Viewpoints

By Rita Winkler, PhD, RPF

In it for the Long Haul: BC's Legacy of Hydrometric Monitoring and Watershed Research

British Columbia is a province rich in water resources. Central to our understanding of the environmental processes controlling the flow and availability of water are research and hydrometric data collection. Although long-term data and the knowledge gained through process-based research are often not valued until a crisis occurs (Stednick et al. 2004), it is our responsibility as professionals to ensure that BC's legacy of hydrometric monitoring and watershed research is sustained providing a solid foundation for forest and water resource management into the future.

To better understand watershed processes and our water supply, a network of hydrometric monitoring sites and research watersheds have been established throughout BC by the federal and provincial governments in collaboration with universities, industry and consultants (Redding et al. 2010). Forest professionals, engineers, geoscientists and biologists rely on the data and knowledge gained from these sites to meet regulated environmental standards, develop sustainability criteria, design safe structures and protect habitat.

Long-term monitoring data provide the baseline necessary to detect the hydrologic effects of changing land cover and climate. Long-term research expands our knowledge of how forests and forest management practices affect water supplies in a changing environment. Although short-term data and research can provide some immediate insight into watershed processes, they may also result in erroneous decisions with potentially irreversible long-term consequences.

A simple example that shows the importance of long-term data is the snow survey record at Upper Penticton Creek, the site of one of BC's long-term watershed experiments (Winkler et al. 2008). The amount of water stored in the snowpack (snow water equivalent) on April 1st of each year is commonly used as an indication of water supply and flooding potential. In the 150+ year old lodgepole pine forest at Upper Penticton Creek, April 1st snow water equivalent has varied from 171 mm to almost double that (373 mm) over the past 15 years. In the clearcut, April 1st snow water equivalent has varied from 233 mm to 415 mm. Expressed as the percent increase or decrease after logging, the data show changes ranging from a 4% reduction to an increase of 36% (Figure 1).

Professionals are often asked to estimate the change in water accumulating as snow once forest cover is removed. If only a single year of data had been available, for example 2004, foresters would have been told that removing the trees might lead to a slight decrease in water. This might raise concerns regarding low flows and water supplies. On the other hand, if surveys had only been completed in 2001, foresters would have been warned that clearcutting could increase the water available to run off by over 30%, raising concerns about flooding. If at least five years of data were available, they would be told that 14% more water would accumulate as snow; which is close to the 15-year average of 13%. However, data from this five-year period also shows that increases in snow water equivalent after logging range from 7% to 21% which does not capture the extreme values in the 15-year dataset.

These results highlight the differences in water input to a watershed from year to year and with changing forest cover. They clearly show how long-term records are necessary to predict extreme changes, high or low, in water supplies. They also suggest the consequences of decisions made using limited data.

Questions remain about the conditions under which changes in forest cover may substantially alter streamflow volumes or the frequency of flow events above or below concern and what the additional effects of climate change might be. Both our understanding of hydrologic processes and our ability to quantify key variables affecting water supplies has increased tremendously over the past 50+ years (Pike et al. 2010). This knowledge has been gained through the efforts of water resource specialists working in roles ranging from hydrometric monitoring and fundamental research to developing policy and advising forest operations.

The advancement of our understanding of hydrologic processes in BC has relied heavily on data from the province's network of hydrometric stations and both short- and long-term research installations. At a glance, these installations seem numerous but on closer examination they represent only a few of the hydrologic regimes and land cover types found throughout BC. Very few research installations, such as Carnation Creek, Malcolm Knapp, Rennel Sound and Russell Creek at the coast, Upper Penticton Creek, Mayson Lake and West Arm in the southern interior and the Bowron River watershed study in central BC, provide more than 10 years of record quantifying key hydrologic processes (Redding et al. 2010). These installations are at continuous risk of being discontinued due to lack of funding.

Whether an individual or organisation's goal is the quest for new knowledge or to sustain water values while harvesting timber, both require data. Precipitation and streamflow are essential

The photo above shows the long-term stream flow gauge in Dennis Creek which is part of the Upper Penticton Creek Watershed experiment.

variables that must be known to quantify the effects of changing forest cover and watershed management on streamflow, for flood forecasting and for water supply management. Understanding how watersheds function also requires measurements of energy, water storage, routing and losses, and changes in forest cover.

Some professionals would argue that the hydrometric network is an essential service while others may argue that this network is too costly. But what are the costs of allowing this legacy to fall into disarray? Data not collected can not be replaced; even by optimistic gap filling based on assumptions that nothing has changed during the lapse in measurement. What if hydrologic models used for flood forecasting and climate change projections were run on one or five years of data rather than a record that adequately captures the variability in watershed processes over space and time? The downstream consequences of decisions based on insufficient data or knowledge could be disastrous.

One of the fundamental building blocks of science, which forms the foundation of professional practice and environmental policy, is data. Although knowing the magnitude and variability of all biophysical variables in a watershed would be ideal; quantifying a few is essential.

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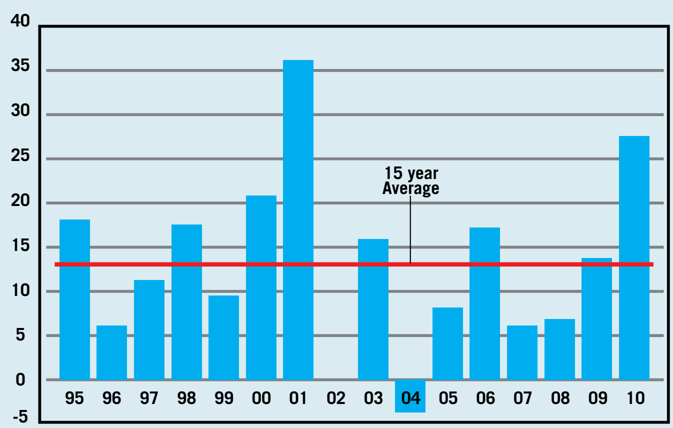

Figure 1. The percent change in April 1 snow water equivalent after clearcut logging at Upper Penticton Creek, BC.

References

Pike, R.G., T.E. Redding, R.D. Moore, R.D. Winker, and K.D. Bladon (editors). 2010. Compendium of forest hydrology and geomorphology in British Columbia. B.C. Ministry of Forests and Range, Forest Science Program, Victoria, B.C., and FORREX Forum for Research and Extension in Natural Resources, Kamloops, B.C. Land Management Handbook No. 66.

Redding, T., Moore, R.D., Winkler, R.D., Pike, R.G. and Wilford, D.J. 2010. Long-term watershed research in British Columbia. Streamline Watershed Management Bulletin 14(1): 1-5.

Stednick, J.D., C.A. Troendle and G.G. Ice. 2004. Lessons for watershed research in the future. In: A century of forest and wildland watershed lessons. G.G. Ice and J.D. Stednick (editors). Society of American Foresters, Bethesda, Md. pp.277-287.

Winkler, R., D. Spittlehouse, D. Allen, T. Redding, T. Giles, G. Hope, B. Heise, Y. Alila, and H. Voeckler. 2008. The Upper Penticton Creek Watershed Experiment: Integrated water resource research on the Okanagan Plateau. In: One Watershed, One Water Conference Proceedings. Kelowna, October 21–23, 2008. pp.38-47.