

# Chehalis Basin Strategy: Reducing Flood Damage and Enhancing Aquatic Species

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## *Aquatic Species Enhancement Plan*

*Policy Work Group Meeting*

*Chehalis, Washington*

*September 25, 2014*



# Overview of Study - Salmon

- Scope: Upstream of and including the Wynoochee River
- EDT model: Spring- and fall-run Chinook, coho, steelhead
- Enhancement – culverts, riparian maturation in managed forests, riparian enhancement and installation of wood in other lands, off-channel reconnection
  - Low combo: Culverts, managed forests (low range), other lands (low range)
  - High combo: Culverts, managed forests (high range), other lands (high range)
- Climate
  - Low and High scenarios of wetter winters, drier summers and warmer temperatures

# Current Status of Salmon Habitat (EDT)

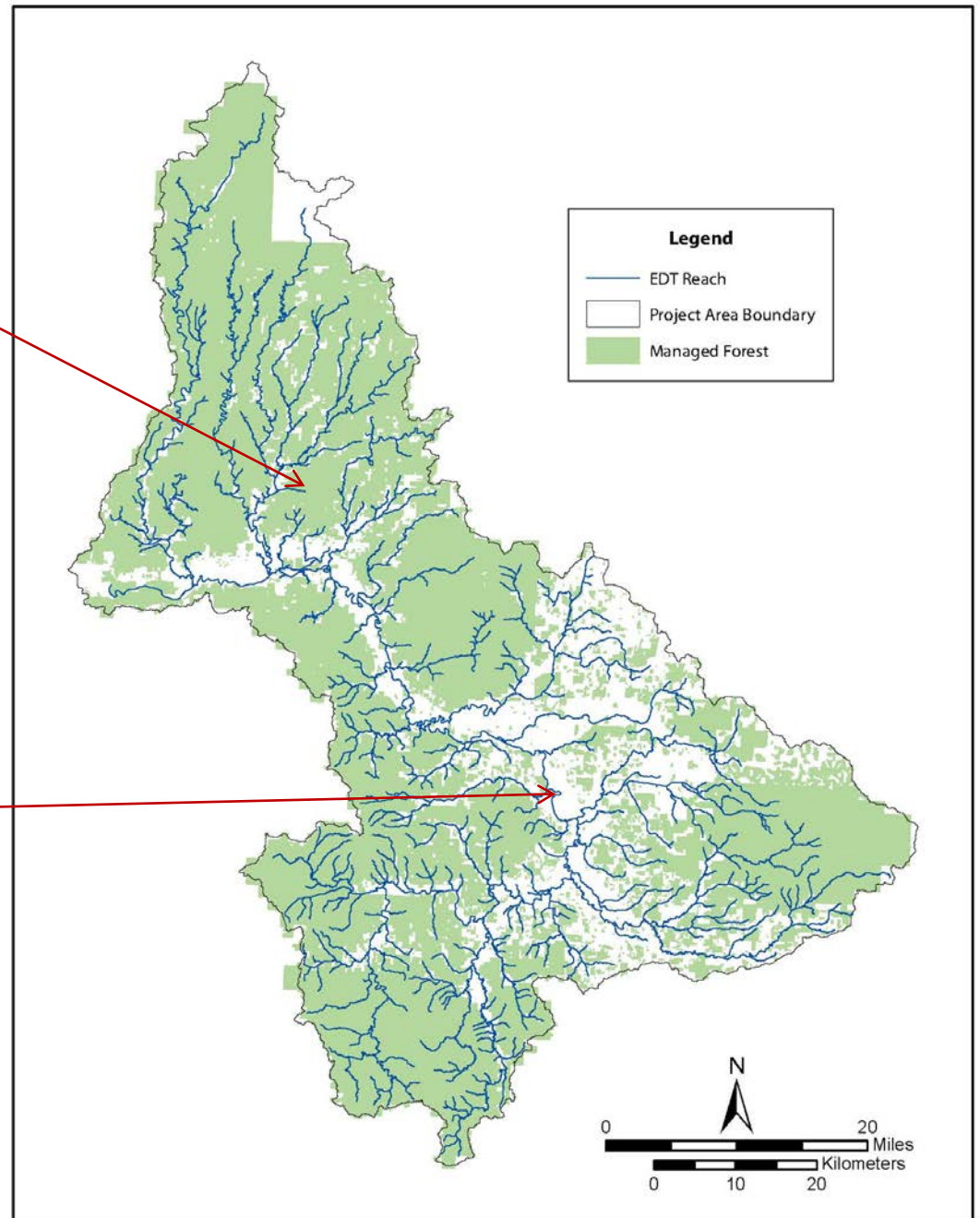
- Degraded
- Impairment varies by species and tributary
  - Spring-run Chinook salmon: 78%
  - Fall-run Chinook salmon: 45%
  - Coho salmon: 69%
  - Steelhead: 44%
- Conclusion: Large potential for enhancement

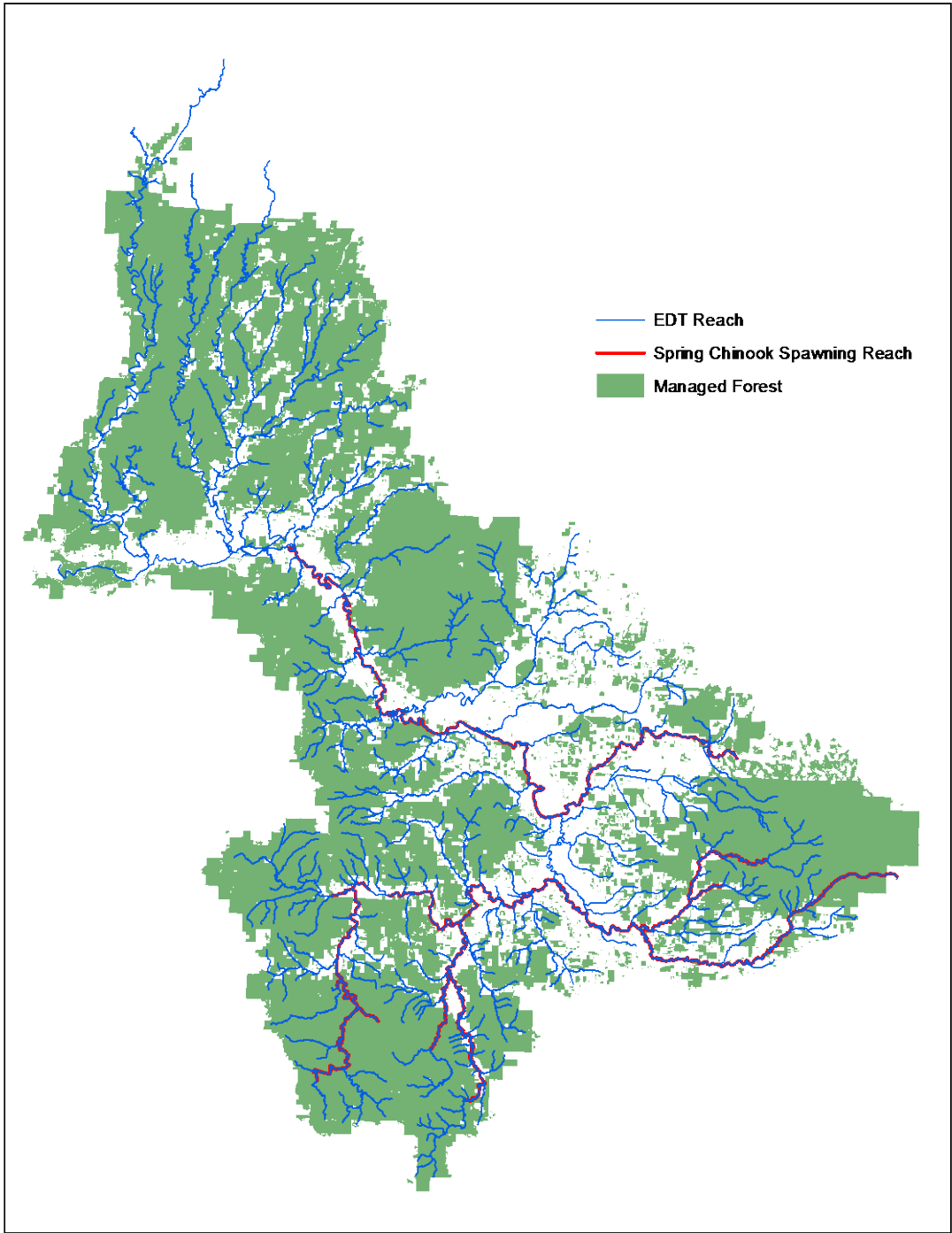
# Barrier Removal

- Action:
  - Removed 169 high priority culverts
  - 11 State owned; 158 on non-State owned land
- Results:
  - Coho +8.5%                      Steelhead +8.2%
  - Fall-run Chinook +1%        Spring-run Chinook 0%
- Assumptions:
  - Repairs are effective and do not fail over time
  - 169 of ~2,200 culverts in basin included
  - Spring-run Chinook do not inhabit reaches above barriers

Restoration in  
Managed Forest  
Lands (green)

Restoration in  
Non-managed  
Forest Lands  
(white)







# Stream Miles of Enhancement

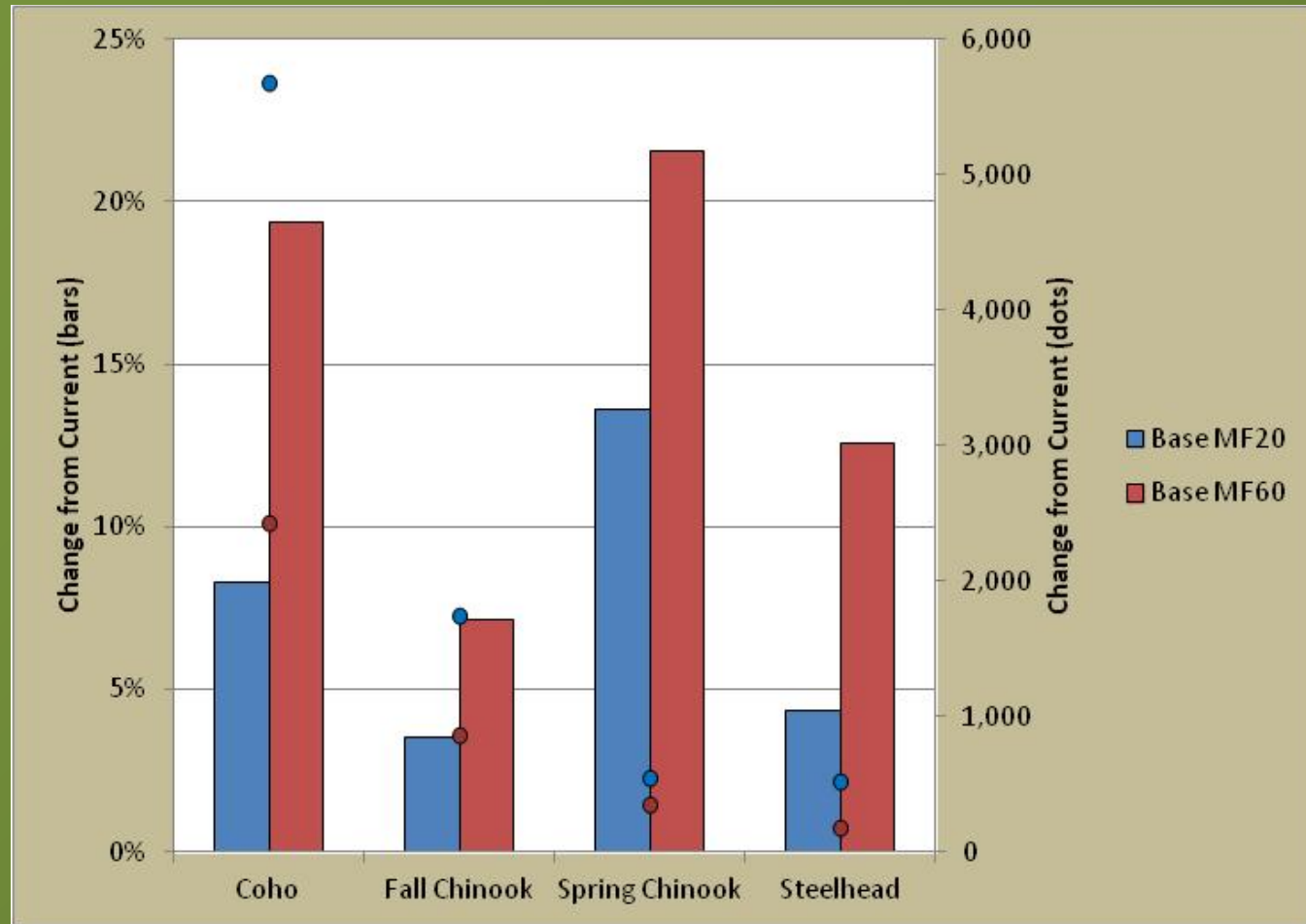
Stream/reach	Managed Forest	NMF - 50%	NMF - 75%
Wynoochee	98	-	-
Satsop	149	-	-
Lower Chehalis (Porter to Skookumchuck)	23	16	27
Middle Chehalis (Elk to Newaukum)	26	18	20
Skookumchuck	31	13	16
Newaukum	72	12	28
South Fork	95	7	12
Elk	51	2	2
Upper Chehalis above dam	56	-	-
<b>TOTAL</b>	<b>789</b>	<b>73</b>	<b>112</b>

# Managed Forest - Riparian Buffers

- Action:
  - Model riparian conditions increased by 20% and 60%
  - Wood added\*, temperature reduced\*, channel complexity increased, sediment reduced (\*key response variables)
- Results: +3 to +22%; largest benefit to coho and spring-run Chinook
- Assumptions:
  - Functional response occurs over 100-year period; can be achieved; wood stays in system
  - No change in baseline over time



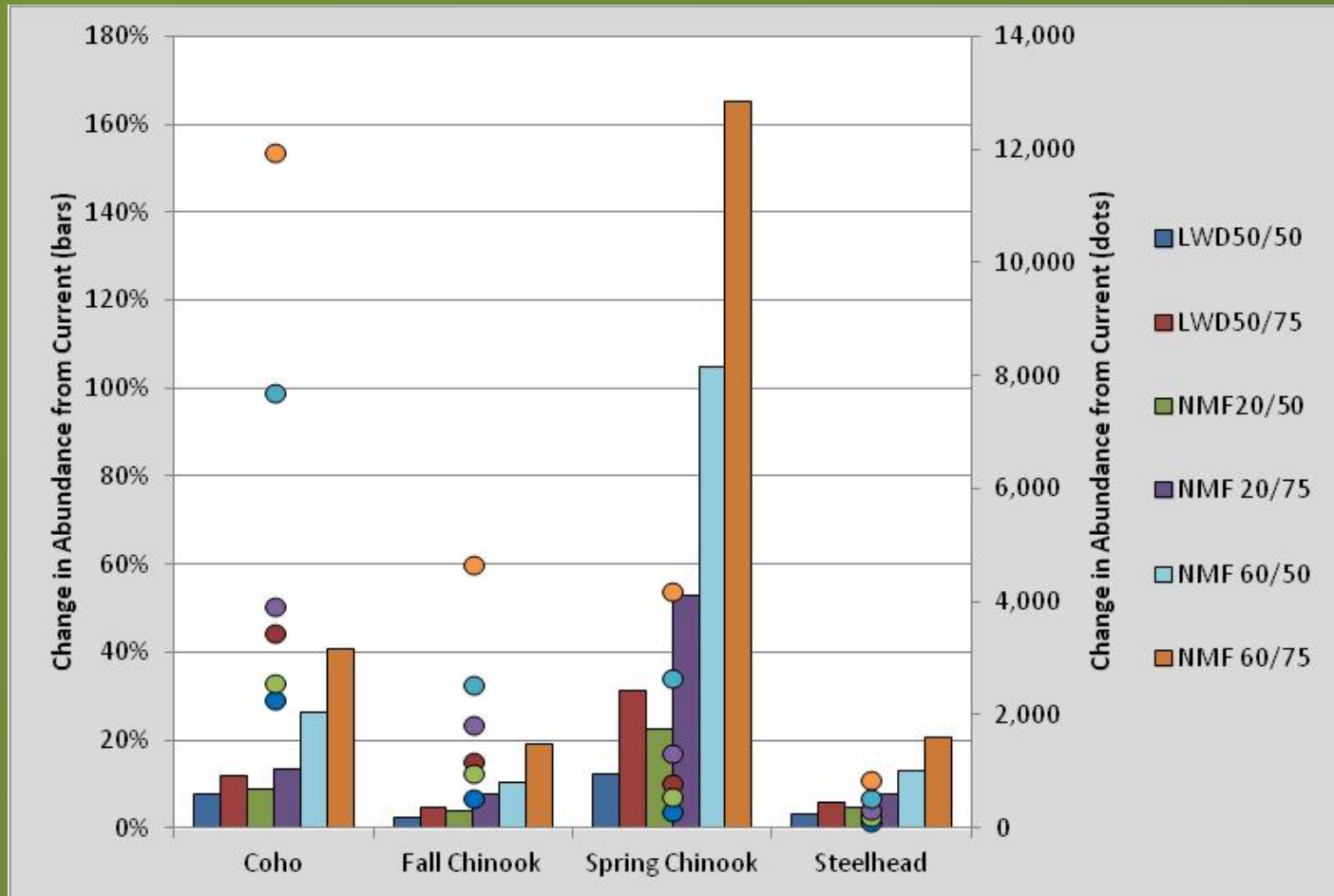
# Results of Managed Forest Riparian Maturation (bars are %'s; dots are #'s)



# Lands Outside of Managed Forests

- Actions:
  - Short-term: Added large wood to channel for immediate response
  - Long-term: Restored riparian conditions by 20% and 60%, over 50% and 75% of spring-run Chinook salmon reaches
    - Wood added\*, temperature reduced\*, channel complexity increased, sediment reduced
- Results: Largest increase to spring-run Chinook; action has to be effective and extensive to see large increases
- Assumptions:
  - Functional response occurs over 100-year period; can be achieved; wood stays in system
  - No change in baseline over time

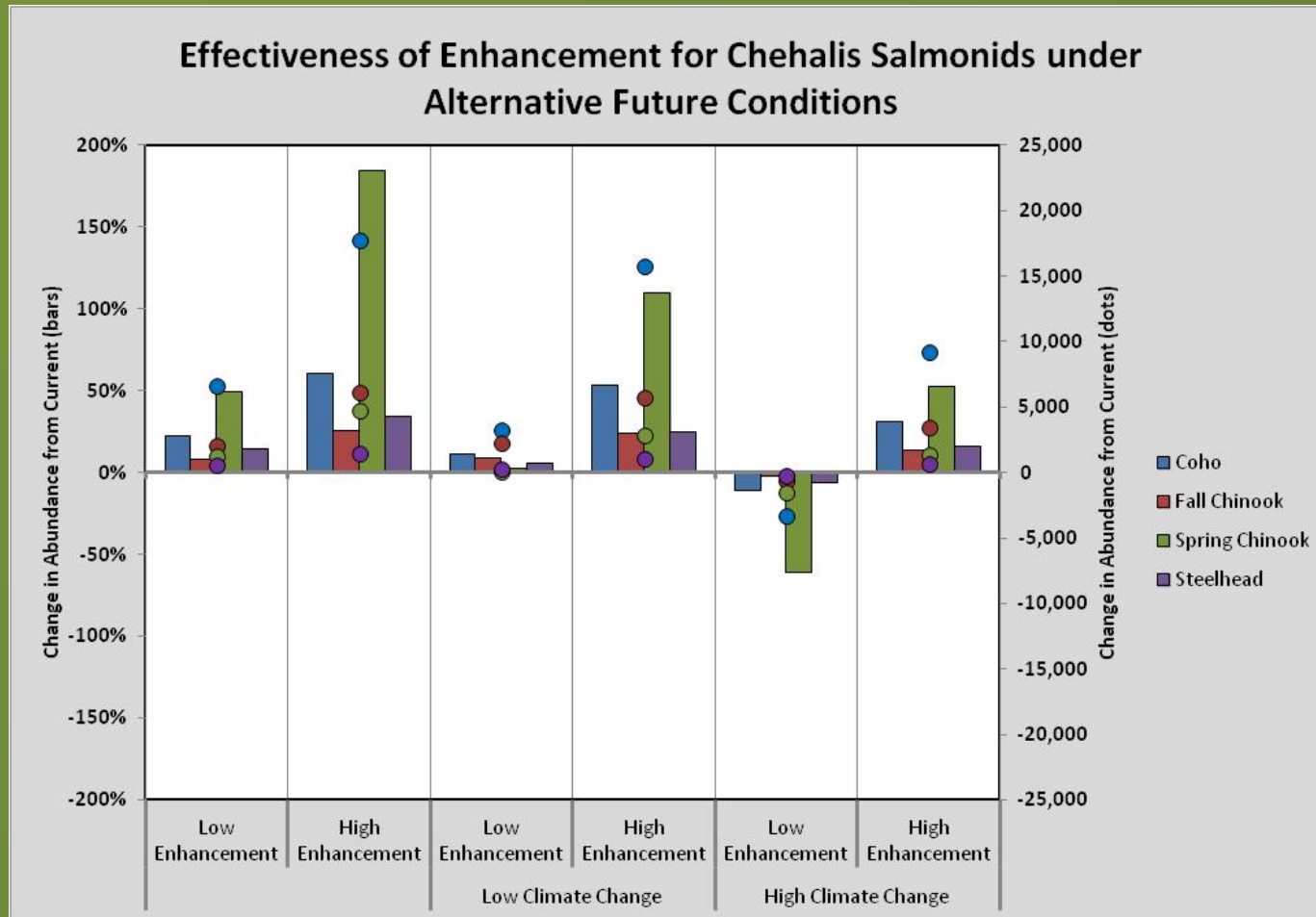
# Lands Outside Managed Forests (bars are %'s; dots are #'s)



# Combining Enhancement Actions (High and Low)

- Results:
  - Spring-run Chinook and coho had largest benefit
  - Synergistic effects from combining; to achieve large effect need High Enhancement (enhancement had to be effective and extensive)
- Assumptions:
  - Targeted spring-run Chinook; if targeted other species, responses would be somewhat different
  - Functional response can be achieved; wood stays in system
  - No change in baseline over time

# Habitat Enhancement Combinations + Climate Change (relative to current base case; bars are %'s; dots are #'s)



# Key Findings – Salmon Habitat Enhancement + Climate

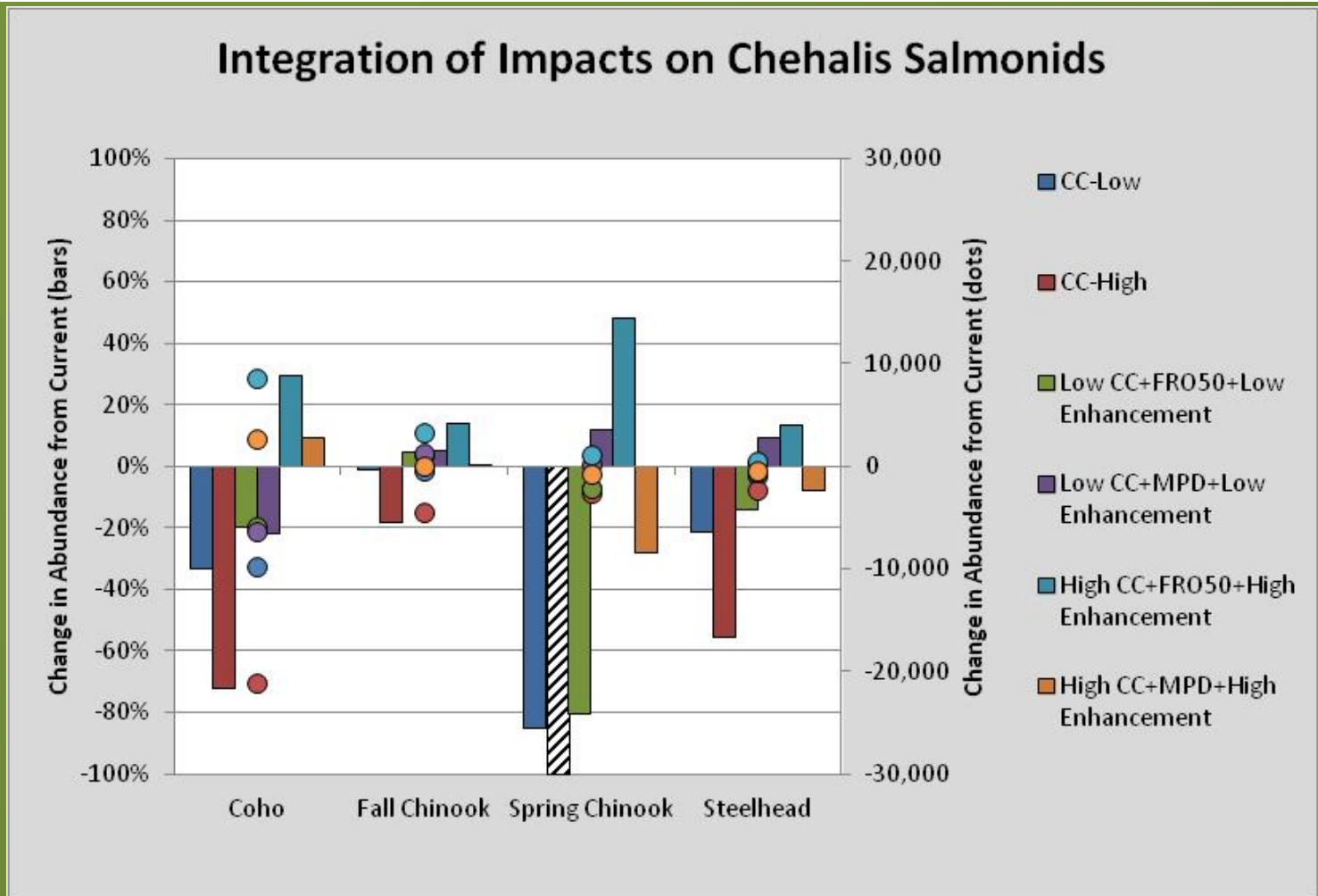
- Spring-run Chinook had largest % increases from enhancement because they were targeted
- Enhancement can mute climate impacts
- To achieve results, need to
  - Combine enhancement actions (culverts, managed forest, other lands)
  - Enhancement has to be effective and extensive (i.e, High) to partially overcome the effects of future climate scenarios
- Key assumptions:
  - No change in current baseline (but it will change!)

# Water Retention Structures + Habitat Enhancement + Climate

- Many combinations  $< 0$  (climate is a major driver of the response)
- The High Enhancement scenario was typically needed to overcome climate
- Assumptions:
  - MPD results sensitive to key assumption of whether MPD or Enhancement controls temperature downstream of dam
  - No degradation in baseline over time other than climate
  - Habitat benefits assume functional response can be achieved; wood stays in system; culverts continue to function



# Water Retention Structures, Habitat Enhancement, and Climate Combined (bars are %'s; dots are #'s)



# Major Conclusions:

## Water Retention Structures + Habitat + Climate

- The water retention options (MPD and FRO) in general negatively impacted salmon; assumption of cool water benefit from MPD for spring-run Chinook salmon needs validation
- Both High and Low Enhancement Scenarios positively affected fish populations
- Climate change is major factor – only the high enhancement scenario offset the high climate scenarios
- Climate change could lead to a major decline for all salmon and steelhead, and the extirpation of spring-run Chinook salmon in the basin and some populations of other species. Given the potential magnitude and uncertainty, climate warrants a more in-depth risk assessment

# Major Conclusions:

## Water Retention Structures + Habitat + Climate

- Enhancement had to be effective and extensive to overcome the effects of future climate scenarios and water retention alternatives
- In most cases the modeled results and underlying assumptions need tested and validated, especially with respect to the interactions between enhancements and dam effects
- Sequencing of enhancement actions is critical to achieving the predicted results (i.e., both short-term and long-term actions are needed)

# Off-channel (Floodplain) Enhancement

- Actions:
  - Large mainstem project (24,000'; 11 to 16+ acres; \$5.7 M)
  - Small Skookumchuck project (1,100'; 0.5 acre; \$ 0.5 M)
- Results:
  - Small effect on salmonids (from 0 to < 1%)(designed primarily to address the needs of Other Fish and Non-fish species)
  - Local populations benefitted
- Assumptions:
  - Functional response can be achieved
  - No consideration of non-native predators entering site
  - No change in baseline over time

# Enhancement Cost Estimates

- Barrier removal: \$35 M (average; \$31 M non-state)
- Riparian enhancement in lands other than managed forests:
  - 50% - \$ 64 M (average)
  - 75% - \$ 96 M (average)
- Off channel: \$6 M/large project

# Uncertainties

- Enhancement has to be effective and extensive
- Need to ensure enhancement measures stay in place and are allowed to provide benefit
- Future baseline:
  - Included high/low climate scenarios, but high uncertainty associated with future climate predictions
  - Did not include human land use policies and development pressures, although they will almost certainly change

# Key Findings – Other Fish and Non-fish Species

- No restoration or enhancement projects were modeled due to a lack of specific design information
- Habitat actions that focused on salmon were reviewed and thought to be positive or have no effect for Other Fish and Non-fish species
- Effects on Other Fish and Non-fish species carry high uncertainty (e.g., effects of non-native predators)
- Monitoring and research will be needed to evaluate enhancement actions for Other Fish and Non-fish and ensure salmon habitat enhancement is neutral or positive



# Next Steps – Salmon

- Studies to better understand Chehalis Basin salmon life history diversity (e.g., yearling Chinook)
- Survey culverts and develop culvert removal strategy and priority
- Add Chum salmon to EDT
- Additional studies to refine assumptions and effects of climate change

# Next Steps – Other Fish and Non-fish Species

- Surveys of species to determine/verify abundance and distribution, life histories, habitat use, and limiting factors
- Non-native predator monitoring to better inform habitat restoration project design and location