



British Columbia's

# Forest Fertilization Strategy



*October 2008*



Ministry of  
Forests and Range



*British  
Columbia's  
forests,  
a valuable  
resource*



*Extensive  
mortality in  
lodgepole pine  
caused by the  
mountain pine  
beetle*



*Since every tree to be harvested over the next 50 years is in the ground and growing now, fertilization is considered the key investment option to improve conifer growth during that timeframe.*

## Introduction

British Columbia's forests are important in many ways to our environment, economy, and communities. They are a valuable resource to protect and improve for future generations.

British Columbia's forests and resource-based communities throughout the province are undergoing a variety of changes and transitions, and the forest industry in particular is experiencing a range of economic challenges. The mountain pine beetle epidemic in the Interior has created unprecedented mortality in lodgepole pine that will significantly reduce the available timber in the near future. Harvesting in British Columbia's coastal forests is undergoing the predicted transition from old-growth to second-growth forests. Concerns about global warming have led to the B.C. Climate Action Charter between the Province and local

governments to reduce greenhouse gas emissions. Consequently, forest managers have been examining present conditions and defining desired future forests to make management decisions now that best address these changes and transitions.

## British Columbia Interior

The British Columbia Interior is experiencing the largest known outbreak of the mountain pine beetle in recorded history. By the end of 2007, an estimated 710 million cubic metres of lodgepole pine had been killed. The current epidemic in the province's northern and southern Interior regions has affected about 13.5 million hectares, and continues to expand.

The mortality resulting from the mountain pine beetle will create a significant reduction in the mid-term timber supply 10–50 years from now for some Timber Supply Areas (TSAs) and Tree Farm Licences. For example, reductions in the mid-term timber supply are projected to be up to 45 percent for several TSAs and Forest Districts in the British Columbia Interior (Snetsinger 2006). This will greatly affect many forestry-dependent Interior communities in which forestry accounts for a significant amount of total employment.

The Province's co-ordinated response to the mountain pine beetle epidemic is presented in the **Mountain Pine Beetle Action Plan**. The forest fertilization program contributes to the plan's objectives by reducing the time required for key stands to reach a harvestable size and thus increase the mid-term timber supply. This will contribute to long-term economic sustainability for affected communities.



*Coastal Douglas-fir that has been spaced and pruned*

## British Columbia Coast

Coastal forests have been managed and harvested for many decades, and second-growth stands are now becoming merchantable. The **Coastal Forest Action Plan** addresses the shift from harvesting old growth to harvesting second growth.

The provincial government is investing in fertilization to help second-growth stands become merchantable sooner. Research results indicate the appropriate criteria of species, site quality, timing, and stand conditions under which to apply fertilizer to obtain good results. Fertilizing 20 000 hectares over 3 years is estimated to produce an additional 600 000 cubic metres of wood over the next 10 years. That extra wood will contribute to the timber harvest, thereby supporting sustainable jobs.

## Carbon Sequestration

Trees use carbon from carbon dioxide (CO<sub>2</sub>) to create woody plant material. A forest increasing in biomass is storing carbon extracted from atmospheric carbon dioxide, and returning oxygen to the atmosphere through plant photosynthesis. Trees respond to the additional nutrients supplied from fertilizer by growing faster and thereby storing carbon at an increased rate. Each tonne of carbon stored in wood means 3.67 tonnes less carbon dioxide in the atmosphere. With the carbon sequestration role of forests included in the new **Climate Action Plan**, fertilization has become an even more useful and practical silvicultural tool.

## Rationale

This forest fertilization strategy was developed to direct program planning and activity, and is based on input from program managers, technical specialists, and operational staff involved in the provincial fertilization program.

Fertilization is a proven method for increasing carbon sequestration and harvest volume, and for accelerating stand operability. As a silvicultural treatment, it provides an opportunity to increase the merchantable yield and value of established forests. By adding key nutrients that are known to be limited on a specific site, fertilization can improve stand growth and productivity.

Based on the predicted timber supply profile, and on the timing and magnitude of wood supply needs, fertilization can also be strategically used to accelerate the development

*Excerpt from the Intergovernmental Panel on Climate Change, Working Group III (Mitigation) Report: "In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fibre or energy from the forest, will generate the largest sustained mitigation benefit" (Nabuurs et al. 2007).*



*Helicopter with motorized bucket spreading fertilizer*

*Fertilization is a proven method for increasing carbon sequestration and harvest volume, and accelerating stand operability through increased site productivity. As a silvicultural treatment, fertilization provides an opportunity to provide benefits by increasing the merchantable yield and value of established forests.*

of specific age classes and timber types, and facilitate an even supply of wood at the forest level. Fertilized trees grow more quickly, reach a target merchantable size sooner, and are thus available for harvest sooner than unfertilized trees. Estimated volume gains are based on an average expected increase over 10 years of 15 cubic metres per hectare in the Interior and 30 cubic metres per hectare on the Coast.

Fertilization also helps to reduce atmospheric levels of carbon dioxide by increasing tree biomass accumulation and carbon storage. The increase in merchantable wood will sequester more carbon for the long term, particularly when the wood is used in building material that is maintained for long timeframes. For every 100 000 hectares fertilized in British Columbia, a net increase of 550 000 tonnes of carbon (which is equivalent to about 2 million tonnes of carbon dioxide) can be sequestered

through the production of approximately 2.2 million cubic metres of wood.<sup>1</sup>

## Program Goal and Objectives

The goal of the fertilization program is to increase merchantable volume of coniferous timber by fertilizing stands that are 20–80 years of age over a 5-year period from 2008/09 to 2012/13.

The objectives of the fertilization program are to:

- Mitigate timber supply impacts through strategically focused fertilization activities,
- Accelerate the development of merchantable volume of existing stands aged 20–80 years to ensure that they become operable sooner,
- Sequester carbon from the atmosphere through increased tree biomass accumulation of carbon,
- Modify age class imbalances and help redistribute timber flow and availability,
- Help reduce the depth and duration of the reduced timber supply,
- Help reduce the impacts to communities and regions from the mountain pine beetle infestation,
- Increase the volume and value of selected stands, and
- Increase opportunities for future employment when fertilized stands are harvested.

<sup>1</sup> Based on an approximation of 0.25 tonnes of carbon per cubic metre of wood (W. Kurz, Nov. 2006, pers. comm.)



Fertilizer applied to the forest floor



Ground crew in radio contact with the helicopter pilot



## Delivery

The fertilization program is developed and delivered through the following steps:

1. **Management unit silviculture strategies** that show positive opportunities from fertilization are used for forest-level selection.
2. A **local project leader** for each management unit manages the fertilization program on both an annual and long-term planning basis, and co-ordinates the local program and activities with the provincial fertilization program.
3. Provincial **stand selection guidelines** are used to choose stands based on species, age, density, and other considerations, such as forest health.
4. **Financial efficiencies** are achieved through collaboration among the local project leaders, the program's third-party administrator, and program staff for provincial-level fertilizer orders and large-scale application.
5. The fertilization program encourages an open and competitive contractor base using **large-scale contracts** to achieve economies of scale, effective co-ordination, and logistical efficiencies.
6. The criteria to select candidate stands are based on **research and operational trials** and **staff expertise** within the Research Branch and the Forest Practices Branch.
7. **Training** on forest fertilization planning and operations is primarily web-based through the Forests for Tomorrow website, which provides reference documents and other information resources. As well, the Interior and coastal project leaders and ministry specialists have formed working groups that meet regularly to discuss ways to improve program planning and delivery.

## Participants and Partners

Several important participant agencies and partners are essential to the fertilization program in different ways, as described below.

Staff from the **Ministry of Forests and Range** contribute to the fertilization program at three levels. The Forest Practices Branch manages and co-ordinates the program with regional staff. The Research Branch conducts relevant research and provides technical expertise to the program. Regional staff serve as technical specialists for forest licensees, contractors, and others. Ministry staff are also involved in site selection and program co-ordination with the local project leader.

**Ministry of Environment** staff provide technical expertise on matters relating to water quality and the protection of environmental integrity.

*The forest fertilization program follows the direction provided in silviculture strategies for key management units.*



*Time of fertilization*

*Subsequent growth*



*Helicopter with loaded bucket of fertilizer*

*Forest fertilization activities are based on forest-level and stand-level planning, biological principles, and an analysis of operational, biological, and economic factors.*

Regional staff conduct project referrals.

**Fisheries and Oceans Canada** staff receive and review project plans to check that the risk to fish-bearing streams under the *Fisheries Act* is minimized.

As delivery agents, **forest licensees and other program recipients** are selected to implement the activities of the fertilization program. The recipients are critical to program delivery, as they undertake many of the following components of the program:

- conduct site selection, fertilizer ordering and delivery, operational logistics, and project application management,
- administer both fertilization and implementation contracts,
- install monitoring plots, and
- report accomplishments upon project completion.

**Fertilization contractors** provide

both bulk fertilizer and application services.

**Implementation contractors** manage a range of program components, from site selection to project management and reporting.

**First Nations** groups are contacted by the local project leader regarding information-sharing for the protection of traditional plants and other resources and values.

The program's **third-party administrator** manages all financial and audit arrangements with the recipients related to the fertilization program.

## Monitoring

A large-scale program such as fertilization requires carefully planned monitoring of several factors and criteria. The fertilization monitoring program focuses primarily on the treatment response of fertilized stands, but also addresses project costs, the effects of fertilization on forest health and non-timber values, and consistency of treatment results with projected responses. Monitoring is designed to support continuous improvement. Timber supply analysis will incorporate the revised volume projections and determine if the increased stand volumes contribute to a corresponding increased timber supply at the management unit level.

## Communications

The purposes of communicating about the fertilization program are to:

1. Inform land users, forest licensees, First Nations, and the public that a large-scale provincial



*Larger needles after fertilization (top) compared to needles before fertilization (bottom)*

- fertilization program is a means to increase timber volume in the mid term,
2. Encourage participation in program delivery, and
  3. Provide technical information about fertilization and its stand- and landscape-level effects to practitioners, regional specialists, forest licensees, implementation contractors, and others who are interested.

The communications plan is posted on the fertilization website under Forests for Tomorrow, and more information can be found in specific program documents, including relevant strategic plans and program management plans.

## References

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## Websites

For further information, visit the following websites:

### **B.C. Ministry of Forests and Range, Forest Practices Branch**

[www.for.gov.bc.ca/hfp/](http://www.for.gov.bc.ca/hfp/)

### **Forest Fertilization Program**

[www.forestsfortomorrow.ca/GuidelinesAndStandards/Fertilization/Fertilization.html](http://www.forestsfortomorrow.ca/GuidelinesAndStandards/Fertilization/Fertilization.html)

### **Mountain Pine Beetle Action Plan**

[www.for.gov.bc.ca/hfp/mountain\\_pine\\_beetle](http://www.for.gov.bc.ca/hfp/mountain_pine_beetle)

### **Coastal Forest Action Plan**

[www.for.gov.bc.ca/mof/CoastalPlan/cap07.pdf](http://www.for.gov.bc.ca/mof/CoastalPlan/cap07.pdf)

### **Climate Action Plan**

[www.livesmartbc.ca/plan/index.html](http://www.livesmartbc.ca/plan/index.html)

### **Silviculture Strategies**

[www.for.gov.bc.ca/hfp/silstrat/index.htm](http://www.for.gov.bc.ca/hfp/silstrat/index.htm)

