

Summer Low Flows: Processes, Trends, Uncertainties, and Forest Management

Organized by the Pacific Northwest Research Station, the Bureau of Land Management, Weyerhaeuser Company, and National Council for Stream and Air Improvement

Workshop Goals: Explore the current science of low summer stream flows in western Cascades, primarily Oregon, and identify gaps in our knowledge on the topic.

AGENDA Low Flow Forum

Time	Торіс	Speaker
9:00 - 9:05	Welcome! Outline of the day	Cheryl Friesen, Science Liaison, USFS
9:05 - 9:15	Setting the Stage and	Mike Brown, Soil, Water & Air Program Lead, BLM,
	Definitions and use of "Best Available Science"	and Johan Hogervorst, Hydrologist, Willamette NF
		Forest
9:15 – 9:25	Introduction to summer low flows: organizing principles and	Maryanne Reiter, Hydrologist, Weyerhaeuser Co.
	terminology.	
9:25 – 9:45	Climate change projections and potential effects on stream flow.	Kathie Dello, Associate Director, Oregon Climate
		Change Research Institute
9:45 - 10:05	Evapotranspiration variability across dominant ecosystems in the	Hyojung Kwon, Research Associate, OSU
	PNW.	
10:05 - 10:25	How forest management influences interaction between	Klaus Puettmann, Silviculturist, OSU
	vegetation and water.	
10:25 - 10:40	Break	
10:40 - 11:00	Subsurface flow paths and low summer flows: influence of channel	Steve Wondzell, Research Ecologist, USFS PNW
	geomorphology.	Research Station
11:00 - 11:30	Streamflow trends from long term data in the Western Cascades.	Julia Jones, Geography Professor, Oregon State
		University
11:30 - 12:00	Streamflow trends from long term data in the Coast Range,	Elizabeth Keppeler, Hydrologist, or Joe
	northern California.	Wagenbrenner, Research Hydrologist, USFS PSW
		Research Station
12:00 - 12:40	Lunch:	
12:40 - 1:00	Effects of drought and regional low flows.	Charlie Luce, Research Hydrologist, USFS Rocky
		Mountain Research Station
1.00 - 1.20	Biological response to low stream flows	Brooke Penaluna, Research Eisheries Biologist, LISES
1.00 1.20		PNW/ Research Station
1.20 - 1.35	Break	
1.20 1.35		
1:35 – 1:45	Revisiting the water budget and forest management: overview of	Sherri Johnson, Research Ecologist, USFS PNW
	questions posed by managers.	Research Station
1:45 - 3:30	Facilitated discussion on using the best available science on	Cheryl Friesen, USFS Science Liaison and Ashley Coble,
	summer low flows to link processes, issues of scale, uncertainties,	NCASI
	data gaps, and management implications.	



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Workshop Goals:

-Explore the current science of low summer stream flows in western Cascades, Oregon

-Identify gaps in our knowledge on the topic.





Applying "Best Available Science" to management decisions

- It is not possible to have had site specific studies across seasons (space and time) everywhere
- Hopefully managers have findings from a similar site at a similar time of year and can apply those findings to a new situation
- Process studies help us to understand why versus studies of patterns that are more difficult to scale.
- Science can inform policy but policy decisions are societal choices that involve more than science.



Low Flow and Water Budgets



Streamflow= Precipitation – Evapotranspiration ± Δ Storage (groundwater, soil, etc)

Precipitation Inputs



-Timing and Form - Impacts of changing climate



Water uptake and Evapotranspiration

- Variation with type of vegetation

Organizing Principle

 Measurements of single trees to stands and landscapes



Outputs as Streamflow







-Influences of geomorphology
-Changes in output over time and with changes in forest cover



What does low flow mean for biota?





- How consistent or how variable are these findings from site to site and year to year?
- What the limitations of these data? Are there upper and lower limits of measurement errors or challenges in collecting and interpreting these data?
- When and where are these findings most pertinent?
- How broadly can the findings be extrapolated?



- Mechanistic controls of the water budget
- Forest harvest effects on summer low flow
- Climate change or climate considerations and low flow
- Biological responses to summer low flows



Mechanistic controls on the water budget

Vegetation

- To what extent does species composition in the riparian zone potentially affect the observed summer low flow responses? For example, the presence of alder in the riparian zone of harvested watersheds versus conifers in old growth.
- Are there eddy covariance towers in even aged Douglas-fir stands to show how large-scale evapotranspiration rates change across 20 y, 40 y, 60 y stand ages?
- What are the advantages and disadvantages of measuring transpiration rates with different methods and implications of each for scaling up (sap flow versus eddy covariance)?

<u>In Channel</u>

- What are the relative roles of groundwater storage versus evapotranspiration on summer low flow? Can groundwater storage mitigate the effects of summer low flow due to either climate change or forest management?
- How much are summer minimum flows affected by channel morphology, e.g. incised vs well connected to the floodplain?



Forest harvest effects on the summer low flows

- How consistent is a response of increased streamflow following removal of trees? How long is this increase typically observed?
- How similar and different are the flow responses to forest harvest in Northern coastal California to Oregon Coast range and Cascades?
- To what extent do wide riparian buffers, such as NWFP Riparian Reserves, or 120 foot Inner Zones under the Revised RMP for Western Oregon, play in dampening the effects from forest harvest?
- In an actively managed forest with riparian buffers and mixed stand ages throughout the watershed, when might we expect to see low flow deficits?



Climate change or climate considerations and low flow

- How much does Climate Change play into the low flow effects that have been studied? Predictions for the PNW is for less snow pack, less precip to fall as snow, and therefore, less summer flows.
- Can we separate the effects from climate change vs land management? Are these effects cumulative?
- Are there studies in large watersheds in rain dominated west side examining the effect of forest management on streamflows? Are they seeing different responses than in small watersheds?
- Would harvest be able to increase snow pack in the watershed and/or delay spring melt? Would this have an effect on summer stream flow?



Biological responses to low flows

- What are the most sensitive species and life stages to low flows in late summer?
- For (non fish) biota that live in the streams where summer low stream flows were documented in the HJ Andrews, which are most likely to be affected and why? Is there any data to evaluate these potential responses?
- Streamflow deficits occur after 20+ years following historical clearcuts in non fish-bearing reaches. How does this translate to downstream fish bearing reaches? Modeling? Observations?