Effects of Timber Harvesting, Fire, Forest Regeneration and Succession on Seasonal Soil temperature, Subsurface Water and Snow Accumulation

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Theme: Hydrology and Microclimate

Status: Continuing

Start: 1999

Participants

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Background

In the EMEND project area, the climate is influenced by both boreal and mountain landscapes and weather patterns. In winter 1998?99, three mature coniferous stands (> 70% white spruce), along with several other stands, were subjected to five different levels of timber harvesting (clear-cut, 10, 20, 50 and 75% treed residual), referenced to an undisturbed control. In the treated stands, canopies have differing porosity values with respect to snow, rain, wind, and light penetration, and therefore will experience different hydrologic conditions and influences. In general, clear-cutting results in an increase in soil water content, higher summer and lower winter soil temperatures, and a reduction in evapotranspiration (Donnelly et al., 1991, Kubin and Kemppainen, 1991). These changes will in turn affect the depth of the water table, and surface water ? groundwater interactions. Riparian zones, which are important ecological areas, will therefore also be affected. Timber harvesting can also affect snow accumulation by reducing the intercepting canopy and changing the aerodynamics of the forest stand. It can also affect snowmelt rates by exposing the snow to increased amounts of wind and solar radiation. Pre-treatment hydrology data for precipitation, soil temperature and soil moisture were obtained in summer 1998 in G Block (a spruce dominant stand) of the EMEND project area. Timber harvesting was carried out in winter 199899, to provide treatments

where 0, 10, 20, 50, 75 and 100% of the canopy was retained. Post-treatment data collection was initiated in 1999. By 2002, the instrumentation network had been expanded to include most of the components of the hydrologic cycle, such as snow accumulation and melt, shallow groundwater levels, and surface water ? groundwater interactions in riparian areas. Detailed descriptions of the sites, installations and methodologies were provided in previous reports to the Manning Diversified Forest Products (MDFP) Research Trust Fund Secretariat (Hillman et al., 1998, 200003a,b). The comprehensive instrumentation network allows for both periodic and ongoing data collection. Such data become increasingly valuable with time, as the trends of measured variables can be interpreted for forest regeneration and succession management.

Objectives

• To measure the influence of overstory retention on winter snowpack • To relate snowpack and growing season microenvironmental conditions to survival, physiology and growth of white spruce seedlings • To determine the effects of different levels of timber harvesting, fire and forest succession in coniferous stands on components of the hydrologic cycle and establish hydrological relationships under climate change •To establish relationships between plant variables and seasonal subsurface water and temperature under different climate change scenarios. • To compare and contrast changes in water flow, quality, and channel morphology in the riparian zone resulting from different levels of harvesting, fire and forest succession in coniferous stands.

Key Results