



Forest Fertilization in British Columbia

The largest recorded mountain pine beetle outbreak in North America began in the late 1990s and caused widespread mortality of lodgepole pine throughout B.C.'s Interior. By the time the mountain pine beetle epidemic is over, projected to be by 2020, it is expected the infestation will have killed approximately 740 million cubic metres of merchantable pine.

Combined with increasingly large wildfires, beginning in 2003, British Columbia's forests have been under unprecedented attack for the past few decades. The available timber volume has decreased dramatically in a number of timber supply areas.

Reductions to the timber harvesting land base, and a transition to harvesting lower volume second-growth on the Coast, have also had an impact on the available timber.

Government is committed to mitigating the economic and environmental impacts of these events. This includes taking action to offset the reduction in the mid-term timber supply, increasing carbon sequestration and managing for resilient and sustainable forests. Forest fertilization is one treatment forest managers are using to accomplish these objectives.

Fertilization has been widely used in B.C. since 1981, with treatments on public lands made by government and treatments on private land (on the Coast) made by industry. The current fertilization program is delivered through government's Forests for Tomorrow program and approximately 20,000 hectares are treated annually. Additional partnerships with the Forest Enhancement Society of BC (FESBC) and the Forest Carbon Initiative (FCI) may see the annual area fertilized increase by another 10,000 hectares.



Ministry of
Forests, Lands, Natural
Resource Operations
and Rural Development



Why Fertilize Our Forests?

Conifer trees rely on a range of vital nutrients to grow. Over three decades of research shows that nutrient deficiencies are widespread throughout B.C.'s forests. Research also shows that young forests respond favourably to fertilization with nitrogen and other nutrients, such as phosphorus, sulphur and boron. Douglas-fir, western red cedar, lodgepole pine and Interior spruce forests all respond to nutrient additions.

To ensure strategic investments, government oversees the preparation of management unit silviculture strategies that sustainably manage the full suite of forest values in a given unit. Research results and financial analyses provide stand-level criteria (e.g., tree species, site quality, age and density) to select stands that will respond positively to additions of fertilizer. At the stand level, forest fertilization projects are based on an analysis of the conifer needles to determine the growth-limiting nutrients.

After a forest is fertilized, the trees take up the nutrients through their roots and first grow longer needles from the higher concentration of available nutrients in their foliage. Then, two or three years after fertilizing, more needles are produced. The increased foliar mass from the longer and more abundant needles increases photosynthesis, enabling the trees to increase wood production on their stems and branches.

Objectives of the Fertilization Program

- Reduce the impact to communities and regions from the mountain pine beetle infestation and wildfires.
- Increase opportunities for future employment when fertilized stands are harvested.
- Mitigate timber supply impacts through strategically focused fertilization activities.

- Accelerate the development of merchantable volume of existing stands aged primarily 40–80 years, to ensure they become harvestable sooner.
- Modify age class imbalances and help redistribute timber flow and availability.
- Reduce the depth and duration of the constrained timber supply.
- Increase the volume and value of selected stands, ensuring a minimum return on investment.
- Sequester carbon from the atmosphere through increased tree biomass accumulation of carbon primarily in stands 20–50 years old.

Benefits of Fertilization

Within 10 years, a single fertilizer treatment can add about 15 cubic metres of wood per hectare in the Interior and 30 cubic metres per hectare on the Coast. Fertilization is one of the most effective treatments to maximize volume production and financial return. There are benefits to the forest under-story as well. By absorbing some of the nitrogen, shrubs and forage plants provide nutritional benefits to wildlife and livestock.

By enabling second-growth stands to become merchantable sooner, investments in fertilization can effectively compensate for reductions in the available timber volume. Fertilization can also help offset an increasing number of forest cover constraints by shortening the time until young forests can provide restored hydrological functioning, visual recovery and wildlife habitat.

The provincial fertilization program contributes significantly to meeting B.C.'s legislated provincial greenhouse gas (GHG) emission reduction targets and, by enhancing the capacity of our forests to sequester carbon, aligns with Federal *Pan-Canadian Framework on Clean Growth and Climate Change*



objectives. It also supports Government's Forest Carbon Initiative by providing climate change mitigation opportunities through increasing the rate of carbon sequestration of B.C. forests.

The current level of Forests for Tomorrow fertilization funding treats approximately 20,000 hectares annually. At this rate, the 100,000 hectares fertilized every five years will produce approximately 2 million cubic metres of incremental wood – this is a net increase of 1.7 million tonnes of carbon dioxide sequestered.

How Are Forests Fertilized?

Large-scale forest fertilization treatments are conducted using helicopters. Fertilizer is manufactured into small pellets, about 3 millimetres in diameter, that are heavy enough to fall relatively straight down to the ground.

The fertilizer is applied with a pilot-controlled spreader that hangs below the helicopter. This allows for over 100 hectares to be fertilized in a typical day. Helicopters are equipped with a global positioning system (GPS) so that their precise location is known throughout the application process. Treatment block boundaries are entered into the GPS along with the positions of any sensitive sites, such as streams and waterbodies. No fertilizer is applied within a minimum of 10 metres of these sensitive sites.

Where Are Treatments Carried Out?

The forest fertilization program focuses on treating candidate stands that are well-stocked but with stand density low enough that the tree crowns can expand after fertilization, which is necessary for increased tree growth. Provincial stand selection guidelines also require the consideration of the site's natural productivity, the trees' current amount of foliage and other biological factors.

Logistics are also important. The location of a potential site will have an impact on transportation costs, both in trucking



in the fertilizer, and later, hauling out harvested timber to manufacturing plants and markets. Likewise, factors such as a stand's layout around a central loading area and the general terrain should be considered.

Who Conducts The Work?

The fertilization program is a cooperative effort among the provincial government, forest licensees and private silviculture contractors. The Ministry of Forests, Lands, Natural Resource Operations and Rural Development provides oversight and coordination.

How Are Other Concerns Addressed?

As part of the planning process for fertilization treatments, forest managers give consideration to protecting forest values and addressing the potential concerns of other forest users. Fertilizer is applied carefully to minimize run-off to waterbodies, and fertilization in community watersheds is stringently managed. Fertilizer pellets are cleaned up at all loading areas and not left for wildlife or livestock to consume. Project timing can also mitigate concerns: late fall applications reduce the possibility that wildlife or cattle may ingest the fertilizer, as cattle are off the range by then, and a light snow cover at the time of treatment reduces the likelihood of wildlife ingestion.

Impacts of fertilization on forest health are also considered. For example, the potential growth benefits from fertilizing young spruce forests must be weighed against the risk of increased susceptibility of fertilized stands to leader damage by the white pine weevil. Trial results show that the benefits of fertilization on the growth of planted spruce outweigh the negative effects.



Summary

The experience of British Columbia forest managers with forest fertilization gives the province a promising option for mitigating the upcoming timber supply shortfall caused by the mountain pine beetle, wildfires, the coastal transition to second growth, and reductions to the timber harvesting land base. Government's expanded fertilization program helps supplement the mid-term timber supply and the recovery of multiple values provided by our forests, while supporting forestry-based communities through this critical phase. Fertilization also contributes significantly to meeting B.C.'s GHG emission targets by providing secure short- to medium-term emission sequestration, as well as a means for risk-managing GHG benefits from other activities to ensure that the GHG targets are reached.

For More Information

Forests for Tomorrow: <http://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/land-based-investment/forests-for-tomorrow>

Ministry of Forests, Lands, Natural Resource Operations and Rural Development – Fertilization Program: <https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/land-based-investment/timber-supply-mitigation/fertilization/fertilization-activity>

