Watershed moment

Can appropriate harvesting be better for drinking water than outright forest protection?

More Carbon storage & Woodland Farming

The forested Pockwock watershed supplies drinking water for Halifax, Bedford, Lower Sackville, Fall River, Timberlea, and Waverley. (David Foster photos)

by David Foster

I have visited the same four streams in the Pockwock watershed some 20 times during the last year, observing how the path on the forest floor, travelled only by me and my colleagues, becomes a little more obvious with each visit. When I hike these increasingly defined trails, I contemplate the impacts of my own footsteps in comparison to the forestry operations that are planned to commence this fall. I think about the hidden flows of water below my feet that feed a network of streams draining into Pockwock Lake, which is responsible for providing water to more than 200,000 people. And inevitably I wonder – how can forestry make this water cleaner? Actually, it makes perfect sense that my mind would go there, because that's the question I'm seeking to answer here in these forests.

The Pockwock watershed covers just more than 4,000 hectares of land straddling the boundary between Halifax and Hants counties, most of it Crown land to the south of Highway 101, of which a considerable portion (1,609 hectares) is under provincial protection as the Pockwock Wilderness Area. Transportation corridors and private land, mostly to the north of Highway 101, comprise 500-plus hectares of the watershed. This landscape is dominated by spruce-pine hummocks, with healthy populations of hemlock and tolerant hardwoods, especially Yellow birch, and it is home to populations of hare, deer, and black bear. These forests have been managed for timber production for generations, but today serve a greater purpose as well.

Pockwock Lake, with a surface area of 900 hectares, is fed by runoff from those 4,000 hectares. It supplies water to homes, businesses, and institutions in Halifax, Bedford, Lower Sackville, Fall River, Timberlea, and Waverley. The management and supply of water to these communities is the responsibility of Halifax Water – and one that comes with many challenges.

The Pockwock watershed has been granted special protections by an Act of the Government of Nova Scotia, giving Halifax Water the authority to ensure that human activities do not interfere with the provision of potable water. This includes restricting vehicular access to the watershed and limiting the types and timing of activities permitted. Management is coordinated and carried out by a multidisciplinary team at Halifax Water, the members of which all share a common

goal: ensuring that the water in Pockwock Lake is easily treatable to ensure cost-effective delivery of high-quality drinking water.

The team includes Barry Geddes, a forester who must plan management activities in pursuit of this goal. Most of the water entering Pockwock Lake has fallen through tree canopy and has been filtered into the soil before eventually joining a network of streams that drain into the lake. What happens in the forest greatly influences the water that moves through it, and this makes Geddes a critical member of the management team.

Some may wonder why the forest is actively managed at all. If Halifax Water has the authority to restrict access and activities within the watershed, why not leave it completely up to nature? While ecosystems will evolve in a dynamic balance without human interventions, this may not be to our advantage as consumers of water. The forest naturally produces a variety of compounds that add to the challenges faced by water treatment engineers. An increasingly troublesome issue in the Pockwock watershed is the presence of dissolved organic carbon (DOC).

DISSOLVED ORGANIC CARBON

DOC is produced when organic material like tree limbs, trunks, roots, and leaf litter decompose on the forest floor. It gives water a reddish-brown colour, and plays several important roles in ecosystems, such as regulating light penetration and thereby moderating water temperature and protecting aquatic organisms from UV radiation. For these and other reasons, DOC is an important constituent in water, but too much can be a problem – both for the ecosystem, and for those who depend on it for goods and services such as the provision of easily treatable water. While the water in Pockwock Lake has historically had low DOC concentrations, these levels are on the rise. Halifax Water is looking for answers as to why this is happening, and how to minimize DOC loading in the lake.

Managing DOC levels seems simple: cut it off at the source by reducing the amount of dead organic matter on the forest floor. This can be achieved by preventing trees within the forest from dying and rotting in place through active forest management, resulting in lower DOC production and runoff. This is the assumption under which Geddes has been operating, and it informs the management he practices, coordinating low-impact interventions to manage forest health.

But managing for water quality is more complex than managing DOC alone; Geddes must also take into consideration the impacts of harvesting, such as the introduction of other contaminants like

The water in the Pockwock watershed is coloured reddish-brown due to the presence of dissolved organic carbon (DOC), which is produced when dead wood on the forest floor is broken down by microbial activity.

The author poses in one of the streams in the watershed, with some of the equipment used to continuously monitor parameters such as pH, temperature, and height of the water column.

sediment, other organic compounds, and minerals. The potential benefits of forestry interventions for improving water quality as a whole, and specifically for reducing DOC concentrations, are poorly understood. This is what I seek to clarify through my research.

The issue of excess DOC loading is not limited to Pockwock; it is a problem facing watershed managers across Canada. National interest in how to manage forests to reduce DOC led to the formation of *for*Water, the Network for Forested Drinking Water Source Protection Technologies, funded by the Natural Sciences and Engineering Research Council of Canada (NSERC).

The network, which includes researchers and managers from universities and partner water utilities across the country, is studying how alternative forest management techniques affect water quality. Dalhousie University and Halifax Water comprise the Atlantic Canadian research node, and are working together to understand the type, magnitude, and duration of effects of forest management interventions on water quality. From this, we hope to produce tools that will be useful for watershed managers throughout our region and beyond – to make it easier to understand the impacts of forestry, and how it can be used as a tool for water resource management.

Wading in for sake of science are (from left) Dillon Langelaan, a Master's student at Dalhousie University's Centre for Water Resources Studies (CWRS); Evan Muise, an undergraduate student in Environmental Science; and Meggie Letman, a research associate in the CWRS.

Meggie Letman, a research associate with Dalhousie University's Centre for Water Resources Studies, conducting field work in the Pockwock watershed.

We have been monitoring water quality in four streams within Pockwock since spring of 2018, and this summer we will study forest composition in the same parts of the watershed. These baseline data will contextualize the effects of forest interventions planned for fall 2019 in two of the stream catchments. We will measure the post-harvest effects for two years, and use these data to calibrate models to predict long-term implications for water quality. The study is set to run until the spring of 2022, when I will publish my results.

So, is forestry another tool in the arsenal of watershed managers who seek to provide cleaner water that can be affordably treated to a world-class standard? The first step toward answering that question is to define "cleaner." For my research, it means reducing the amount of DOC and other constituents that complicate treatment for Halifax Water. But this must be balanced with minimizing the overall impacts of forest management interventions, so that solving one problem does not create another. Ultimately, we hope to be able to demonstrate the relationship between water quality and forestry techniques and show that forest management is not only a tool for watershed managers, but essential to the sustainability of our surface-water supplies.

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