CANADIAN TREE IMPROVEMENT ASSOCIATION/ ASSOCIATION CANADIENNE POUR L'AMÉLIORATION DES ARBRES



Tree Seed Working Group

NEWS BULLETIN

No. 46 December 2007

SEED TRANSFER

THIS ISSUE AT A GLANCE

Page Article

- 3 Ontario Tree Seed Conference A Success
- 4 Seed Transfer 101
- 8 Seed Transfer in Quebec
- 9 Transfer of Seed in New Brunswick
- 10 Water Activity: A New Paradigm for Seed and Pollen Management
- 13 National Tree Seed Centre Turns 40
- 13 CTIA Tree Seed Working Group Tour and Workshop
- 14 Upcoming Meetings
- 14 Recent Publications

CHAIR'S 'ARMCHAIR' REPORT

Happy Holidays to all. As 2007 draws to a close we can look forward to a wide variety of meetings and extension events in 2008. The CTIA will be having its meeting in Quebec City August 25th to 28th with a special tour of the Berthier nursery and tree seed centre on Sunday August 24th just before the CTIA. Please see Fabienne Colas's note on the topic and look for updates on the conference web site: http://www.iufro-ctia2008.ca/index.php

In January, our Northern Silviculture Committee in BC is addressing "Changing Northern BC Forests – Silvicultural Challenges and Implications" and this meeting will explore many of the options and information available regarding strategies to deal with the post-Mountain pine beetle and climate change scenarios that this portion of BC needs to deal with now. Nationally, a meeting was held in November in Sault Ste. Marie "Adapting to Change: Managing Tree Seed Under an Uncertain Climate" and Kathleen Brosemer has provided an overview of the meeting and indicated that proceedings should be available in the spring of 2008.

We at the BC Ministry of Forests and Range Tree Seed Centre are celebrating 50 years in operation this year and are planning several activities for clients, neighbours, and staff. I am also hoping to incorporate a technical session in the mix and this will likely take place prior to the next News Bulletin. We will be advertising heavily in BC, but if others would like to be made aware of upcoming activities, please send me an e-mail and I'll include you in our announcement distribution list.

Last, but certainly not least is the upcoming Tree Seeds 2008 meeting with the theme of 'Trees, Seeds and a Changing Climate" that is being co-

- Ying, C.C.; Liang, Q. 1994. Geographic pattern of adaptive variation of lodgepole pine (*Pinus contorta* Dougl.) within the species' coastal range: field performance at age 20 years. For. Ecol. Manage. 67: 281–298.
- Ying, C.C.; Yanchuk, A.D. 2006. The development of British Columbia's tree seed transfer guidelines: purpose, concept, methodology, and implementation. For. Ecol. Manage. 227: 1–13.
- Zobel, B.J.; Talbert, J.T. 1984. Applied Tree Improvement. John Wiley and Sons, New York.

Greg O'Neill Ministry of Forests and Range 3401 Reservoir Road Vernon, BC V1B 2C7 E-mail: Greg.ONeill@gov.bc.ca



SEED TRANSFER IN QUEBEC

The main concern for tree breeders and reforestation managers is to provide seedlings of good genetic and morphological quality, that are well adapted to a variety of growing conditions, so their genetic potential can be realized. To achieve this goal, the Ministère des Ressources naturelles et de la Faune du Québec (MRNF) has established seed transfer rules across the province, that take into account the genetic quality of the material.

Since 1985, Quebec has established seed transfer rules for every species reforested, using primarily the hierarchical system of ecological classification (Thibault 1985; Saucier et al. 1998). In order to meet reforestation needs of a specific region, preference was given to transfers within the same ecological unit moving to the largest ones. Maximum limits were fixed at 300 m elevation, 0.5 degrees latitude to the south and 1 degree latitude to the north. These rules still apply to unimproved sources, which represent 20% of the seedlings used for reforestation.

Over the years, studies on patterns of genetic variation were conducted by geneticists for the most important conifer species. These studies led to the development of mathematical models for connecting patterns of variation observed between sources with geographic coordinates of their origin as well as variables representing the climatic

conditions of the reforestation sites (Mátvás and Yeatman 1992; Li et al. 1997a, b; Beaulieu et al. 2004). Variables such as latitude, longitude, elevation, aridity index, vapor pressure deficit, precipitation, and number of degree-days are considered in the models. Software was also developed to automate the calculation of risk associated with the transfer of a provenance within a region. Using Arcview 3.2 in conjunction with ecological region boundaries, a map is created that represents the region in which a specific source can be used and the risk associated to every location on the map. These are powerful tools to guide seed transfer decisions in Quebec (Beaulieu et al. 2003); they were used to refine seed zones for first-generation seed orchards, primarily established in the 80's. For second-generation seed orchards, seed zones correspond to breeding zones, as defined by tree improvement programs.

While a seed zone is determined for every seed source, the notion of risk associated to that seed zone could still be interpreted differently according to the reforestation manager in each region. It was thus necessary to establish standards for the management of risk. Since 1999, the MRNF has set up management information system databases called "SEMENCES" (for seeds) and "PLANTS" (for seedlings), to which every manager has access. This software is the main tool for managing the overall operations, from cone collection to seedling production to reforestation.

The next challenge is to incorporate impacts of climate change into seed transfer rules. The model developed for white spruce in Quebec (Andalo et al. 2005) could be used as a reference for other species. Also, monitoring the performance of white spruce seed sources transferred according to this model, within provenance tests replicated on a large number of sites (Beaulieu and Rainville 2005), is desirable to support growth expectations.

References

- Andalo, C.; Beaulieu, J.; Bousquet, J. 2005. The impact of climate change on growth of local white spruce populations in Quebec, Canada. For. Ecol. Manage. 205: 169–182.
- Beaulieu, J.; Bousquet, J.; Rainville, A.; Zhang, S.Y. 2003. Le Québec à l'aube d'une révolution en génétique forestière. Carrefour de la recherche forestière 2003. Actes des Colloques. pp 5–16.
- Beaulieu, J.; Perron M.; Bousquet, J. 2004. Multivariate patterns of adaptive genetic variation and seed source transfer in *Picea mariana*. Can. J. For. Res. 34: 532–545.

- Beaulieu, J.; Rainville A. 2005. Adaptation to climate change: genetic variation is both a short- and long-term solution. For. Chron. 81: 704–709.
- Mátyás, C.; Yeatman C.W. 1992. Effect of geographical transfer on growth and survival of jack pine (*Pinus banksiana* Lamb.) populations. Silvae Genet. 41: 370–376.
- Li P.; Beaulieu J.; Bousquet J. 1997a. Genetic structure and patterns of genetic variation among populations in eastern white spruce (*Picea glauca*). Can. J. For. Res. 27: 189–198.
- Li, P.; Beaulieu, J.; Daoust, G.; Plourde, A. 1997b. Patterns of adaptive genetic variation in eastern white pine (*Pinus strobus*) from Quebec. Can. J. For. Res. 27: 199–206.
- Saucier, J.-P.; Bergeron, J.-F; Grondin, P.; Robitaille, A. 1998. Les régions écologiques du Québec méridional, 3e version : Un des éléments du système hiérarchique de classification écologique du territoire mis au point par le ministère des Ressources naturelles du Québec. Ordre des ingénieurs forestiers du Québec. Encart de L'Aubelle no 124, 12 pages.
- Thibault, M. 1985. Les régions écologiques du Québec méridional, deuxième approximation : carte en couleurs à l'échelle 1/1 250 000. Serv. De la rech. Appliquée, Min. Énerg. et Ress., Quebec.

André Deshaies

Direction générale des pépinières et des stations piscicoles Ministère des Ressources naturelles et de la Faune 880 chemin Ste-Foy

Québec, QC G1S 4X4 E-mail: andre.deshaies@mrnf.gouv.qc.ca

André Rainville

Direction de la recherche forestière Ministère des Ressources naturelles et de la Faune 2700 rue Einstein Québec, QC G1P 3W8

—••;;••—

TRANSFER OF SEED IN NEW BRUNSWICK

Almost half of the land area, or approximately three million ha of New Brunswick forest land, is Crown Land. Under the Crown Land and Forests Act, the Province is responsible for reforestation of all Crown land. Kingsclear Provincial Nursery grows 20 million seedlings per year that are planted on harvested sites. The main species are black spruce (*Picea mariana*), white spruce (*P.* glauca), red spruce (*P. rubens*), and Norway spruce (*P. abies*) which make up ~85% of the planting program. The remaining species planted include jack pine (*Pinus banksiana*), white pine (*P. strobus*) and small quantities of red pine (*P. resinosa*) and eastern white cedar (*Thuja* occidentalis).

Although forest management *per se* is under legislation there are no legislated seed transfer regulations. The Tree Improvement Unit is responsible for providing the seed to the provincial nursery for seedling production. So the seed is "regulated" at least on Crown land. There are no regulations or legislation for private land although many of the companies and private woodlot owners do plant the best possible seed sources on their lands.

As New Brunswick is one of the smallest provinces we are fortunate that we do not have many seed zones. Based on testing conducted by the NB Tree Improvement Council we have determined that for most species the entire province can be treated as one seed zone. An exception to this is red spruce where we have a southern and a northern seed source.

For the major tree species that are planted such as black spruce, white spruce, Norway spruce, and jack pine all the seed originates from seed orchards. Some improved seed is also planted for the southern source of red spruce. For the other species, seed is collected from good quality natural stands.

We are fortunate to have one seed zone as it has allowed us to focus on many species. For black spruce and jack pine we are close to starting thirdgeneration programs and have started collecting seed from second-generation white spruce orchards. Red spruce orchards are just starting to produce and we will be establishing white pine orchards in the next couple of years.