Workshop Report

A multi-scale comparison of hydrologic and biogeochemical impacts of insect and disease outbreaks with forest harvesting

Saturday, 23 September, Mount Ypsilon Tower II meeting room, Estes Park, Co.

Across the United States, plant mortality has been increasing in many ecosystems as a result of insect and disease outbreaks. These outbreaks may be by native or exotic organisms that impact areas predisposed to attack due to changes in climate or ecosystem management objectives. Historically, plant removal by harvesting led to hypothesis-driven experiments to test the impacts of plant removal on watershed hydrology and biogeochemistry. In this workshop we compare the results from four sites including mesic eastern with more xeric western ecosystems. We have found that the threshold of disturbance to detect a hydrologic or biogeochemical response at the watershed scale is greater in xeric vs. mesic ecosystems.

Workshop Summary Notes:

Presentations:

Brian Kloeppel (Coweeta): Treatments in North Carolina (Coweeta) Introduction and summary of potential impacts from hemlock woolly adelgid, sudden oak death, and southern pine beetle

Sam Fernald (Jornada): Treatments in New Mexico Impact on water yield, water quality, and vegetation regrowth as a result of forest thinning, grazing, and herbaceous treatment. The results include no water quantity increase, but maintenance of water quality during watershed

Lee MacDonald (Colorado State University): Treatments in Colorado Impact of thinning and raking on sediment production and water yield. Increases in bare soil exposure as a result of raking significantly increase the sediment yield even in a dry environment with relatively. High impact of fire of sediment production on stream channels.

Kelly Elder (Fraser Experimental Forest - Colorado): Treatments in western Colorado (Fraser Experimental Forest) Impacts of mountain pine beetle on forest hydrology. Impacts and gradual death of trees impacting rain interception, snow interception, variable soil spatial distribution. Open questions: impact of thinning, versus future stand development.

Rob Hubbard (Fraser Experimental Forest - Colorado): Treatments in western Colorado (Fraser Experimental Forest) Tree and stand level impacts of mountain pine beetle on tree sapflow and tree water stress measured by tree predawn water potential. What is the

potential impact as mountain pine beetle continues? Trees die gradually so the transpiration stream is initially reduced and movs to 0 in about 1.5 years.

Chuck Rhoades (Fraser Experimental Forest - Colorado): Treatments in western Colorado (Fraser Experimental Forest) The extent of lodgepole pine decreases as elevations increases. In Fraser, the percent of alpine increases from a low elevation 10% to a high elevation ~50%. Importance of nitrogen cycling differences between harvested and beetle "treatments" includes export from harvesting and the consideration of nitrogen retranslocation before needle abscission. There is a long record (1993? to present) of streamwater chemistry at Fraser including approximately 7 watersheds at high and low elevation.

Chelcy Ford (Coweeta): Treatments in North Carolina (Coweeta) Introduction of hemlock woolly adelgid range and movement in E/W and N/S directions. Review and current long-term physiology of hemlock showing high (>180 liters/day of water per hemlock tree) water use per tree per day. Possible suggestions for cross-site long-term summarization

Discussion:

framework for follow-up work …

potential modeling approach to work
limitation includes the species and age-structure of ecosystems

What are the time and space limitations of our studies and analyses?

What are the changes in streamflow, sediment, tree species changes as a result of insect impacts?

The process level studies that we are currently undertaking across sites are extremely important to understand the larger-scale questions.

Potential fire

Logical next step: bring together the scales of data presented…

Comparison of wet vs. dry systems
Comparison of young vs. old
Comparison of regenerating vs. "stagnant" stands with a changing understory
Comparison of

Structure of table tree, stand, watershed, landscape…
Changes in water, nutrients, permafrost…

Changes in trajectory of systems: conversions to different species, grasses, N-fixers, etc.
Changes in large or small herbivore populations …

Participants List

Last Name	First Name	Site or Research Location
Ayres	Ed	MCM
Barker-Plotkin	Audrey	HFR
Caine `	Nel	NWT
Clinton	Barry	CWT
Elder	Kelly	Fraser Experimental Forest
Elliott	Katherine	CWT
Fernald	Sam	JOR
Ford	Chelcy	CWT
Foster	David	HFR
Hadley	Julian	HFR
Hubbard	Rob	Fraser Experimental Forest
Juday	Glenn	BNZ
Kirk	Ryan	CWT
Kloeppel	Brian	CWT
Lodge	Jean	LUQ
MacDonald	Lee	Colorado State University
Mitchell	Stephen	AND
Morkeski	Kate	CWT
O'Keefe	John	HFR
Record	Sydne	HFR
Rhoades	Chuck	Fraser Experimental Forest
Tepley	Alan	AND
Turner	Monica	NTL / CWT
Vadeboncouer	Matt	HBR
Ward	Kristen	HFR
Webster	Jack	CWT
Welsch	Matt	Colorado State University
Winslow	Steve	BNZ
Wolfe	Ben	HFR
Zausen	Greg	CWT

Total = 30 participants