



## Climate-Based Seed Transfer Frequently Asked Questions - November 2016

The Ministry of Forests, Lands and Natural Resource Operations Tree Improvement Branch is leading the development of a Climate-Based Seed Transfer (CBST) system to support forest ecosystem resilience, health, and productivity in the face of a changing climate.

This Frequently Asked Questions document provides answers to questions pertaining to specific elements of the CBST project, as well as those questions related to benefits, opportunities and potential impacts to stakeholders in the tree improvement and seed use community of practice. It is our intent to update this document from time to time as we move through the four phases of the project.

### 1. What is Seed Transfer?

**Seed transfer policy** is one of the foundations of effective reforestation to ensure that trees planted are genetically adapted to the environments in which they grow. This is fundamental in meeting reforestation objectives and sustainable forest management in BC. Seed transfer policy is used to support seed movement with minimum risk of poor adaptation of regenerating stock to its planting site.

**The current seed transfer system in BC**, is a system of 'fixed' seed zones originally developed in the early to late seventies and refined in the late eighties to incorporate geographic transfer limits (latitude, longitude and elevation). These limits were the result of extensive provenance testing and research trials reflecting the science of the day. Science has since advanced, and we know that current seed deployment is unnecessarily restricted in some places. In addition, the current geographic-based system does not lend itself to a province-wide, effective system of assisted migration to address a changing climate.

### 2. What is Climate-Based Seed Transfer (CBST)?

**CBST** is a science-based methodology and framework that uses climate variables to match seed sources (seedlots) to climatically suitable planting sites. CBST in BC<sup>1</sup> also includes the use of **Assisted Migration** as a climate change adaptation strategy.

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<sup>1</sup> O'Neill G, Wang, T, Ukrainitz N, et al. Technical Report 099 - *A proposed Climate-Based Seed Transfer System for British Columbia*



### 3. What is Assisted Migration?

**Assisted migration** is the act of helping a plant or animal move to a different place. Within the context of CBST, assisted migration is the deliberate movement of tree species and seeds/seedlings to planting sites that will be most suited to them in predicted future climates. The goal of this strategy is to maintain the health and productivity of planted forests in a changing climate, given the expectation that local climate on some sites is currently, or may, in the near future become, poorly suited to local seed.

**Assisted migration has two distinctive components:** assisted population migration (seeds are moved within the current, known range of the species), and assisted range migration (seeds are moved beyond the current, known range of the species).

In BC and CBST, the parameters for assisted migration are to move seed/seedlings to sites that represent the predicted climate appropriate for the seed, a quarter of a rotation into the future (i.e., 20 years in the Interior and 15 years on the Coast). As the climate changes, a time lag can develop in the capacity of trees to adapt. This 'quarter rotation' adjustment will be updated as we move forward in time.

### 4. Why employ Assisted Migration as a climate change adaptation strategy?

Currently, reforestation (both natural regeneration and planting), occurs on some sites at which the local climate is not suitable for the healthy growth of those trees, due to changes in climate. The area of the province covered by such sites is expected to increase with time. **Assisted migration** will help address the mismatch of seed production with the current climate at that site (termed the 'adaptation lag'), by moving seed to sites that are predicted to be climatically suitable in the near future.

### 5. How far will BC be moving seed?

The actual distance that seed will be moved will vary for each species and seed source, and is currently under review by the CBST Policy Working Group.



## 6. If we plant trees now for a future climate, will they survive in the current climate?

The risk of mortality at planting using CBST policy is expected to be lower than the risk of mortality at planting under current seed transfer policy.

- Due to climate change since the industrial revolution (and associated adaptation lag), most seedlings are currently being planted into cutblock climates that are on average **1.2° C warmer than the seedling's origin.**<sup>[1]</sup>
- Under CBST, by planting seedlings into cutblock climates projected **a quarter of a rotation into the future**, we will be planting into a current climate that is only about **0.5° C colder** than the seedling's origin.

Frost damage, drought or extreme weather events may also increase and impact a seedling's early establishment. However, foresters currently plan for and mitigate such events with reforestation strategies such as microsite planting, mounding, and trenching which are expected to remain important in a changing climate. Other reforestation strategies such as using species mixes, planting at higher densities or underplanting may become more important in a changing climate, particularly if assisted migration is not employed.

## 7. Will use of Assisted Migration in CBST result in greater forest productivity?

Although it is now commonly understood that climate change will negatively impact forest productivity through the increase of pests, wildfire and maladaptation, there has been little work to date to quantify losses.

The amount of productivity loss CBST and assisted migration will mitigate is similarly unknown at this stage. However, based on a sensitivity analysis that looked at the economic value within a range of timber supply impacts, public investment in CBST as a strategy that will maintain forest productivity is estimated to result in a net present value between \$1 and \$3 billion over the next century, with a benefit cost ratio of 8:1 to 70:1<sup>2</sup>.

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<sup>[1]</sup> Climate projections supporting the CBST project are based on a consensus of climate models combined into "[ClimateBC](#)", an application developed by Dr Tongli Wang working with FLNRO climate scientists and others at the UBC Department of Forest and Conservation Sciences.

<sup>2</sup> Hotte, N., Mahony, C., and Nelson, H. 2016. The Principal agent problem and climate adaptation on public lands. *Global Environmental Change* 36 (163-174).; and Woods, J. and Mahony, C. 2016. Climate-based seed transfer: guiding British Columbia's reforestation investments in a changing climate. [Forest Genetics Council of BC Extension Note](#).



8. How does this scenario fit with the notion that BC's forests are supposed to benefit from climate warming in colder areas?

Some BC species may benefit from climate warming in the short term. In the long term most species and forests are expected to be negatively affected by losses from forest pests, wildfire, and lower productivity due to trees growing on sites that they are no longer genetically best adapted to. CBST has the potential to mitigate these losses.

9. How is Genetic Worth affected by Climate-Based Seed Transfer?<sup>3</sup>

**Genetic worth is a relative measure** of how much more volume tested orchard (Class "A") seed will add to a stand at the end of its rotation, compared to that of local populations registered as natural stand seed sources (Class "B"). CBST, including **Assisted Migration**, is expected to affect Class "A" and "B" seed equally and there is no expectation that the relative difference between them will change. Therefore no adjustments to GW are currently anticipated.

10. What happens under CBST if seed currently owned by Government and/or Industry is no longer suitable for the areas in which they operate?

**Moving from our current seed transfer system to CBST** will, in some cases, result in mismatches in seed inventories and seed orchard production capacity with seed plans and operational seed needs. The CBST Policy Working Group will be considering different approaches and transition options to minimize impacts on stakeholders while maintaining acceptable risk to meeting regeneration obligation and future timber supply.

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<sup>3</sup> Genetic gain is the percentage increase in certain traits (e.g., stem volume, relative wood density, or pest resistance) of trees grown from select seed, over those grown from wild-stand seed. The genetic gain of a seedlot is expressed as its genetic worth (GW). The GW for stem volume is measured as the percentage gain in volume expected for a seedlot at or near harvest age. The GW for each seedlot is recorded on the MOF Seed Planning and Registry system (SPAR). *Incorporating Genetic Gain in Timber Supply Analysis*. Tanz, J., Forest Genetics Council, March 2001. <http://www.fgcouncil.bc.ca/ExtNote1-Final-web.pdf>



11. How does the CBST fit with the broader initiatives of BC Government Climate Change response?

**The Chief Forester chairs a FLNRO Climate Change Steering Committee**, tasked with coordinating FLNRO's response on a full range of expected climate change impacts on BC Forests and the Forest Industry.

At the Provincial scale, addressing climate change impacts on the BC economy is being led by the **Provincial Climate Leadership Committee** which includes representatives from most government ministries.

**For Further Information:**

For more information on the **CBST Project** go to:

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