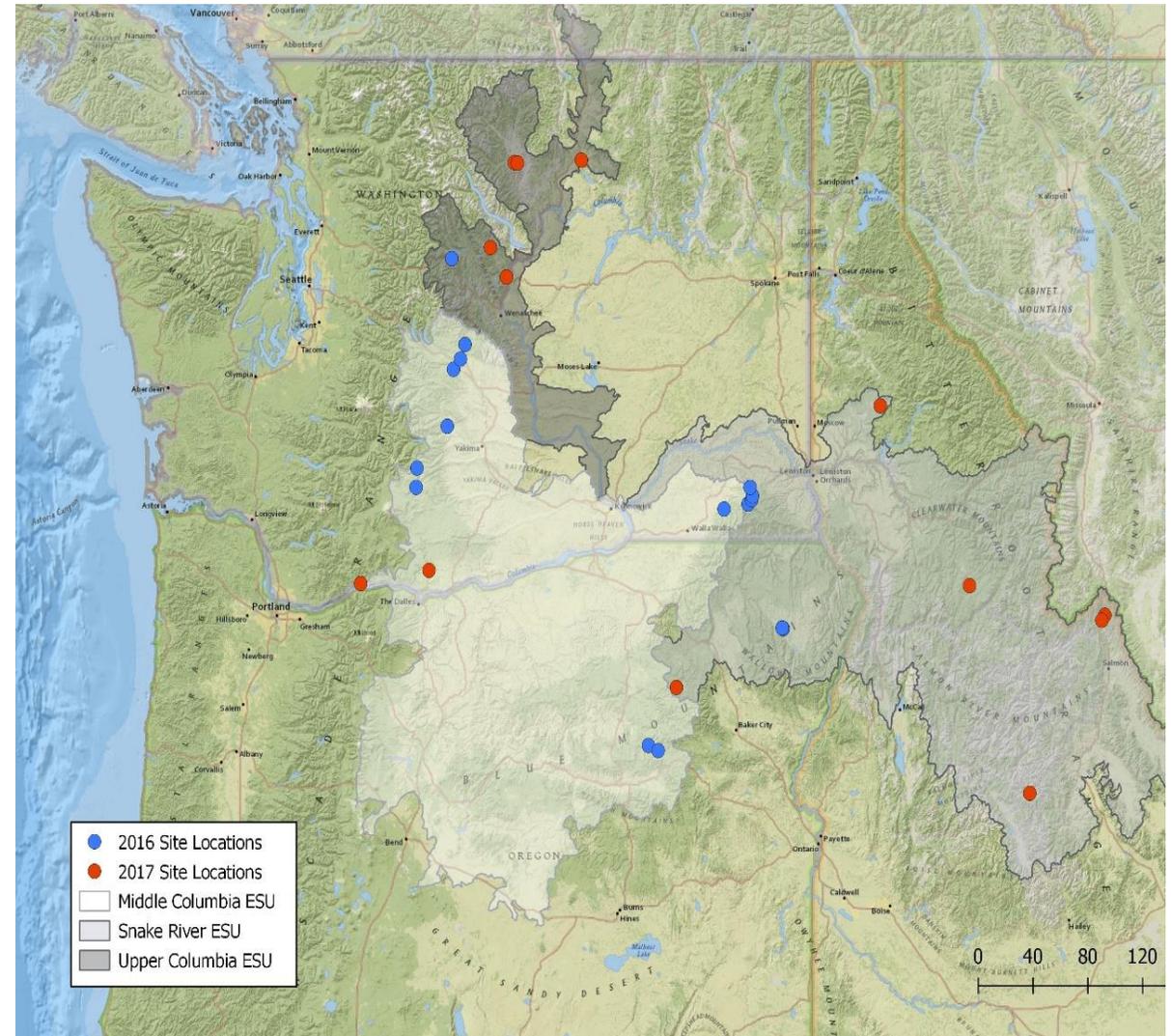

* Sites in Yakima basin

EPT Results - LWD/Instream
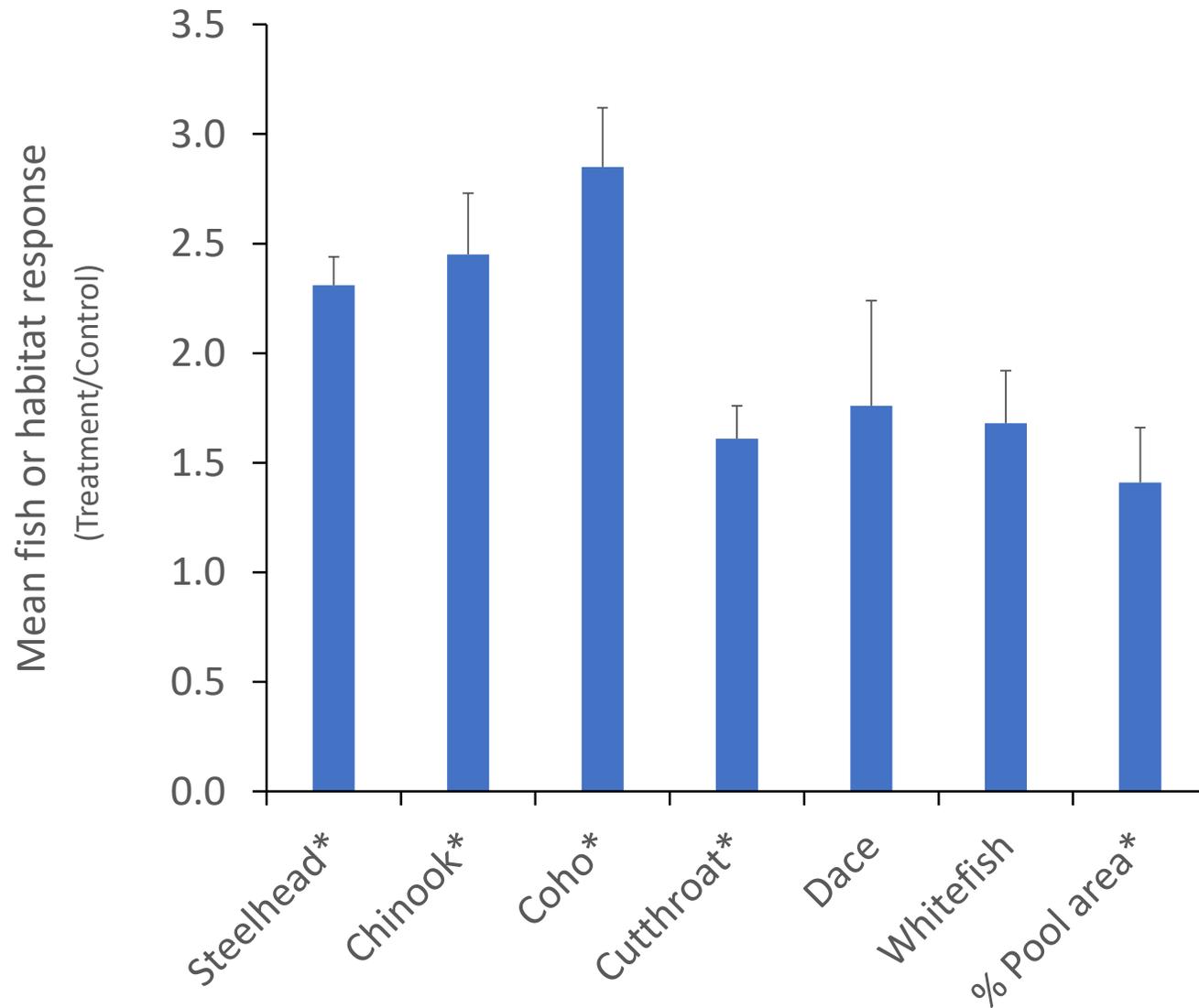
*significant increase < 0.05

EPT Results - LWD/Instream & water temp
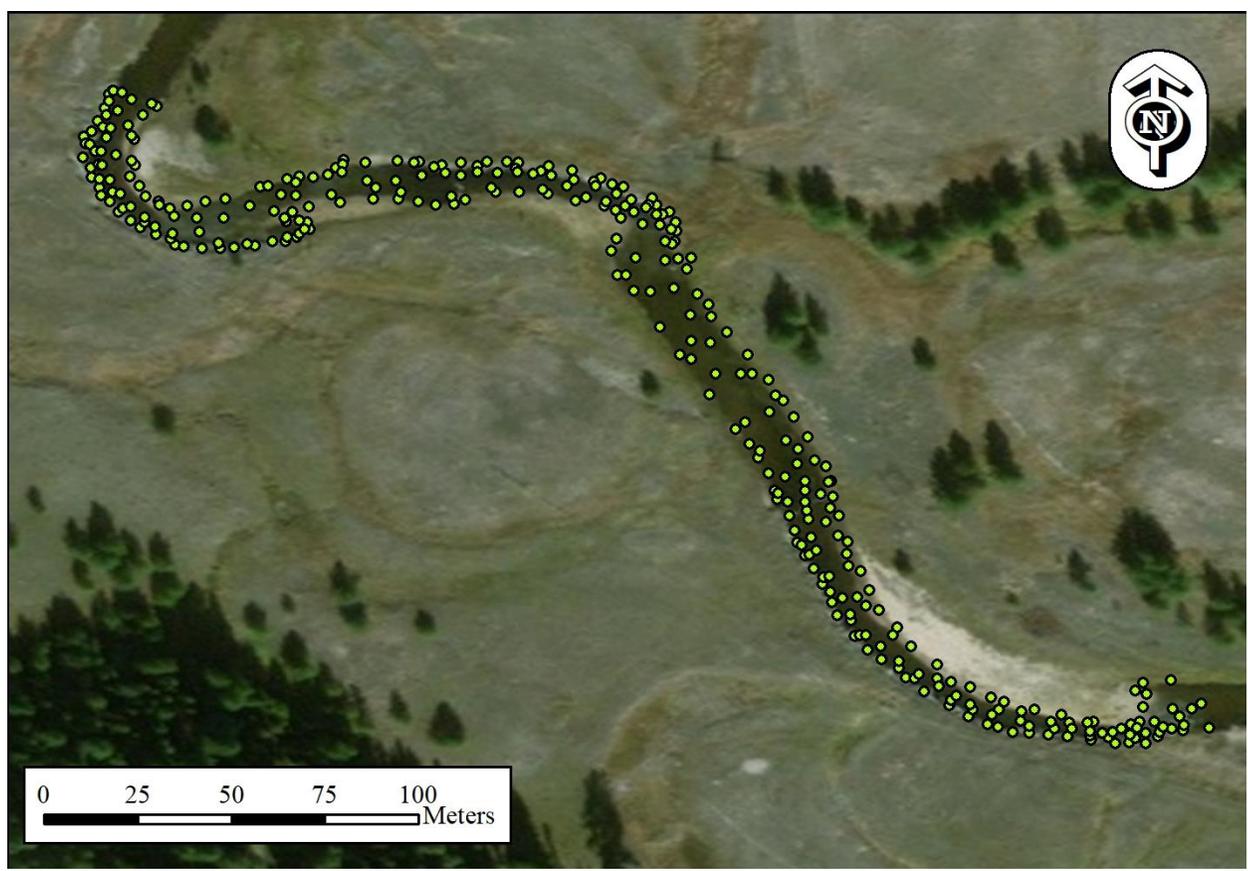
Raw Temperature Data

Control   Treated

Detrended Temperature Data

Control   Treated

Temperature (deg. C)

14.5 - 15.0	13.5 - 14.0	12.5 - 13.0	11.5 - 12.5
14.0 - 14.5	13.0 - 13.5	12.0 - 12.5	11.0 - 11.5
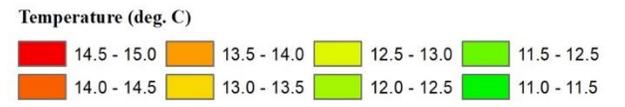
* 9 sites – no sig. diff. in temp when detrended for time of sampling

EPT Results – Riparian planting (preliminary)

- Sampled 21 with suitable treatment and controls

- Will sample 40 additional sites in 2019

- Measured riparian plant species abundance, richness, diversity, vegetation structure and cover, stream shade
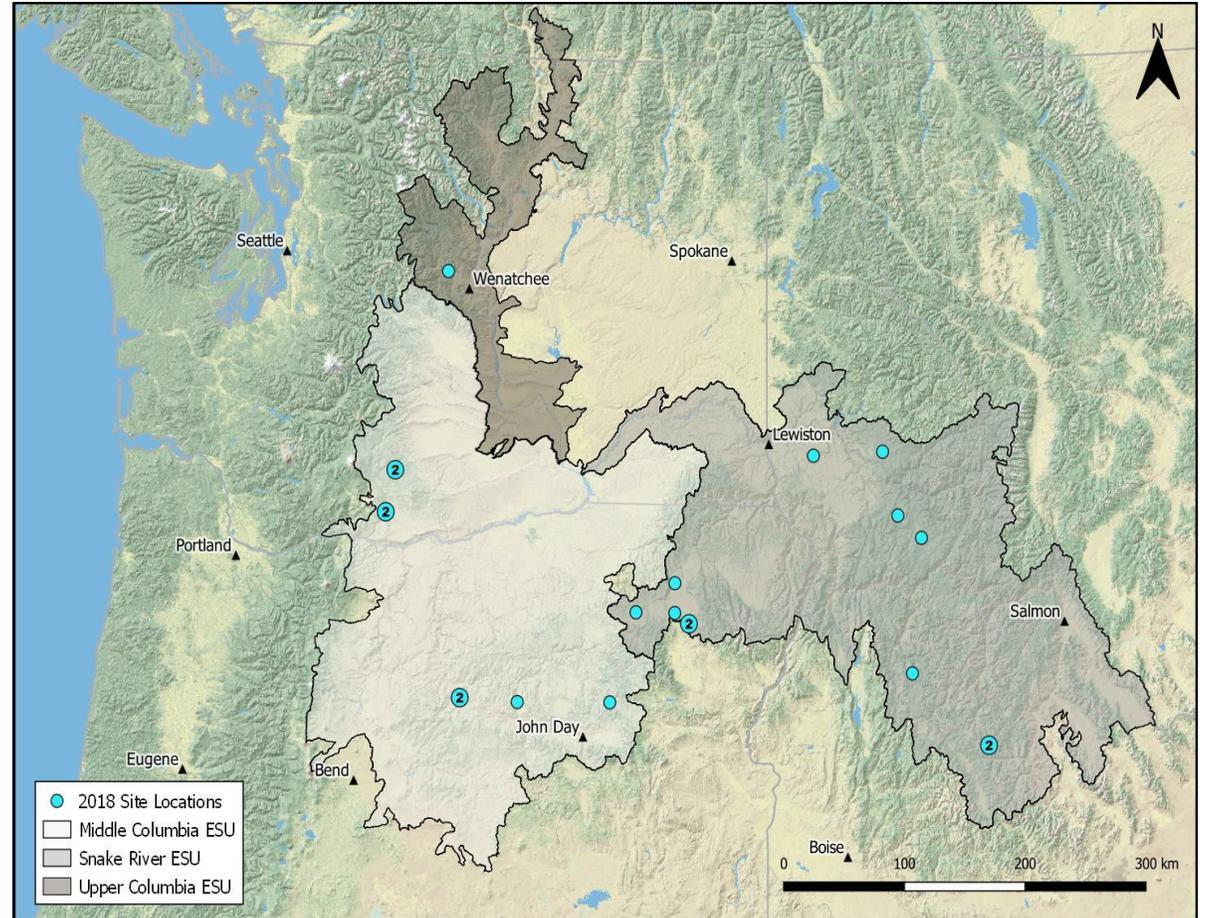
MBACI – Results….well update really

- Concerns with MBACI implementation from 2014 to 2017 led to AEM Program being put out to bid

- AEM put all under one contract in Feb. 2018

- We reviewed all data, protocols, and sites in early 2018

- Identified issues with prior implementation
  - Restoration implementation issues
  - Control sites
  - Timing of data collection
 - SRFB and CHaMP protocol and data issues*

MBACI – Update continued

Partial Barrier - 3 of 9 Sites OK
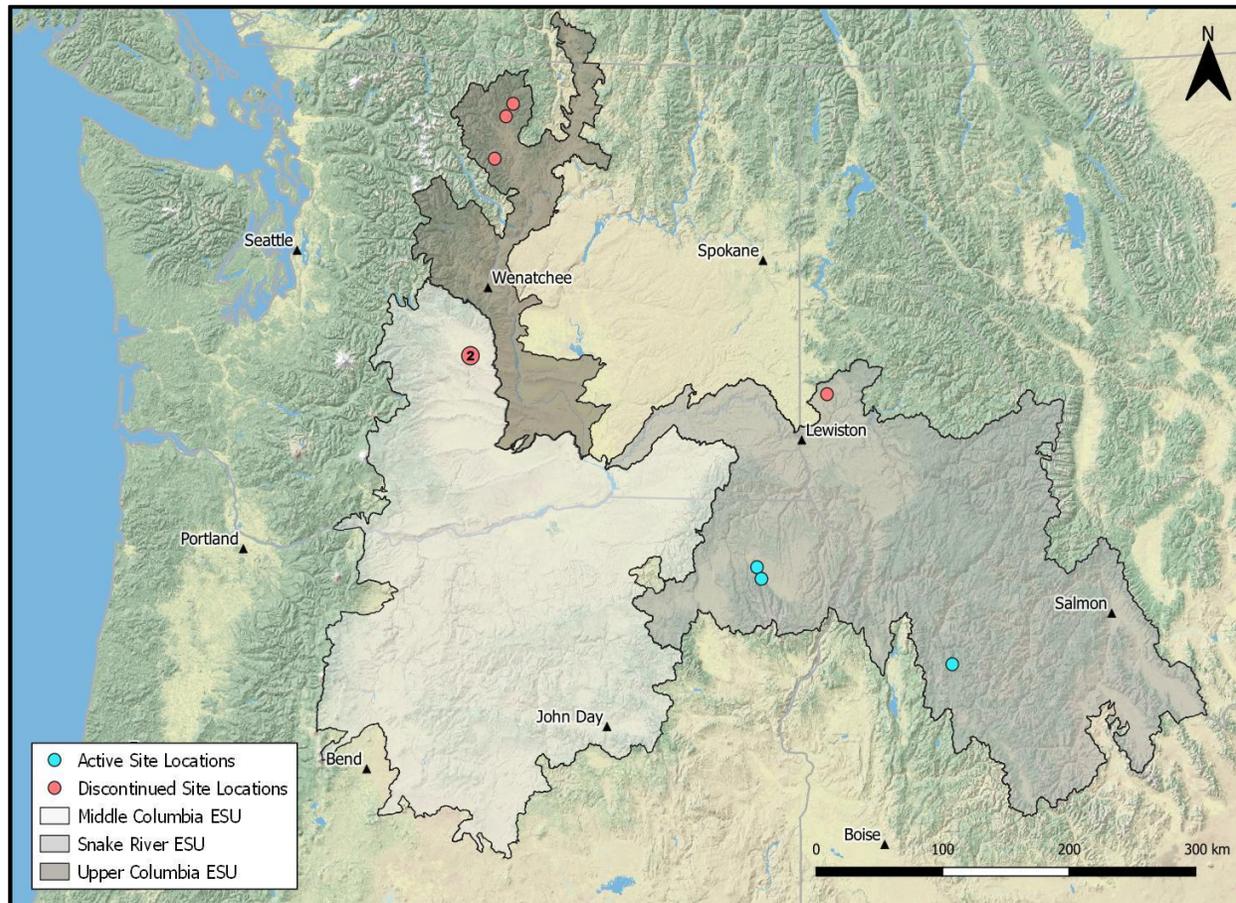
Floodplain Projects – 6 of 32 Sites OK
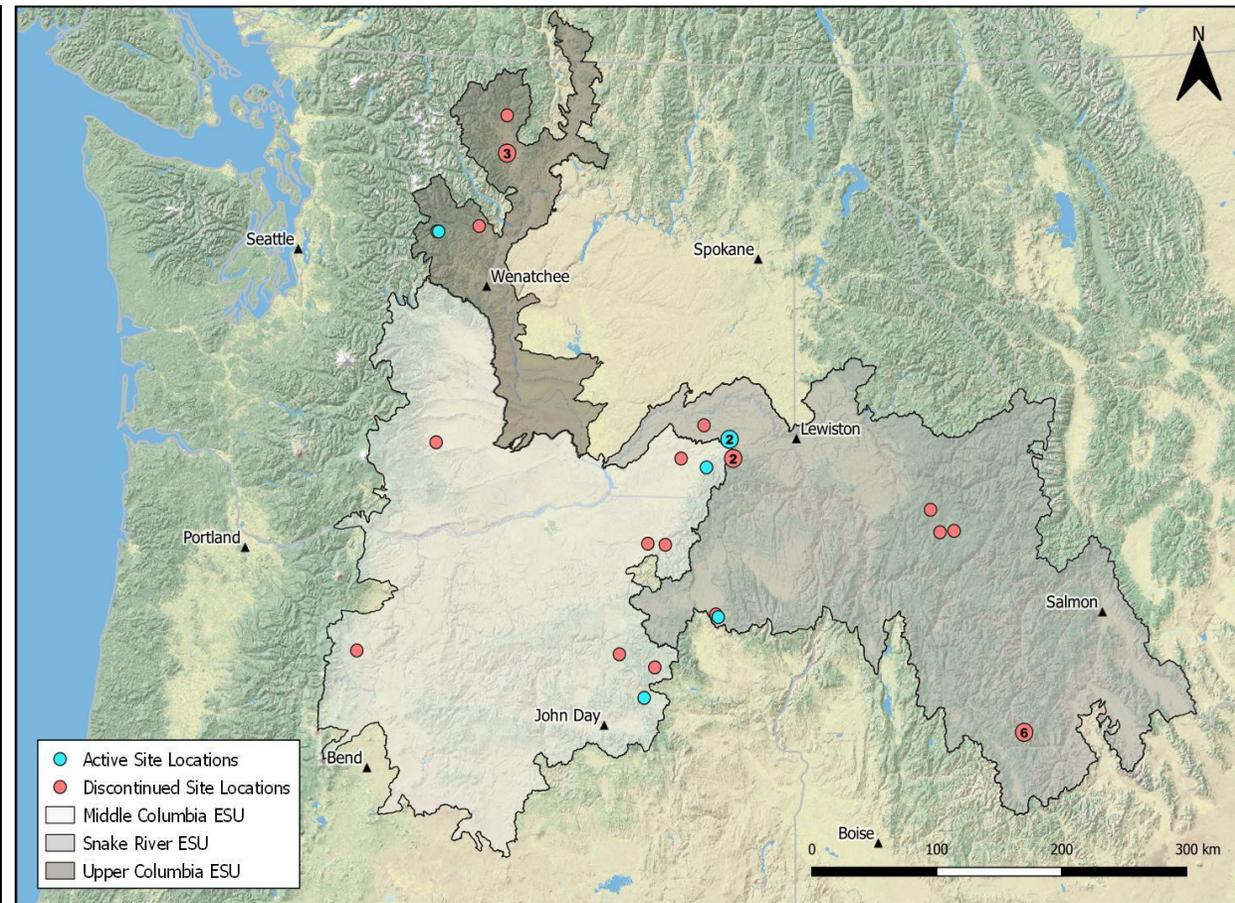
MBACI – Moving forward

- Based on this information we developed a new schedule and approach for floodplain projects
  - Continue with MBACI approach for those sites with good data
  - Move other floodplain sites to EPT design

- This allows
  - Continue good MBACI sites as case studies
  - Robust EPT design widely used in Europe
  - Updated sampling protocols better suited for floodplains
  - Achieve original objectives by 2022
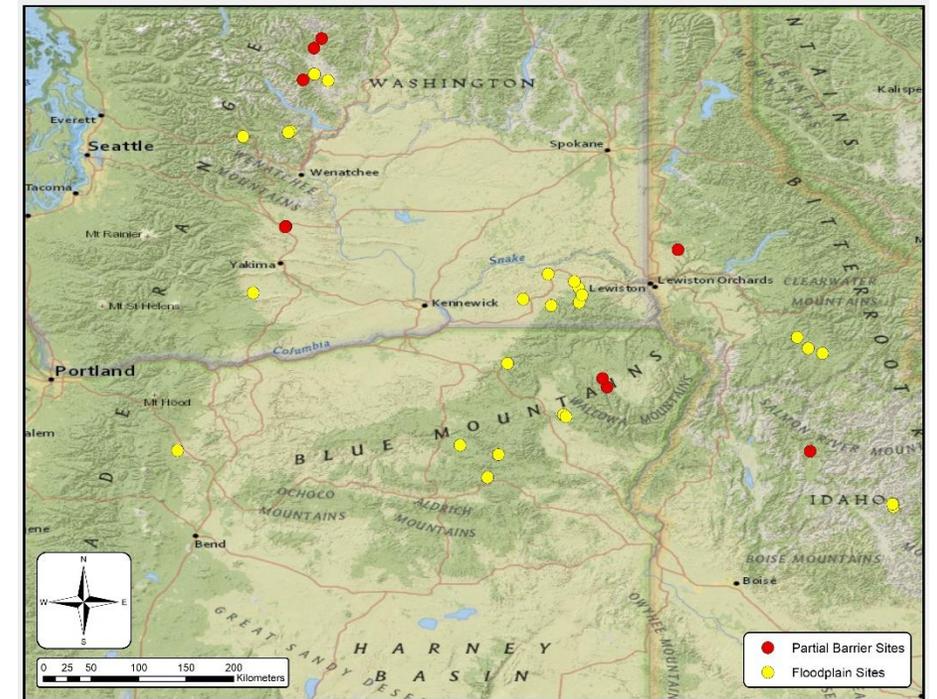
Project /Design	Year of Data Collection				
	2018	2019	2020	2021	2022
Floodplain enhancement					
MBACI	X	X	X	X	X
EPT			X	X	X
Partial barrier					
MBACI	X	X	X	X	X

AEM Summary

- EPT Full barriers and LWD completed
  - Both show positive fish responses

- EPT Riparian planting and invasive removal
  - Preliminary results for 21 sites
  - ~40 additional sites in 2019

- MBACI Adaptive Management
  - Continue sampling those partial barrier and floodplain sites with good data
  - Sample 30 floodplain projects using EPT in 2020, 2021 & 2022

Bonneville Power Administration Action Effectiveness Monitoring Program – 2018 Annual Report

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Acknowledgements

Looking for More Projects to Include !

We will be scouting for additional riparian planting, invasive plant removal, and floodplain projects to monitor in next few years so if you have any please let us know!

They need to be directly or indirectly BPA funded projects and have a suitable control reach.

Questions?

Additional information in our annual report.

Roni, P., C. Clark, M. Krall, S. Burgess, and K. Ross. 2019. Action Effectiveness Monitoring 2018 Annual Report. Project No. 2016-001-00. Report to Bonneville Power Administration, Portland, Oregon.

Bonneville Power Administration Action Effectiveness Monitoring Program – 2018 Annual Report

Additional Slides

EPT – Preliminary Riparian Planting Results

- Shrub abundance was significantly higher in treatment versus control reaches

- No difference in other metrics, but…

- Site age was positively correlated with tree abundance

- Species richness negatively correlated with precipitation.

$R^2 = 0.46$

$R^2 = 0.45$