Natural Resources Canada | Ressources naturelles Canada

Research Connections: Cumulative Effects

A flexible tool for predicting cumulative effects on forest water resources

Note 2

Lead Researcher: Jason Leach (GLFC) **Project Type:** Cumulative Effects **Project Status:** Active (2020)

Need/Drivers

Forests supply clean water and reduce flood and drought risk for those who live downstream. Changes to the forest, as a result of mining, forestry, climate change, wildfire and insect outbreaks, can alter the forest hydrologic cycle. Being able to model and predict how changes in forest cover will impact downstream water resources is critical for informing effective land management approaches. Stakeholders and regulators need to predict how a new development project that causes a change to forest cover can impact water resources at a landscape scale. This can be challenging given numerous other effects on the landscape caused by past, present, and future natural and anthropogenic disturbances. Hydrologic computer models used to make these predictions either poorly represent how forests change over time or are cumbersome and time consuming to operate. This project will develop a flexible hydrology modeling tool to predict cumulative effects on forest cover and subsequent impacts on water resources.

Approach

Developing a flexible tool for predicting cumulative effects on forest water resources has three main components: model development, model application and knowledge transfer. Model development will add forest disturbance and growth algorithms to an existing robust and flexible hydrology-modeling framework called "Raven". Forest hydrologists and vegetation modellers will develop a set of algorithms that vary in complexity and data requirements. This project will incorporate these forest disturbances and growth algorithms into the existing Raven model framework. The model application phase of this project will apply the developed model to six test watersheds across Canada. The watersheds have different climates, forest types and dominant disturbance regimes. This model will assess both historic and realistic cumulative effects scenarios for watersheds across Canada. Once the new algorithms are tested and incorporated into Raven, the new model will be available as open source code to end users. In addition, this project will provide supporting documentation and test studies to facilitate model use.

Anticipated Impacts

Hydrologic models, including Raven, help predict potential impacts of resource development and other cumulative effects on water resources. This informs adaptation and mitigation strategies. Current hydrologic models inadequately represent changes in forest cover and the impacts on water resources over time. The model developed through this project will be able to do both. It will predict the impact of cumulative effects on water resources and account for changes in forest cover from cumulative effects. This project will allow end-users to predict how potential cumulative effects across a forested watershed will impact water resources over short-term (seasonal) and long-term (decades to centuries) time scales. Using these models provides a rigorous, science-based approach for predicting cumulative effects and informing sustainable management.

Linkages to other CFS Programs:

This project links to research priorities within Forest Climate Change, Pest Management, Wildfire and Sustainable Forest Management programs.

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