Introduction to the study

Approximately 90% of south-central British Columbia's domestic and irrigation water originates in upland forested watersheds. These watersheds also supply timber, cattle range, minerals, and recreational opportunities. The continuous supply of high-quality water, and the effects of changes in land use on this resource, are of concern to land managers and water users alike.

Three small watersheds tributary to Penticton Creek were set aside in 1982 for long-term study, to improve our understanding of how forest land use affects streams, aquatic organisms, streamflow, and water quality. The Upper Penticton Creek Watershed Experiment is a collaborative effort of the British Columbia Ministry of Forests, the British Columbia Ministry of Environment, Lands and Parks, the City of Penticton, the University College of the Cariboo, the University of British Columbia, the Water Survey of Canada, and Weyerhaeuser Canada Ltd.

The watersheds included in the Upper Penticton Creek Watershed Experiment drain into 240, 241, and Dennis Creeks, located 26 kilometres northeast of Penticton, B.C. Each watershed covers an area of approximately five square kilometres and an elevation range of 1600 metres to 2100 metres.

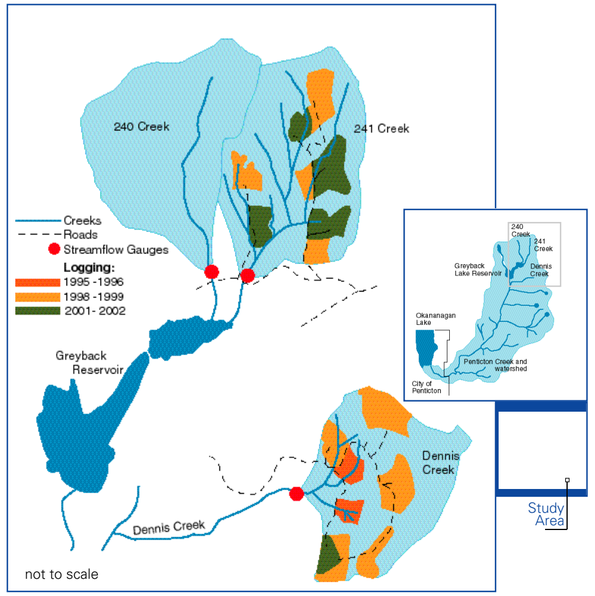
The 240 Creek watershed is forested with lodgepole pine, some Engelmann spruce, and some subalpine fir. This watershed will remain unlogged throughout the experiment. It will provide information regarding the relationships among weather, streamflow, and water quality. The natural variability in watershed processes observed at 240 Creek will be compared to changes brought about as a result of logging and associated land use in the 241 and Dennis Creek watersheds.

The 241 Creek watershed is forested with predominantly lodgepole pine, some Engelmann spruce, and some subalpine fir. In contrast, Engelmann spruce and subalpine fir are the dominant tree species in the Dennis Creek watershed. These forest cover differences enable researchers to study the effects of forest cover on hydrologic processes independent of, and in combination with, the effects of logging.

Portions of each of the 241 and Dennis Creek watersheds will be logged in three stages over a period of seven years. Approximately 10% of the 241 and Dennis Creek watersheds were logged during the winter of 1995 – 1996. Water quantity, water quality, climate, and aquatic organisms are all being monitored to evaluate the effects of this logging and associated road construction. In the winter of 1998 – 1999, an additional 10% of each watershed will be logged. Again, each watershed will be observed for three years, after which another 10% will be logged. Conventional, clearcut logging techniques, to community watershed standards, are being used in this experiment. All openings created by logging will be site prepared and replanted, and roads will be deactivated in accordance with the Forest Practices Code.

Streams, streamflow, water quality, aquatic life, climate, snow, and forest characteristics will be monitored throughout the experiment, prior to and during logging, and as the forest regrows. Through the diversity of research and breadth of collaboration in the Upper Penticton Creek Watershed Experiment, this endeavour provides an excellent opportunity for scientific discovery as well as a forum for improved communication among researchers, land managers, students of the natural sciences, and the public. The research results obtained at Upper Penticton Creek will contribute to a sound scientific base for improved watershed management in British Columbia.

The Upper Penticton Creek Watershed Experiment



BRITISH COLUMBIA

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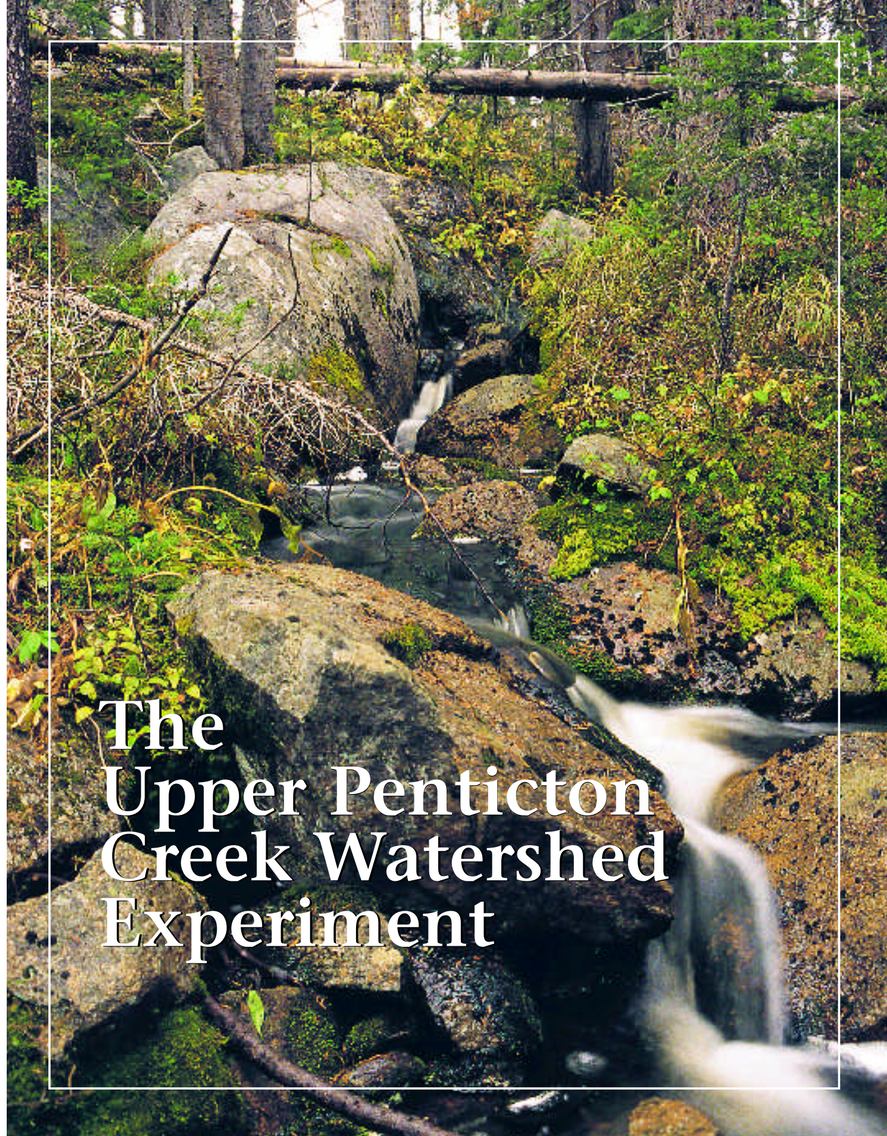


The Upper Penticton Creek Watershed Experiment

Forests and the Water Cycle

Five climate stations, scattered throughout the research area, make detailed hourly measurements of rain, snow, wind, temperature, humidity, and sunshine. This information is needed to answer questions about how the climate varies in different forest types, after logging, as forests grow, and from site to site. Answers to these questions will improve our understanding of the interactions among climate, forests, and streamflow.

This will enable researchers to develop computer models that land managers can use to predict watershed response to logging and changing climates.

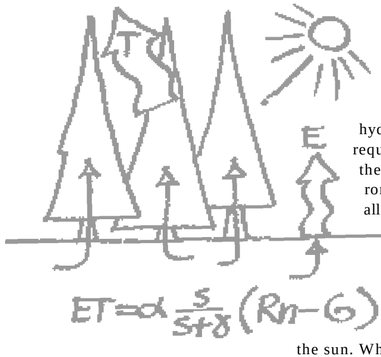
PRECIPITATION

INTERCEPTION

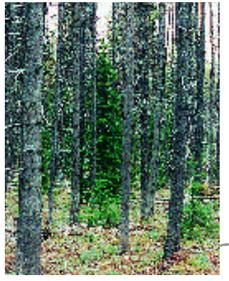
$Q=P-ET-I\pm S$

EVAPOTRANSPIRATION

SUBSURFACE FLOW



Physical processes, such as the hydrologic cycle, require energy. In the natural environment, nearly all of the energy used by physical processes (such as the evaporation of water) comes from the sun. When sunlight reaches the earth's surface, some will be reflected and some will be absorbed. The energy absorbed may heat the surface, evaporate water, or melt snow. The amount and distribution of energy throughout the hydrologic cycle is being measured in both the forests and the clearcuts at Upper Penticton Creek. Understanding the physics of processes such as evaporation and snowmelt will improve our ability to explain and extrapolate the results of this study in other watersheds.



In the Upper Penticton Creek Watershed Experiment, one of the most important goals is to understand how water moves through, and flows from, forested watersheds. The movement of water through the physical environment is often called the hydrologic cycle. Much of the rain and snow falling on a forest is caught by the branches of trees from where it may evaporate. Water that reaches the ground may be stored in the soil, or be taken up and transpired by plants. These processes reduce the proportion of precipitation that flows out of the watershed as streamflow. Land use, such as logging and road construction, can alter the proportion of precipitation reaching the ground and affect the amount and timing of water delivered to stream channels. A clear understanding of how each part of the hydrologic cycle affects streamflow is essential to the development of land management guidelines that ensure flow regimes are not significantly altered by forest land use.

Water quality refers to the chemical, physical, and biological characteristics of water in relation to its end use. In British Columbia, forested watersheds supply much of our drinking, domestic, irrigation, and agricultural water. The quality of these water sources depends on the climatic, physical, biological, and land use characteristics of the watershed, including geology, soils, vegetation, road construction, logging, wildlife, cattle grazing, and recreational activities.

At Upper Penticton Creek, water samples are being analyzed for sediment, inorganic elements, organic compounds, and bacteria. Stream channels have been surveyed to identify natural and disturbance-related sources of sediment. Aquatic invertebrate communities are being monitored along logged and unlogged sections of the study streams to identify any changes in species composition associated with logging, cattle grazing, and forest regrowth. The results of this water quality research will be incorporated into watershed management regulations intended to ensure the continued supply of high-quality water from forested watersheds.