Assessing the Effects of Fuel Treatments on Sediment Production in the Fernan Lake Watershed using a Process-Based Modeling Framework

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INTRODUCTION

- Undisturbed forests provide high quality of water since surface runoff and erosion is negligible.
- Natural wildfires remove the vegetative cover on soils, dramatically increasing surface runoff and erosion potential.
- Suitable watershed forest fuel reduction programs are necessary to protect watersheds from severe wildfires and the associated risk of water quality degradation.

OBJECTIVES

- Assess the ability of the WEPP model to simulated snowmelt and streamflow.
- Quantify the impacts of forest fuel treatment strategies on sediment delivery to Lake Fernan.

STUDY SITE

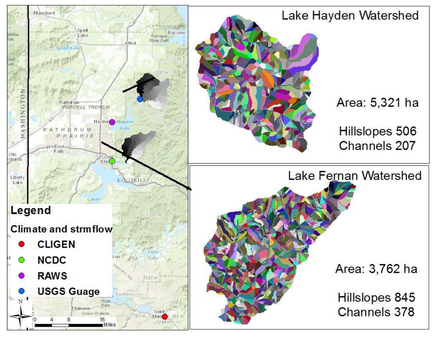
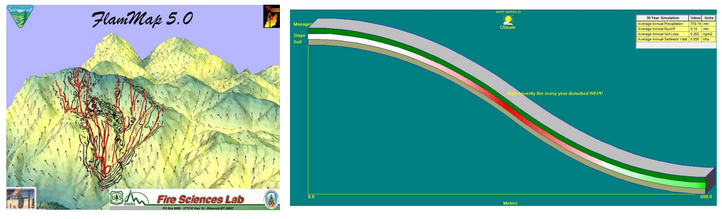


Figure 1. Proximity of weather and streamflow gauging stations to the Lake Hayden and Lake Fernan watersheds.

METHODOLOGY (Models Available)



Interfaces of the WEPP model:

- Undisturbed and Treatment (clearcuts, thinning, prescribed burn); Burn Area Emergency Response (wildfires); Roads

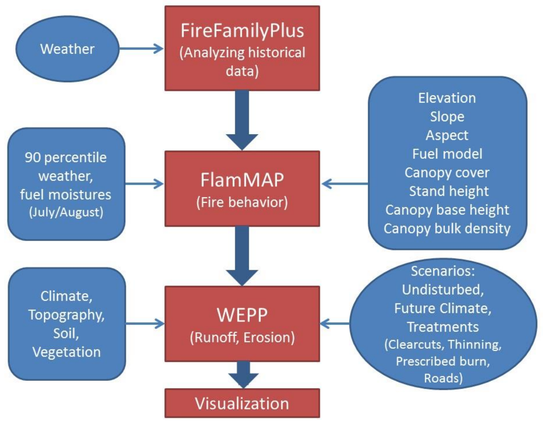


Figure 2. . Modeling flow chart for wildfire simulations.

RESULTS

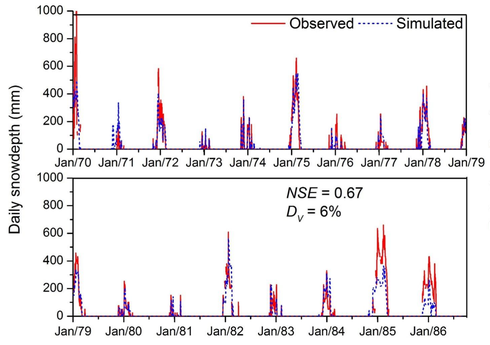


Figure 3. Observed and simulated snow depth for Lake Hayden watershed.

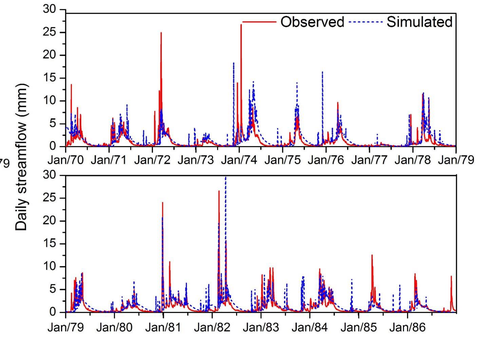


Figure 4. Observed and simulated streamflow for Lake Hayden watershed.

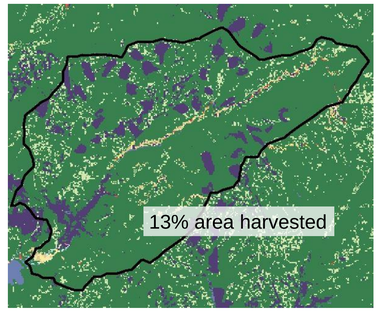


Figure 5. Harvested area in Lake Fernan watershed from 1989-1991.

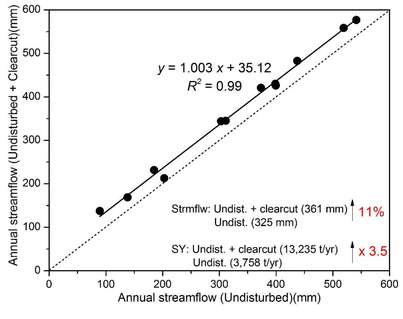


Figure 6. Simulated streamflow for Lake Fernan watershed with and without harvesting.

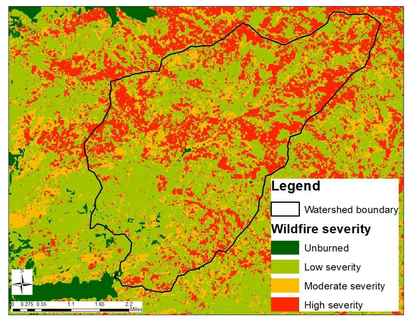


Figure 7. Flame length map obtained from the FlamMap model representing burn severities for the analysis area.

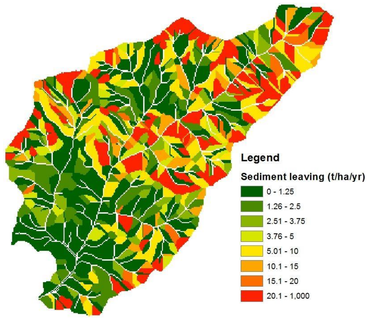


Figure 8. Online GIS BAER WEPP generated average annual sediment yield.

Forest Fuel Treatment Strategies:

- Null/no treatment.
- Treat (Thinning/prescribed burn) top 10% and 30% of the sediment generating hillslopes.

Simulated soil erosion which would likely occur the first year following wildfire, based on a 30 year simulation.

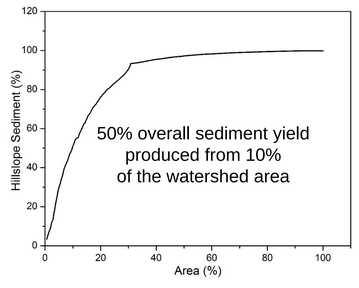


Figure 9. Cumulative hillslope area and percent average annual sediment production following wildfire.

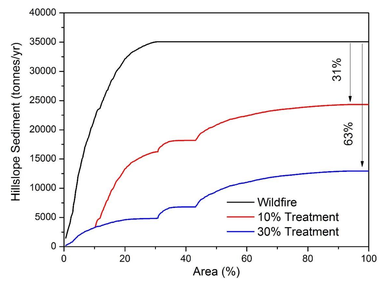


Figure 10. Percent reductions in sediment yields if the top 10% and 30% sediment generating hillslopes were treated (e.g. thinned) prior to wildfire.

FUTURE RESEARCH

- Use observed phosphorus and sediment concentration from stream water samples from spring of 2014 and WEPP simulated streamflow and sediment load to estimate historic phosphorus loads delivered to Fernan lake.
- Work with visualization team to allow users ability to select which hillslopes are treated and quantify the impact on sediment/phosphorus delivery to the lake.

ACKNOWLEDGEMENT

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