

Type N Hard Rock: Stand & Channel Structure, Wood Input, & Amphibians



Aimee McIntyre, Marc Hayes, Reed Ojala-Barbour & Timothy Quinn

Washington State Department of Fish and Wildlife

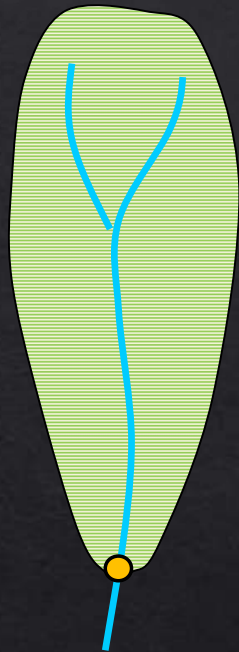
Dave Schuett-Hames & Greg Stewart

CMER Staff - Northwest Indian Fisheries Commission

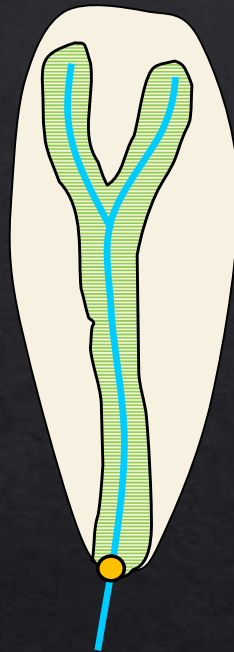
Response	Hard Rock	Soft Rock	
Non-fish Waters	Stand structure & tree mortality	X	X
	Shade	X	X
	Water temperature	X	X
	Sediment	X	
	Wood input	X	X
	Organic input (litter)	X	
	Channel structure	X	
	Amphibians	X	
Exports to Fish Waters	Water temperature	X	X
	Suspended sediment	X	X
	Organic & nutrient exports	X	X
	Macroinvertebrates	X	X
	Discharge	X	X

Hard Rock Experimental Treatments

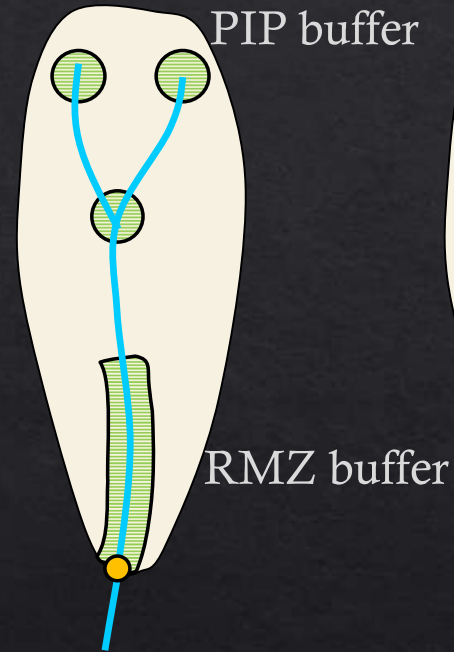
Reference (6)



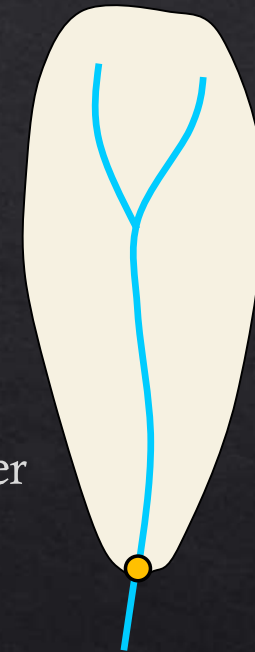
100% (4)



FP (3)

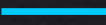



0% (4)



 = non-fish basin

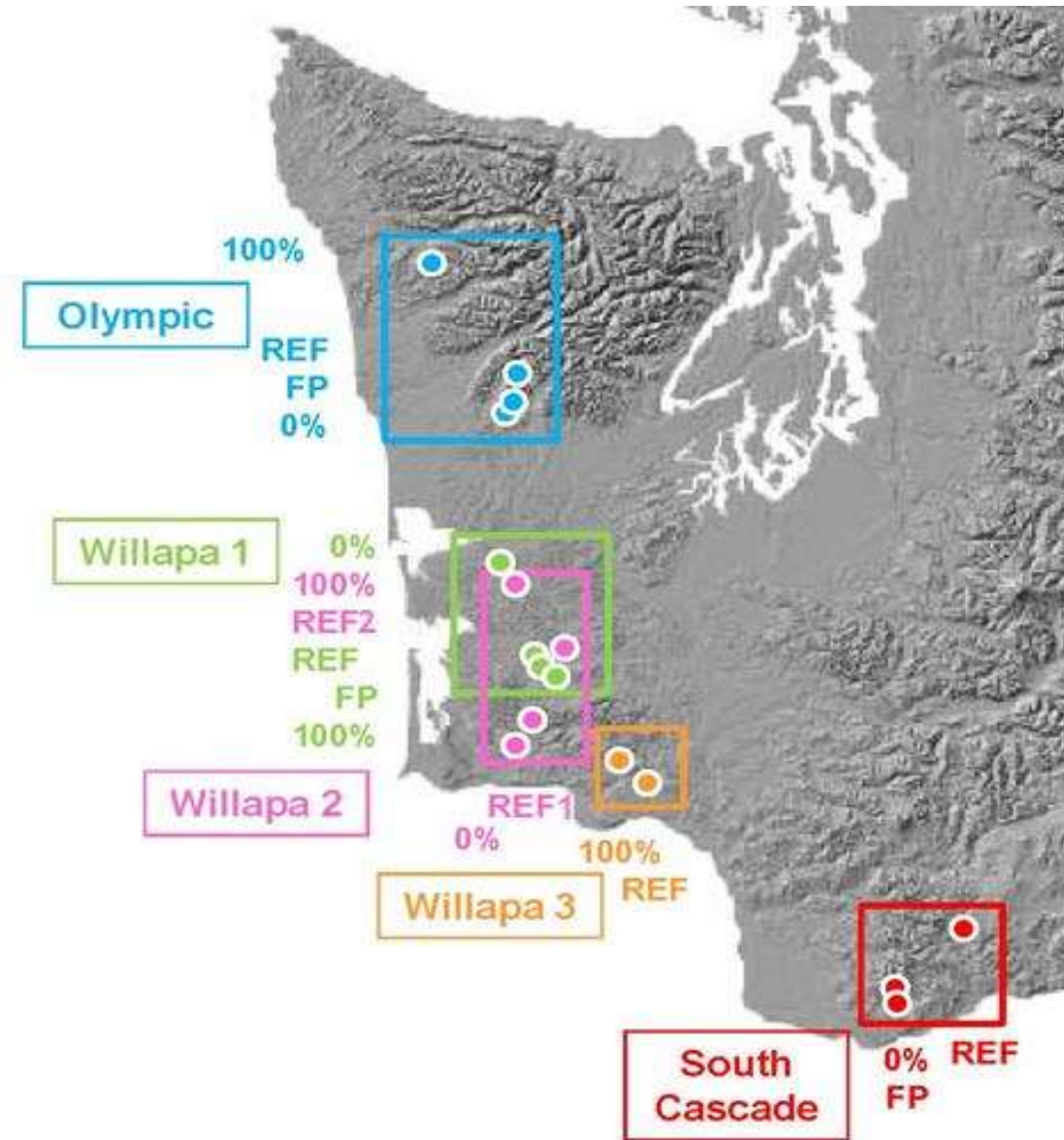
 = unharvested / 50-ft buffer

 = stream

 = fish end point

Study Site Distribution

- ✓ Perennial, non-fish streams
- ✓ Managed 2nd-growth forests
- ✓ Private/state/federal
- ✓ 30-80 year old stands
- ✓ 30-133 acre basins



Timeline

Pre-harvest

Post-harvest



● Monitoring

■ Harvest

Riparian Stand, Wood and Channel Characteristics



Unbuffered Reaches – 0% and FP Treatments



Change in Stand Structure

- ◆ Trees harvested in RMZ

Change in Wood Input

- ◆ Slash input during harvest
- ◆ Wood loading decreasing by Post 8
- ◆ Limited potential for future wood recruitment

Buffered Reaches – FP and 100%

Change in Stand Structure

- ◇ Less disturbance than in unbuffered
- ◇ Dominant disturbance is wind
- ◇ Wind mortality highly variable
- ◇ Greatest mortality 2 years after harvest
- ◇ Greater mortality in PIP buffer than RMZ buffers





Buffered Reaches – FP and 100%

Change in Wood Input

- ◇ Large wood (>10 cm) input variable, driven by wind mortality
- ◇ Large wood suspended over channel (>80% pieces)
- ◇ Provided cover but not channel function
- ◇ Large wood from wind mortality continued
- ◇ Small wood (<10 cm) loading intermediate
- ◇ Small wood contributed to in-channel functions

0% Treatment

- ◆ Greatest disturbance and change
- ◆ Greatest input of small wood, 2.8 times increase vs. Reference in Post 1 & 2
- ◆ Greatest in-channel changes: ~ 0.3 m decrease in bankfull and wetted width, and ~ 2.5 increase in odds of substrate dominated by fines and sand



FP Treatment

- ◆ Includes buffered (RMZ and PIP) and unbuffered reaches
- ◆ Increased but variable tree mortality in buffers
- ◆ Basal area decreased 55% in RMZ buffers in Post 8, little change in Reference
- ◆ Basal area decreased 53% in PIP buffers in Post 8, slight increase in Reference



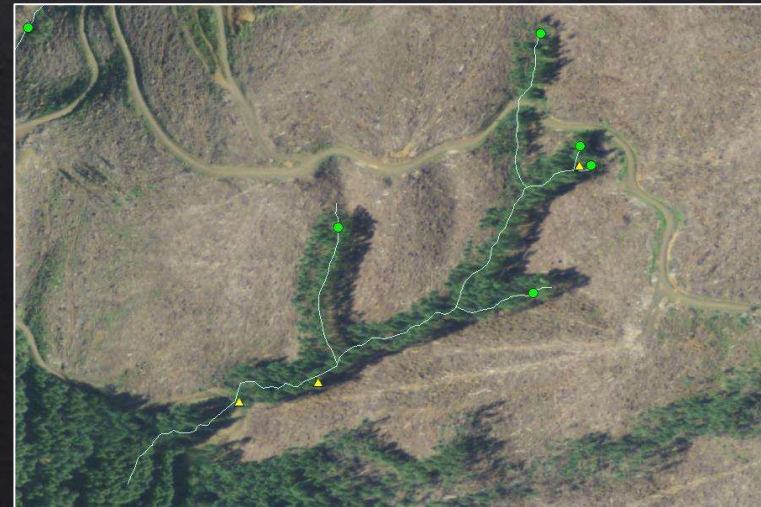
FP Treatment

- ◆ Large wood input from logging debris (unbuffered) and windthrow (buffered)
- ◆ Increased small (64%) and large (44%) wood loading Post 1 & 2
- ◆ Increase in small wood was declining by Post 8, but persisted for large wood
- ◆ Future stand structure and wood recruitment depends on the proportion of riparian stand removed and tree mortality in remaining buffers



100% Treatment

- ◆ Most stable stand structure
- ◆ Intermediate tree mortality relative to Reference and FP treatment
- ◆ Basal area decreased 14% in buffered RMZ in Post 8
- ◆ Basal area decreased 38% in buffered PIP in Post 8
- ◆ Increased small (58%) and large (66%) wood loading Post 1 & 2, differences were decreasing by Post 8



Stream-associated Amphibians



Stream-associated Amphibians



Coastal Tailed Frog
(*Ascaphus truei*)



Torrent Salamanders
(3 *Rhyacotriton* species)

Giant Salamanders
(2 *Dicamptodon* species)



Resource Objectives: Stream-associated Amphibians

Schedule L1 Overall Performance Goal:

- Support long-term viability of other covered species

CMER Work Plan:

- Provide conditions that sustain stream-associated amphibian population viability within occupied sub-basins



Results

- ✓ 21,194 amphibian observations
- ✓ 98% were focal taxa



1,994

0 – 4.5 lar

0 – 2.5 post



12,989

0 – 110



5,727

0.3 – 59

Results: Larval Coastal Tailed Frog Density

Post 1 & 2

- Increase (+106%) in the FP treatment

Post 7 & 8

- Decrease (-65%, -93%, -84%) in the 100%, FP and 0% treatments



Results: Post-metamorphic Coastal Tailed Frog Density

Post 1 & 2

- Increase (+961%) in the 0% treatment (large uncertainty)
- Decrease (-57%) in the 100% treatment

Post 7 & 8

- Decrease (-71%, -97%) in the 100% and FP treatments



Results: Torrent Salamander Density

Post 1 & 2

- Increase (+198%) in the 0% treatment

Post 7 & 8

- Decrease (-64%) in the FP treatment



Results: Giant Salamander Density

Post 1 & 2

- Decrease (-64%) in density in the FP treatment

Post 7 & 8

- *Decrease (-53%) in density in the FP treatment (CI for comparison includes 1)*



Amphibians in Wood Obstructed Reaches

Pre-harvest



Post-harvest



Results: Amphibians in Wood Obstructed Reaches

Post 1 & 2

- All life stages, including egg masses, for all taxa
- Large densities for torrent salamanders (up to 37/m)

Post 7 & 8

- Not all life stages (no giant salamander adults)
- Fewer individuals (only one frog adult)
- No difference in salamander density between reaches



Conclusions - Amphibians

- Riparian buffers did not moderate the effects of harvest, particularly for Coastal Tailed Frogs
- Amphibian response was related to harvest but not necessarily buffer length
- Amphibians were found in wood loaded reaches, especially in Post 1 & 2



Summary

- Responses to harvest observed in all buffer treatments
- Responses were largely intuitive, with some exceptions
- Presence and magnitude of treatment response was:
0% treatment > FP treatment > 100% treatment
- Greatest changes Post 1 & 2, recovery for some by Post 8 & 9



Summary

- Delayed negative amphibian response only in Post 7 & 8
- Post 14 & 15 sampling to evaluate decline, stabilization or recovery
- Schedule L-1 Performance Goal: “Population viability within occupied sub-basins”



Summary

- Changes in 0% treatment more likely to persist through Post 8 & 9, more evidence of recovery in 100% and FP treatments
- A similar response for some metrics across all buffer treatments (i.e., coastal tailed frog density) may imply harvest effects that were not ameliorated by the riparian buffer lengths explored in this study



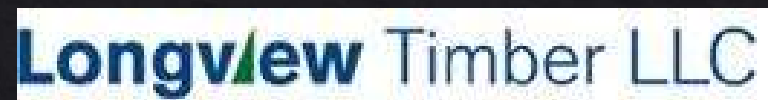
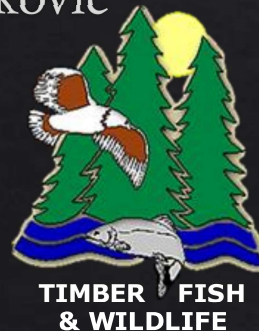
Acknowledgements

Landowners: Fruit Growers Supply Company, Gifford Pinchot National Forest, Green Crow, Hancock Timber Resource Group, Longview Timber, Olympic National Forest, Rayonier, The Nature Conservancy, Washington Department of Natural Resources, Weyerhaeuser

WA State Adaptive Management Program:

Charlene Andrade, Hans Berge, Lori Clark, Darin Cramer, Heather Gibbs, Howard Haemmerle, Jim Hotvedt, Saboor Jawad, Amy Kurtenbach, Jeff McNaughton, Teresa Miskovic

Field Staff!



Ehinger, W.J., W.D. Bretherton, S.M. Estrella, D.E. Schuett-Hames and S.A. Nelson. 2021. *Effectiveness of Forest Practices Buffer Prescriptions on Perennial Non-fish-bearing Streams on Marine Sedimentary Lithologies in Western Washington*. Cooperative Monitoring, Evaluation, and Research Report CMER 2021.08.24, Washington State Forest Practices Adaptive Management Program, Washington Department of Natural Resources, Olympia.

McIntyre, A.P., M.P. Hayes, W.J. Ehinger, S.M. Estrella, D.E. Schuett-Hames, R. Ojala-Barbour, G. Stewart and T. Quinn (technical coordinators). 2021. *Effectiveness of experimental riparian buffers on perennial non-fish-bearing streams on competent lithologies in western Washington – Phase 2 (9 years after harvest)*. Cooperative Monitoring, Evaluation and Research Report CMER 2021.07.27, Washington State Forest Practices Adaptive Management Program, Washington Department of Natural Resources, Olympia.

