Can we create fire resilient landscapes under variable retention scenarios?

Lead by: Hosen Alam

Theme: Fire Science

Status: Continuing

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Participants

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Background

Forest fires are important ecological processes that maintain the integrity of the boreal forest. However, silvicultural treatments (e.g., harvest and fuel reduction) alter fire behavior by changing forest patch shape and forest structure (Ryu et al. 2007). Similarly, fuel management (e.g., thinning and prescribed burning) may mitigate the rate of fire spread, decrease fire intensity, and minimize burn area in the boreal forest (Stephens 1998; Finney 2001; Cumming 2001). Better understanding fuel characteristics, including loading, arrangement, and moisture content dynamics, following variable retention prescriptions will support more effective fuel management on managed landscapes, and clarify implications for persistence of saproxylic species (e.g., sub-projects 1 and 5). The Canadian Forest Fire Weather Index (FWI) system (Forestry Canada Fire Danger Group, 1992) provides effective fire danger rating in many forest types. However, the models are based mainly on closed canopies, and extension to the open/partially open stands that follow variable retention harvest is not fully understood. For example, fuels dry and burn hot under open canopy conditions with decreased fuel loading due to decomposition, but fuel moisture content may increase in partially open stands due to decreased transpiration. Harvest and burn treatments at EMEND are expected to also influence fuel arrangement, because of altered light conditions, primary production, and belowground impacts on nutrient and water competition; effects on the temporal dynamics of vertical fuel arrangement may be significant. For example, retention harvesting is expected to modify the spatial fuel heterogeneity; not only horizontally but also vertically. Such modified conditions will decrease the crown fire risk in the

harvested area, but may also increase the crown fire risk in the retained forest due to decreased canopy base height (CBH) and canopy bulk density (CBD). It is critical to understand the dynamics of fuel moisture and arrangement to model fire behavior on landscapes harvested through variable retention. EMEND provides an excellent opportunity to fill this need through directed research. In a modeling environment, we will generate multiple hypothetical landscapes that have different spatial composition and structures of retention harvest, burned and uncut stands. A fire propagation model (e.g., Prometheus (2012), BurnP3) will be employed to evaluate the rate of fire spread, fire intensity, total area burned, and burn probability given worst case weather conditions (e.g., those of the Chisholm and Slave Lake fires). Core data collected from the experimental, whole-compartment and slash burns at EMEND will be used to help validate model predictions about fire propagation, and perhaps to inspire future prescribed burn experiments in conjunction with Alberta Sustainable Resource Development (ASRD). The modeling will illuminate how variable retention harvesting can be best used to manage fire propagation on managed boreal forest landscapes. This work will involve one PhD student and an undergraduate assistant.

Objectives

To evaluate the impact of retention harvesting on fuel moisture dynamics. To evaluate the canopy condition on transpiration (or moisture loss through plant absorption). To evaluate the impact of retention harvesting on fire propagation using modeling approach.

Key Results