

## Seed Use Efficiency Meeting

Langley, BC July 30 & 31, 2008

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Research Branch, MoFR

### Climate-based Seed Transfer

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#### **Background**

A well designed seed transfer system maximizes plantation productivity and wood quality, ensures the capture of genetic gains, and minimizes the risk of maladaptation due to pests, disease and climate change by ensuring that trees are well adapted to their planting location.

A revolution in the field of geneecology relating to the development of new climate models, geographic information systems (GIS), the availability of mature provenance data, and new statistical techniques, makes it possible to develop an improved seed transfer system. A new climate-based seed transfer (CBST) system will greatly enable effective implementation of assisting migration of seed (i.e., planting seed adapted to future climates), which has been widely regarded as a key climate change adaptation strategy in forestry.<sup>1</sup>

Research Branch has initiated a project to develop a CBST system that will identify seedlots that are best suited climatically to each plantation over the course of the rotation. The system will be operationally simple, will apply to both selected (class A) and wildstand (class B) seed, and will be well suited for implementing measures to mitigate the impacts of climate change.

#### **Methods**

Five fixed-zone seed transfer systems were developed and compared with BC's current B class seed transfer system to assess the degree of adaptation and deployability that each system would provide. Five zonation systems were created, each dividing British Columbia into 12 climate zones. The zonation systems were based on: mean annual temperature (MAT); MAT and mean annual precipitation (MAT x MAP); two principal components which consolidated eight climate variables; two principal components which were clustered using a hierarchical clustering procedure to minimize climatic variation among clusters; and BC's forested biogeoclimatic zones. The MAT x MAP zonation system is illustrated in Fig. 1.

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<sup>1</sup> A small degree of assisted migration can be accommodated within the current seed transfer system. In September 2008 Research Branch will recommend minor changes to the current system to encourage assisted migration.

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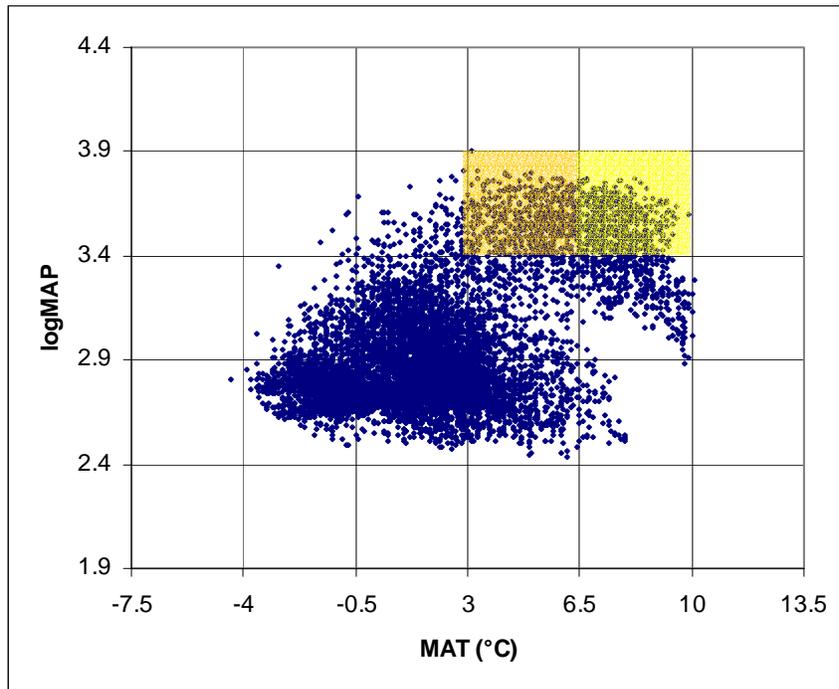


Fig. 1. An example of one of the five climate-based seed transfer systems examined. Twelve fixed-zone climate zones were created for British Columbia on the basis of mean annual temperature (MAT) and log of mean annual precipitation (logMAP).

The level of maladaptation (and associated disease, pest, stem deformation and growth losses) associated with seed transfer increases with climatic transfer distance. Therefore, to evaluate the level of adaptation that would be inherent in each zonation system, a large number of hypothetical seed transfers was created within each zone of each system, and the climatic transfer distance determined for each transfer. Climatic transfer distance was then averaged over each zone and zonation system. To assess deployability, the areal extent of each zone of each system was determined using a geographical information system.

### Results and Discussion

Climate transfer distance of seed transfers was substantially shorter in the zonation systems that were based on MAT x MAP, PC and PC cluster than the systems based on MAT, biogeoclimatic zones, or the current class B zonation system (Fig. 2).

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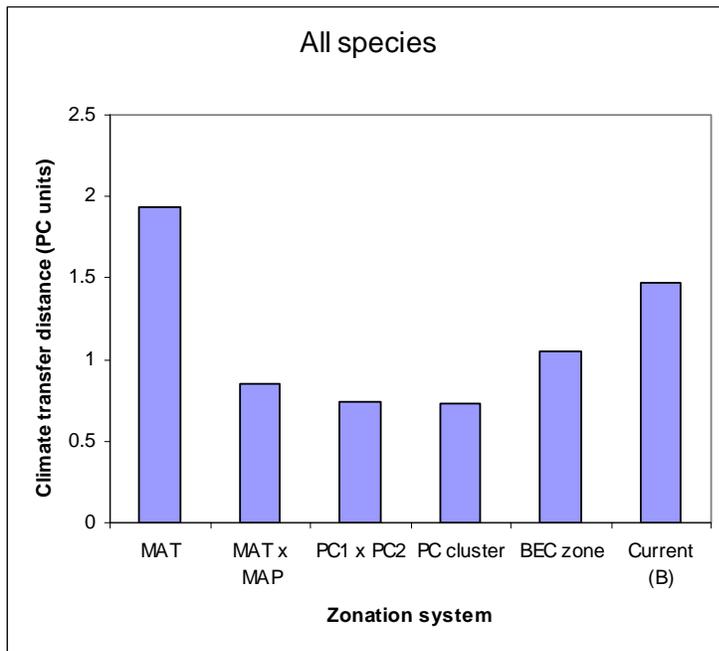


Fig. 2. Results of analysis to estimate the level of adaptation expected to be associated with seed transfers from five climate-based seed transfer systems and the current class B seed transfer system in British Columbia. Climate transfer distance is used as a surrogate measure of maladaptation.

Deployability was considerably greater for all five zonation systems compared with the current class B zonation system (Fig. 3). These results suggest that a new seed transfer system based on fixed zones developed from MAT x MAP, PC, or PC clusters would provide substantial improvements in adaptation and seed deployability. In addition, these systems would facilitate the implementation of a system of assisted migration that could be incorporated incrementally and without the need to revise zone boundaries.

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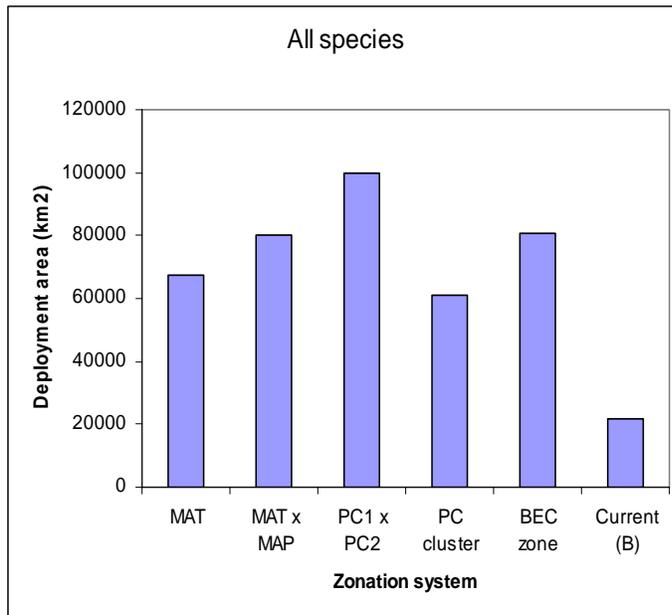


Fig. 3. Results of an analysis to estimate the level of deployability expected to be associated with seed transfers from five climate-based seed transfer systems and the current class B seed transfer system in British Columbia. Deployability is the spatial extent (km<sup>2</sup>) to which each seedlot can be transferred.

Research Branch staff of the Ministry of Forests and Range intend to complete analyses required to propose a new climate-based seed transfer system by mid 2009. Tree Improvement Branch will then review and implement the recommended system. To minimize disruption in seed planning for licensees, a “roll-out” period (3-5 years) is being considered to provide time for stakeholders to adjust seed inventories.