EARLY TRAJECTORY OF CHEMICAL WATER QUALITY RESPONSE TO DISTURBANCE BY FOREST HARVESTING IN THE NORTHERN COAST RANGE OF OREGON

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(1) Objective

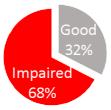
Improve understanding of processes governing retention & export of dissolved nitrogen (N) & phosphorus (P) under natural conditions & in response to forest harvest.

- Examine 10 yrs of water chemistry samples reflecting pre- & post-harvest conditions from paired, nested catchments in a forest watershed.
- Identify trends & drivers in spatiotemporal variability of N & P pre- & post-harvest.

(2) Rationale

- N & P are key macronutrients of many freshwater ecosystems.
- Many rivers and streams are impaired (Fig 1 A) ; excess nutrient concentrations are the 3rd leading cause of impairment (Fig 1 B).
- Forest harvest impacts hydrologic & biogeochemical processes & can alter nutrient retention & export.
- Characterization of spatiotemporal variability of N & P in forested, headwater catchments under natural vs disturbed conditions may be used to improve best practices in land management.

A.) Percentage of Oregon Rivers & Streams Impaired



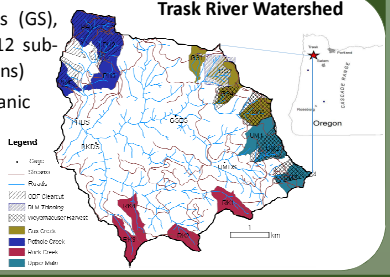
B.) Top Three Causes of Impairment

Cause of Impairment	Miles Threatened or Impaired
Temperature, Water	17253
Sedimentation/Siltation	11996
Nutrients	11272

Figure 1. Oregon Water Quality Assessment Report 2006 EPA & ODEQ. 46,035.7 miles of rivers & streams assessed. A.) Summary of water quality assessments for rivers & streams in Oregon reflecting monitoring of 141 different causes of impairment. B.) Top 3 causes of impairment of Oregon rivers and streams. (https://ofmpub.epa.gov/waters10/attains_state.control?p_state=OR)

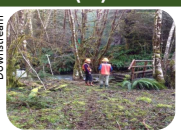
(3) Study Site

- **Catchments**: Pothole (PH), Gus (GS), UpperMain (UM), Rock (RK); (12 sub-catchments nested within 4 basins)
- **Geology**: mixed, basaltic volcanic to sedimentary sandstone
- **Climate**: mean annual precipitation from 180-500 cm; mild temperatures yr-round



(4) Methods

Sample collection



Chemical Analysis

- 6 Headwater (HW) sites; spring & summer grab samples; 2006-2016
- 4 Downstream (DS) sites; storm ISCO's samples triggered by turbidity; 2010-2016
- Nitrate(+nitrite)-nitrogen (NO3 -N)
- Total dissolved nitrogen (TDN)
- Total dissolved phosphorus (TDP)

(5) Preliminary Results

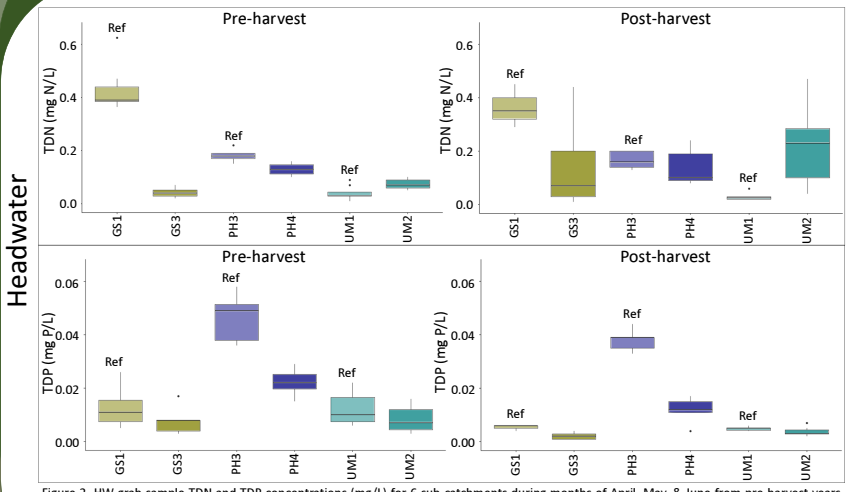
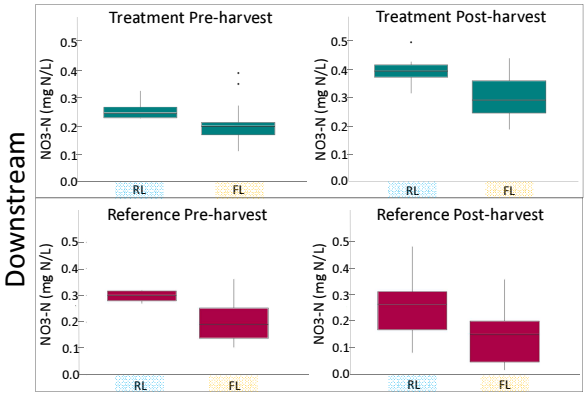


Figure 2. HW grab sample TDN and TDP concentrations (mg/L) for 6 sub-catchments during months of April, May, & June from pre-harvest years 2007-2010 & post-post-harvest year 2013 (pre-harvest n = 7-10; post-harvest n = 3-4 except GS1 = 2).

- TDN: More spatial variability in GS; ↑ temporal variability in treated sub-catchments post-harvest
- TDP: More spatial variability & highest TDP in PH



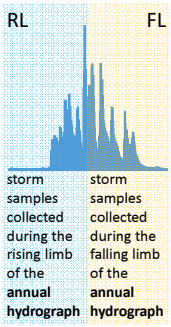


Figure 3. Storm DS sample NO3-N concentrations (mg/L) in treatment basin (UMDS) & reference basin (RKDS) during **rising limb (RL) & falling limb (FL) of the annual hydrograph** for pre-harvest year 2010 (UMDS RL n=7, FL n=26; RKDS RL n=4, FL=8) & post-harvest years 2014-2015 (UMDS RL n=10, FL n=23; RKDS RL=15, FL=23).

- ↑ median NO3-N in RL vs FL pre- & post-harvest in treatment and reference basins
- ↑ median NO3-N post-harvest vs pre-harvest in treatment basin; ≈ median NO3-N pre- & post-harvest in reference basin
- More variability in FL post-harvest in treatment basin

(6) Discussion and Next Steps

- ↓ median NO3-N in FL (Fig 3) → dissolved NO_3^- depleted early in yr pre- & post-harvest
- ↑ median NO3-N post-harvest in treatment basin vs ~no increase in reference basin (Fig 3) → effects of forest harvest
- Future analyses of basin characteristics & harvest effects → explain spatial variability (Fig 2) & response to harvest. For example, PH is distinct in that it:
  - is underlain by highly erodible volcaniclastic geology, which may be a potential source of P;
  - contains several wetland features which may create opportunity for biologic activity & settling of particulates.
- Exploration of primary & secondary controls (i.e., geology, soil type, slope, aspect, basin area, vegetation type & cover, air temperature, precipitation, streamflow) & methods & effects of harvest (i.e., presence of riparian buffers, changes in litter availability, streamflow, nutrient storage capacity, nutrient cycling) may explain spatial & temporal variability & serve to inform land management practices.

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