Russell Creek Watershed

Bill Floyd

Introduction

The Tsitika River Sediment Project began in 1991 in response to concerns that sediment from the Tsitika River might adversely affect the killer whale rubbing beaches at the Robson Bight Ecological Reserve. The project's initial objective was to construct a sediment budget for the entire Tsitika River watershed and use it to determine the amount of sediment originating from forestry-related activities. In 2003, the scope of research narrowed to the Russell Creek watershed to determine the effects of forest harvesting on streamflow during rain-on-snow events through the application of a physically based hydrological model. Efforts to date have focussed on hillslope processes and stand-level interception processes, as well as expanding the meterological station network to better describe spatial variability in the watershed.

This project is determining the effects of forest harvesting on stream flow through the application of a physically based hydrological model.

Watershed Location Data	
Location (descriptive)	Northern Vancouver Island, Tsitika River Watershed
Location (geographic)	50°19'N 126°25'W
Biogeoclimatic zone(s)	Coastal Western Hemlock; Mountain Hemlock; Alpine Tundra
Watershed area	32 km²
Elevation range	275–1700 m
Precipitation (mean annual)	2395 mm
Runoff (mean annual)	1993 mm
Temperature (mean annual)	7.1°C (at 400 m); 5.2°C (at 840 m); 2.9°C (at 1500 m)
Temperature minimum (mean)	–0.3°C (at 400 m); –3.5°C (at 840 m); –7.2°C (at 1500 m)
Temperature maximum (mean)	21.3°C (at 400 m); 19.9°C (at 840 m); 18.5°C (at 1500 m)

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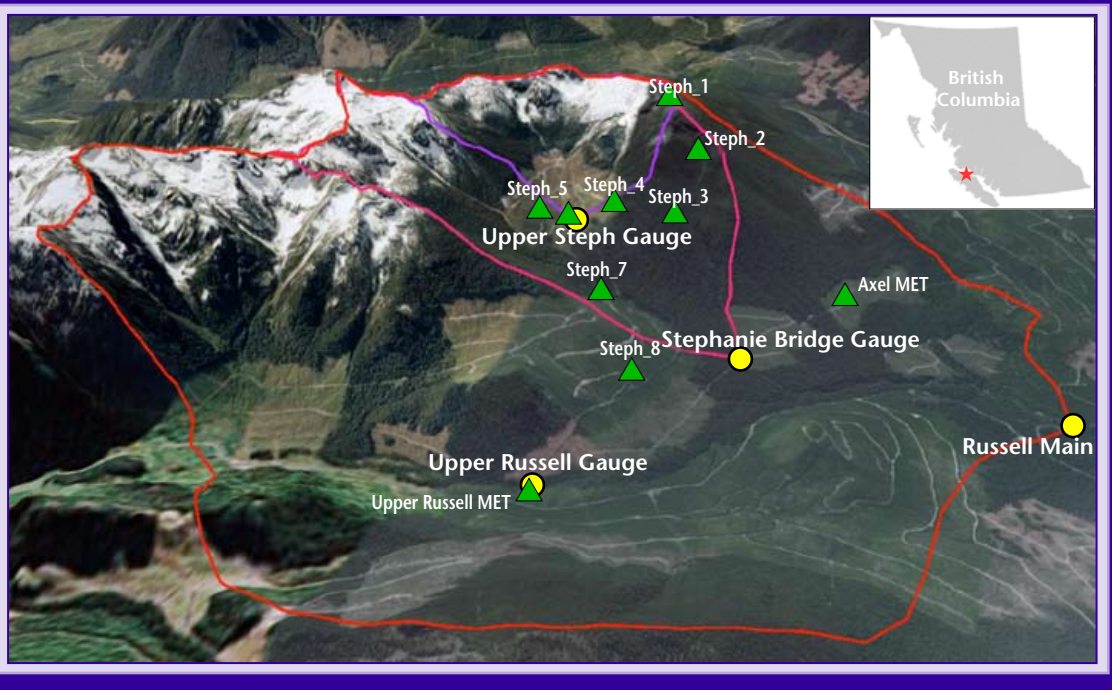

Russell Creek watershed and sub-basins of interest. Yellow circles represent stream gauges and green pyramids show location of climate stations (image from Google Earth).

Research Design	
Study type	**Modelling**
Treatments	**Clearcut 35% (1978 to present)**
Controls	**NA**
Study duration	**1991 to present**
Parameters measured	**Streamflow, air temperature, relative humidity, solar radiation, windspeed and direction, precipitation, snow depth, lysimeter melt, snow courses**

Introduction (continued)

By 2009, 10 weather stations along with snow courses from valley bottom to mountain top were present in the watershed. In addition, four hydrometric stations are located in the watershed. Current research is focussed within Stephanie Creek sub-basin, which is characterized by balsaltic lithology, very active channel morphology, steep slopes, and deep snowpacks. Research on stand-level interception recovery is nearing completion. Work will soon begin on modelling high-elevation snow dynamics and improving streamflow measurements to reduce model uncertainty. To monitor bed movement, channel disturbance, and recovery, tagging sediment and establishing surveyed stream cross-sections will start in 2010. The project's final objective is to use ongoing research results to validate a hydrological model that will assess the effects of forest management and climate change on streamflow.

Results

- Research area provides a development and testing ground for innovative methods to measure streamflow and snow accumulation.
- Landslides from incised stream channels form the majority of storm-based sediment at Russell Creek.
- Sediment production from basaltic lithology is significantly greater than from granitic.
- Connectivity is a key factor in whether sediment reaches the Tsitika River (valley flats and fans key storage areas).
- Road construction and use immediately afterward has order of magnitude effects on sediment yields for return intervals of 1 year and less.
- Preferential flow dominates during storms, many orders of magnitude faster than Darcy flow and some of highest rates of preferential flow reported in the literature (similar to Carnation Creek and New Zealand).
- Dye staining revealed a variety of preferential flow features and connections that formed the network. More developed features and networks were associated with larger hillslope contributing areas.
- Roads will have less of an effect on peak streamflow generation in areas dominated by preferential flow.
- During rain-on-snow events, energy available for melt and cold content in the snowpack are major factors in determining water delivery to the soil profile.

Project Website

http://www.for.gov.bc.ca/rco/research/hydro/Tsitika_River.htm

References

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