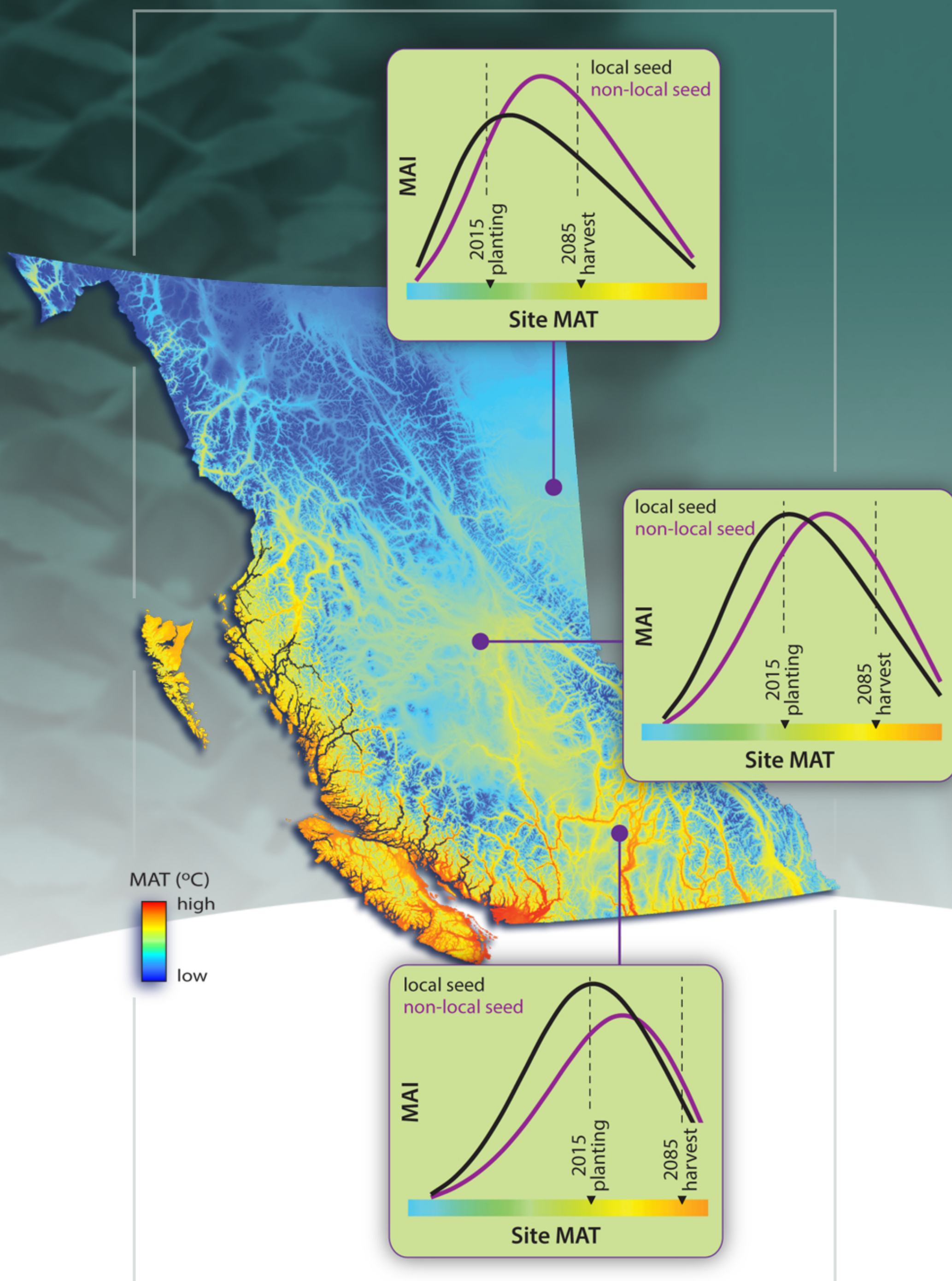
FGC Forest Genetics Council of British Columbia

# Annual Report 2014/15



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### Cover graphic: Lodgepole pine assisted migration

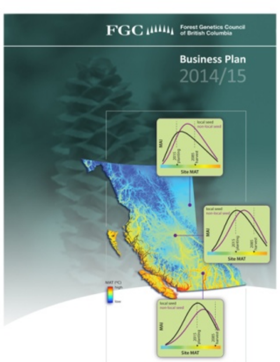



Image prepared by
C. Chourmouzis

Provenance trials test seed from different climatic areas in field trials located on operational forestry sites. These trials help us understand the impacts of climate change on forest growth and health, and identify seed sources expected to perform best in changing climates. This example from lodgepole pine provenance trials established in the 1970s, shows the growth rate of local and a best non-local (migrated) seed sources modeled with site temperature changes from the time of planting to the time of harvest (shown here for simplicity as mean annual temperature - MAT).

Productivity, measured as mean annual increment (MAI) in $m^3$ per hectare, increases slightly as climate warms in some locations, but declines toward the end of the rotation at all locations. This decline in MAI is partially or wholly mitigated by choosing seed sources from climatic areas best suited to expected future climates. Benefits from using the best non-local seed source are greater in cooler climatic areas, as existing local sources can be replaced with faster-growing sources from warmer areas (northern-most graph). In warmer and drier areas, increased warming may result in a loss of productivity over the next rotation regardless of seed source, suggesting that a shift to a species more suited to the warmer climate is warranted for these sites.

Provincial seed transfer policy will change incrementally and conservatively as new research and climate-modelling information comes available. These changes will minimize risk and mitigate (or enhance) productivity declines due to climate change.

## Messages

*We would like to congratulate the Forest Genetics Council of BC (FGC) for completing their 14th consecutive annual business plan and report. The FGC's program continues to be one of the core elements of the Land Base Investment Strategy. These investments, combined with those from the forest sector, account for over 50% of the ministry's annual service plan performance measure for timber-supply gains attributed to incremental silviculture investments.*

*The FGC remains an effective forum for soliciting stakeholder input and developing policies and priorities. We are pleased the FGC continues to deliver a well-balanced program that considers the economic gains from breeding and seed orchard programs, improves forest health and resilience, and maintains genetic diversity to enhance our future forests. We note in this report long-term progress across a broad spectrum of activities from select seed use to genetic conservation.*

*We would like to thank members of the FGC, and its affiliated technical committees, for their contributions and enthusiasm.*

**DIANE NICHOLLS**
A / Chief Forester
and Executive Director,
Resources Stewardship
Division

*and*

**TOM ETHIER**
Assistant Deputy Minister
Resource Stewardship

BC Ministry of Forests
Lands and Natural
Resource Operations

*During the term of this report, the FGC developed a new Strategic Plan for the period 2015 to 2020. This plan sets out a challenging and balanced set of objectives for the cooperative provincial forest genetics program. Looking back at the many successes of this program and looking forward to the completion of many projects currently underway, we are confident that Council's vision can be realized.*

*During the past year Council met quarterly, including a field trip to Western Forest Products Ltd's. Saanich Forestry Centre, which was celebrating its 50th anniversary. This seed orchard and nursery complex demonstrates the success of FGC and its predecessors, and the commitment of our private sector partners.*

*We would like to thank Larry Gardner for his service on Council as an Interior Industry representative and as Industry Co-Chair from 2010 to 2015. We would also like to extend our gratitude to the many people in government, industry and universities who added to this cooperative program.*

**BRIAN BARBER**
Co-Chair,
Forest Genetics
Council of BC

Director,
Tree Improvement
Branch, FLNRO

**MARK TAMAS**
Co-Chair,
Forest Genetics
Council of BC

Chief Forester,
Tolko Industries
Ltd.

*I'm proud to present the 2014/15 FGC Annual Report; the 14th consecutive report in a series that provides a solid record of achievement and action by many people. Further details are available in the FGC Business Plan for 2014/15, and the Tree Improvement Program Projects Report for 2014/15. I would like to thank members of the FGC and Council's technical advisory committees, as well as the many others who contribute to the success of this program.*

*During the 2015 sowing year, seeds for 263 million seedlings were sown in BC. Of these, 158 million came from Class A seed sources, adding very substantially to the province's long-term timber supply potential. Provincial breeding programs continue to advance the process of genetic selection, and seed orchards are well positioned to meet provincial demands for Class A seed.*

**JACK WOODS,**
Program Manager,
Forest Genetics
Council of BC

# 1.0 Introduction

This Annual Report presents provincial-level performance indicators outlined in the FGC Strategic Plan for 2009 to 2014. It also summarizes outcomes from projects funded through the Land Based Investment Strategy (LBIS) Tree Improvement Program. These projects are outlined in the Forest Genetics Council of BC (FGC) Business Plan for 2014/15. Performance indicators reported here represent results from both LBIS investments and the investment of cooperators.

*The FGC Annual Report presents provincial-level performance indicators for genetic resource management.*

## 1.1 Tree improvement and forest genetic resource management in British Columbia

Tree improvement and forest genetic resource management (GRM) includes increasing value through tree breeding and seed production, conserving the genetic diversity of indigenous forest tree species, and enhancing forest resilience through scientifically-based seed transfer standards and forest health. Support activities including research, extension, and records management also advance provincial GRM initiatives.

## 1.2 About the Forest Genetics Council of British Columbia

*The FGC represents stakeholders in the management and conservation of the genetic resource of indigenous tree species.*

The FGC is a multi-stakeholder group representing government agencies (Ministry of Forests Lands and Natural Resource Operations - FLNRO), the forest industry, universities, the Canadian Forest Service, and smaller forest-sector companies. The mandate of the FGC is to champion forest GRM, to oversee strategic and business planning for a cooperative provincial GRM program, and to advise the provincial Chief Forester and the Assistant Deputy Minister, Resource Stewardship, on GRM policies.

The FGC leads program development and business planning for provincial investments through the LBIS, and seeks efficiencies for all investments, including those by industry and university cooperators.

## 1.3 FGC vision and objectives

Council set the following vision statement and objectives in its five-year Strategic Plan (2009-2014), and annually develops a Business Plan outlining activities to meet these objectives.[1] Council is developing new objectives in a Strategic plan for the period 2015 to 2020.

### *Vision*

*BC's forest genetic resources are diverse, resilient, and managed to provide multiple values for the benefit of present and future generations.*

### *Objectives*

- *Increase the average volume gain of select seed used for Crown land reforestation to 20% by the year 2020*
- *Increase select seed use to 75% of the provincial total sown by 2014*
- *Adequately conserve the genetic diversity of key populations of all forest tree species native to BC by 2015, through a combination of in situ, ex situ, and inter situ conservation*
- *By 2020, high-quality genecology research information will guide operationally efficient climate-based seed transfer policy and practice for all trees planted in BC*
- *Coordinate stakeholder activities and secure the resources needed to meet Business Plan priorities*
- *Monitor and report progress in genetic resource management activities*

## Retirements

**Diane Douglas**
Diane began her public service career with the Ministry of Agriculture in 1992 and later transferred to the FLNRO Tree Improvement Branch. Diane chaired the Extension Technical Advisory Committee from 2008 to 2015.

**Karen Turner**
Seed Orchard Technician with the FLNRO at Skimikin Seed Orchards from 1992 to 2014.

[1] For more information on the Forest Genetics Council, see *http://www.fgcouncil.ca.*

# 2.0 Budget and Expenditures

Land Based Investment Strategy Tree Improvement Program and SelectSeed Ltd. allocations and expenditures for the 2014/15 fiscal year that were made in support of the provincial GRM program are shown in Table 1. The table excludes in-kind costs, staff salaries, and other substantial inputs by industry, FLNRO, and university cooperators that contribute to the success of GRM activities in BC.

**Table 1**
Summary of Land Based Investment Strategy Tree Improvement Program budgets and expenditures for the period April 1, 2014 through March 31, 2015 ($ x 1000).

| LBIS Tree Improvement Program | Budget ($) | Expenditures ($) |
|---|---|---|
| Genetic Conservation | 222 | 222 |
| Tree Breeding | 1,123 | 1,280 |
| Operational Tree Improvement Program (OTIP) | 512 | 419 |
| Extension and Communication | 12 | 12 |
| Cone and Seed Pest Management | 81 | 78 |
| Genecology and Seed Transfer | 265 | 260 |
| Genetic Resource Decision Support | 115 | 56 |
| Applied Tree Improvement and Biotechnology | 159 | 159 |
| Administration | 10 | 11 |
| **Total** | **2,500** | **2,497** |
| **SelectSeed Ltd. expenditures on behalf of FGC*** | 152 | 140 |

*SelectSeed provided program management services and paid expenses for communications (website, publications), meetings, research, and consulting on behalf of the FGC.

Non-allocated funds remained with FLNRO and were either re-allocated within the LBIS program or returned to provincial general revenue. Noteworthy is the support of FGC activities by Council-owed SelectSeed Ltd. These funds were derived from revenues on the sale of seed produced in orchards operated under contract to SelectSeed Ltd.

Under-spending in the Operational Tree Improvement Program is due to orchard crops being generally lower than anticipated in 2014, requiring less crop and pest management work than anticipated. The primary reallocation of funding was from OTIP to Tree Breeding to meet ongoing needs for progeny testing and assessments.

# 3.0 Performance Indicators

Progress towards objectives set out in the FGC's new Strategic Plan for the period 2009-2014 (see section 1.3) are measured and reported annually. Two of these objectives are to increase the average genetic worth (GWg[2]) of Class A select seed to 20% by 2020 and to increase select seed[3] use to 75% by 2014 (this objective has been moved to 2020 in the new FGC Strategic Plan for 2015-2020). Province-wide performance on these objectives is shown below.

## 3.1 Increase seedlot genetic worth

### Performance measure

Increase the average volume gain of select seed used for Crown land reforestation to 20% by the year 2020.

### Performance

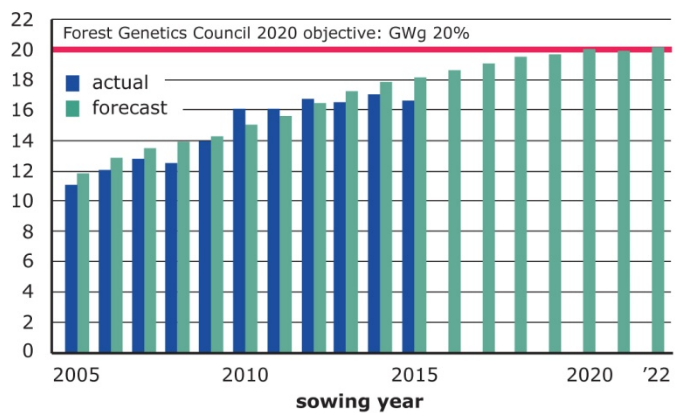



**Figure 1**
Actual and forecast annual average genetic worth for stem-volume growth (GWg) of select seed sown in BC.

The average GWg of select seed sown in the 2015 sowing year dropped to 16.6% from 17.0% the previous year, below a forecast of 18.1% (Figure 1). This decline is primarily due to a poor 2014 orchard-seed production year for lodgepole pine that resulted in less sowing and a lower average GWg than the previous year. Redcedar sowing of high-gain seed also dropped slightly. On the positive side, sowing of GWg seed for interior Douglas-fir and western larch increased. Gains from the use of interior Douglas-fir are expected to continue as orchards enter full production.

[2] Genetic worth is a measure of rotation-age gain in a specific trait, relative to non-selected wild seed. Genetic worth for growth (GWg) is a measure of stand-based gains in wood volume expressed as a percentage.

[3] Select seed includes Class A seed from seed orchards and Class B+ seed from natural stands that have been identified for superior growth performance in field-based provenance trials.

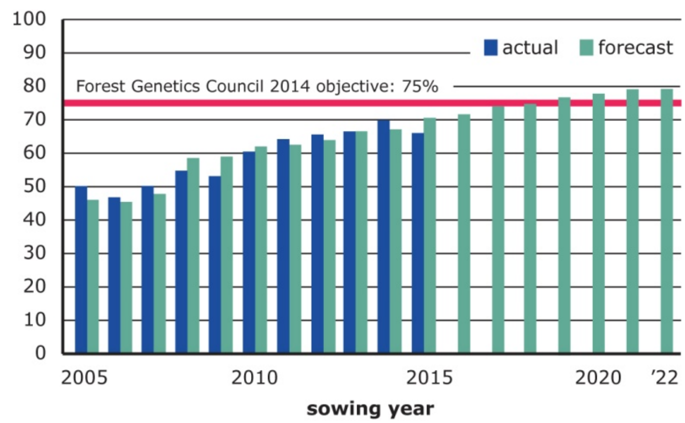
## 3.2 Increase select seed use

### Objective

Increase select seed use to 75% of the provincial total sown by 2014.

### Performance

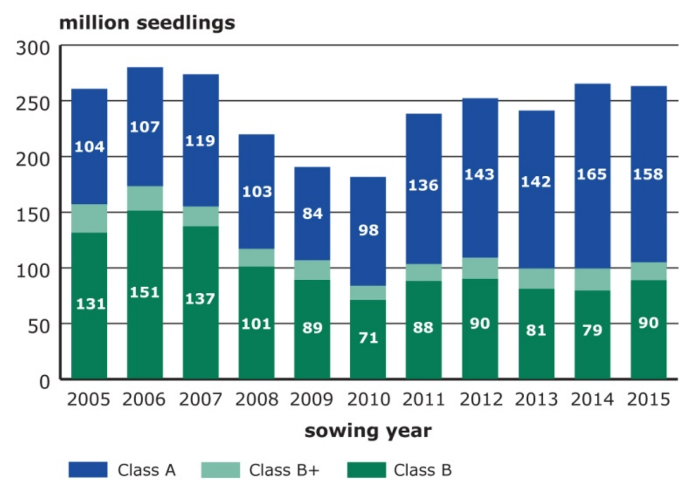
**Figure 2**
Actual and species-plan forecasts of select-seed use as a percentage of total provincial seed use, by year.




Select seed use as a percentage of total provincial sowing dropped to 66.0% in the 2015 sowing year from 70.2% the previous year (Figure 2). This decrease is below the forecast level of 71.7%. Total provincial sowing decreased slightly to 263 million seedlings from 265 the previous year. Overall sowing of Class A seed totaled 158 million, down from 165 million in 2014, but still the second highest level achieved (Figure 3). The objective of 75% select seed use by 2014 was not met, but substantial progress was made over the previous 5 years.

The 2015 sowing year was the fourth consecutive year with provincial sowing levels above 239 million. High demand for select seed is challenging provincial orchards to meet seed needs for some seed planning units (SPU). In particular, lodgepole pine orchards for northern areas continue to produce at levels below expectation. This problem will be partially alleviated by new lodgepole pine orchards at Skimikin and Quesnel entering the production phase.

**Figure 3**
Provincial sowing of orchard (Class A), wild-stand (Class B), and superior provenance seed (Class B+) from 2005 to 2015.



Breakthroughs in lodgepole pine orchard management also show some promise for increasing seed production (see Feature article below).

Class A seed use for western larch, coastal Douglas-fir, western redcedar (coast), western white pine, Sitka spruce, and western hemlock remains high due to generally adequate orchard seed supplies. Orchard seed use for interior Douglas-fir continues to rise as orchards mature, while interior spruce once again accounts for over 50% of provincial class A sowing (Figure 4).

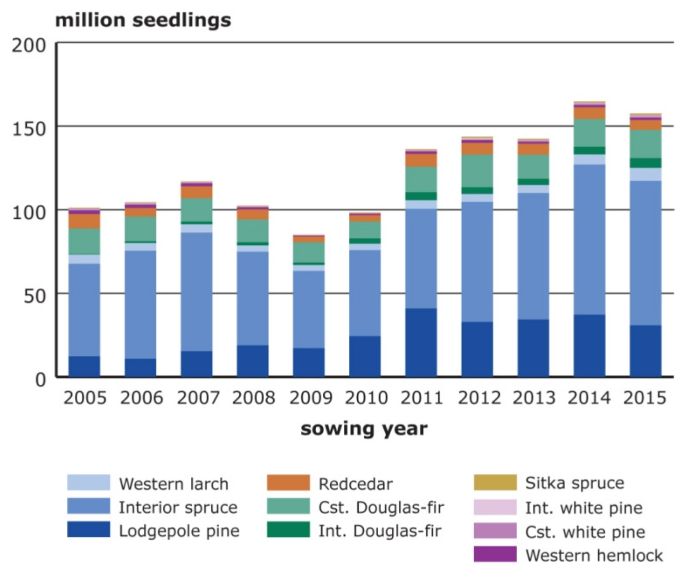



**Figure 4**
Provincial sowing of orchard seed (Class A) by species from 2005 to 2015.

Class A interior Douglas-fir seedlings being grown by Sorrento Nurseries Ltd. for the Nelson low-elevation seed zone. In 2014, about half of the 4 million seedlings produced for this zone were from class A seed. This proportion is increasing.

*(photo J. Woods)*

*Feature:*

## Lodgepole pine challenges orchard managers to meet seed demands

Lodgepole pine (Pli) is the dominant species planted in BC, accounting for 39% to 52% of annual provincial sowing over the past decade. Despite a shift to planting other species and species mixes, Pli remains a preferred species for large parts of the BC interior.

Pli presents several seed production challenges that translate to higher costs and higher risks for seed orchard managers. These challenges include difficult picking, lower cone production, and fewer seeds per cone compared to other species. Cone harvest is laborious because cones are dispersed throughout the crown, and the woody stems, adapted to retain serrotinous cones for many years, require pickers to either clip or "twist and pluck" each cone. In addition, Pli rarely yields more than 20 viable filled seeds per cone (FSPC), with 5-12 FSPC the average for southern BC orchards. For comparison, spruce orchards average 40 to 50 filled seeds per easily-picked cone.

Pli's low number of cones per tree and low FSPC require the establishment of large orchards to meet seed demand. Presently, 57% of the 117 thousand grafted trees in BC's orchards are Pli. However, these Pli grafts are producing less than half the seed needed for this species. New orchards established at Skimikin by the FLNRO and by Vernon Seed Orchard Company near Quesnel will help increase supply. Changes in future harvest levels and reforestation trends, and the implementation of climate-based seed transfer, could reduce *or* increase the demand for Pli orchard seed.

Increasing the number of cones per tree and FSPC has been the focus of research supported through the FGC. This work includes using plant growth regulating hormones such as gibberellic acid and IBA to stimulate increased flowering. Although still under development, large-scale trials of gibberellic acid alone increased cone production by about 35%. Trees can only be treated every 3 or 4 years, however, so overall orchard production increases will be closer 10%. Refined hormone treatment methods are expected to improve cone and seed production in the future.

A subject of much research over the past 15 years is the relatively small numbers of viable or filled seeds per cone (FSPC). This is a very challenging area of investigation due to many causes, with each cause taking on a different level of importance in different seed years. Research has suggested that self pollination reduces FSPC as there is a natural genetic barrier protecting trees from inbreeding. Other research has shown that seed predation by the western conifer seed bug (*Leptoglossus occidentalis*) also has a large impact on FSPC some years. In younger orchards, or in years when wet weather is unfavourable to pollination, insufficient pollen reaching the emerging "flowers" can be a problem. Other potential causes such as high temperatures, humidity, and irrigation have also been investigated, but research to-date indicates that these factors do not strongly influence FSPC. Low FSPC appears to be caused by a combination of *Leptoglossus* predation, poor pollination, self-pollination, and currently unknown factors.

Top - Rick Hansinger in a 5,000-ramet Pli orchard in the Kettle Valley operated under contract to FGC-owned SelectSeed Ltd. Left - Lodgepole pine "flowers" (megasporangiate strobili) at the stage of pollen receptivity. Right - a transverse cut of a nearly-mature lodgepole pine cone showing healthy filled seeds (white) and empty seeds (black) caused by *Leptoglossus* predation, self pollination, or an unknown cause. (*photos J. Woods)*.

Meeting FGC objectives for select seed use and genetic gain requires higher production from Pli orchards. Orchard managers and researchers continue to work together to meet this challenge.

## 3.3 Adequately conserve genetic diversity

### Objective

Adequately conserve the genetic diversity of key populations of all forest tree species native to BC by 2015, through a combination of *in situ*, *ex situ*, and *inter situ* conservation.

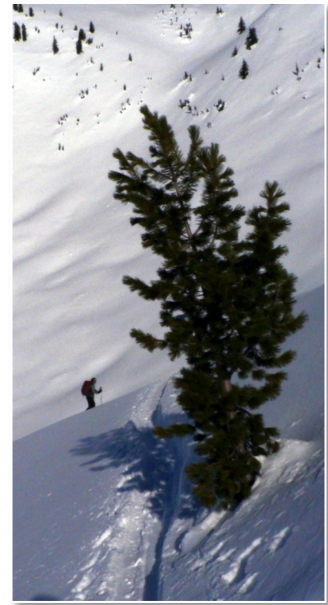
### Performance

Genetic conservation is focused on 42 tree species indigenous to BC. During the fiscal year, 401 family collections from 16 different species/sites were added to the *ex situ* genetic conservation collection held at the Provincial Tree Seed Center, bringing this collection to 10,129 samples representing 34 species. Moisture-content testing was done for 496 family seed lots to ensure seed quality is maintained. Other projects include refining methods to inoculate whitebark pine to test for resistance to white pine blister rust (WPBR). Thirty families were tested, three field-based screening trials were established, and 35,000 seedlings were grown for ongoing research in this area.

This program area supports UBC's widely-used ClimateWNA model. During the year, this model was upgraded and assistance was provided to people using the model for a full spectrum of forestry activities.

Other work includes:

- analysis of genecology[4] data for grand fir and Garry oak,
- upgrading of the existing genetic-conservation catalogue,
- maintenance of western yew and Garry oak genetic archives,
- communications and extension on conservation issues, and
- development of an online Big Tree Registry at UBC.



Whitebark pine is a foundation species in higher-elevation environments in much of western North America. It is listed under the federal Species at Risk Act, and is threatened by white pine blister rust (WPBR), fire protection that allows more competitive species to displace it, and climate change. Efforts to find trees with higher levels of resistance to WPBR are supported through FGC-led programs.

*(photo J. Woods)*

## 3.4 Climate-based seed transfer

### Objective

By 2020, high-quality genecology research information will guide operationally efficient climate-based seed transfer policy and practice for all trees planted in BC.

### Performance

A draft foundational technical report was completed for a proposed climate-based seed transfer (CBST) system for BC. Recommendations based on this report will provide the scientific basis for CBST policy development. Other work included the ongoing development, maintenance, assessment, and analysis of long-term genecology field trials, assessment of interior spruce and lodgepole pine genecology in conjunction with the Genome Canada supported AdapTree project at UBC, identification of cedar blight resistance (University of Victoria), and a project to identify critical soil moisture thresholds in support of assisted migration (College of New Caledonia).

[4] Genecology is the study of the geographic distribution of genetic differences among populations.

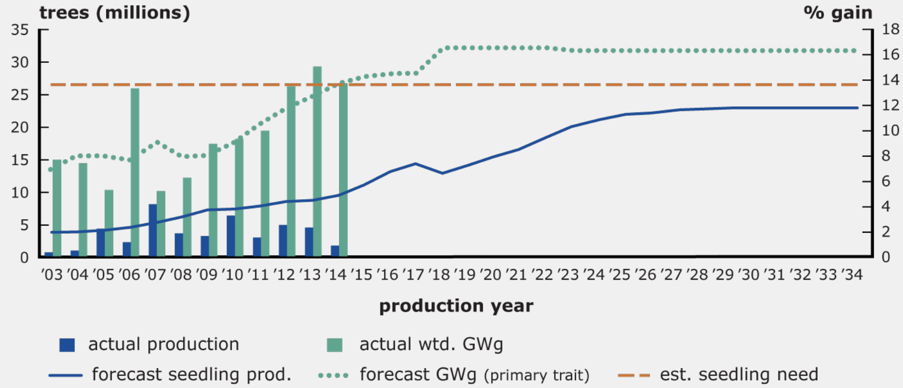
*Feature:*

## How big should orchards be to meet seed demand?

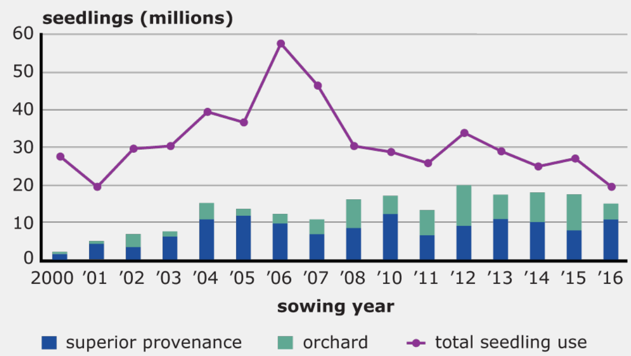
For the past 15 years the FGC has published "species plans" to help seed users and orchard managers with their seed planning. Plans are developed for seed planning units (SPUs), which are unique to a species seed zone, and elevation range. Species plans are updated annually and made available in print and online through the FGC and FLNRO Tree Improvement Branch websites.

The first difficult question related to determining orchard production is "how many seedlings will be planted in the future in each SPU?". Ideally, projections from licensees, BC Timber Sales, and FLNRO would provide these data. However, it is very difficult to project planting needs beyond two or three years due to changing wood markets and externalities such as pests and forest fires. Recent past seedling requests entered through FLNRO's Seed Planning and Registry System (SPAR) can be used to forecast future needs. The lower figure illustrates the annual variation in lodgepole pine (Pli) sowing requests in the Prince George low elevation SPU. Seedling demand in this SPU has fluctuated between 20 million and 60 million since 2000. Although changes of +/- 50% in seed use are common, longer-term trends and local knowledge can reduce uncertainty. Species plan estimates provide broad guidance using the average seed demand for the previous 5-year period.

**Estimated orchard gain and production** (SPU 12 Pli PG 700-1400m)




**Seedling Use Trend – 2000-2015**




Another difficult question is "how much seed will an orchard tree (ramet) produce over its lifetime?". Orchard ramets generally begin producing at age 4 or 5 and reach full production between ages 12 to 15. Seed production also varies considerably year to year, between genetic populations, and among orchard sites. For orchard size-planning purposes, a reasonable average number of seeds per ramet per year is estimated based on historic production data. Numbers vary for each species and range from 1875 for Pli to over 13,000 for interior spruce.

The next question is "how many seeds does it take to produce a seedling?". Sowing factors vary by seedlot germination, client demands, nursery regime, etc. Data on sowing factors are available through SPAR. Overestimates of orchard-capacity needs are less of a

is also kindly provided by some private nurseries. Average sowing factors are estimated and used to convert orchard-ramet seed production numbers to seedling production numbers. For example, Pli has an average sowing factor of 1.5 seeds sown per seedling produced. As a result, each orchard ramet is estimated to annually produce, on average, enough seeds for about 1250 seedlings.

problem than underestimates as excess seed is easily stored and orchard managers can quickly reduce the size of orchards or choose to not harvest crops.

Species plans compile all available seed production and use data and provide seed-production projections for all orchards producing in a SPU. These data are presented graphically to create a snapshot of actual and forecast seed production and genetic worth over several decades.

While these plans provide information for seed supply and orchard size planning, the experience and knowledge of orchard managers and seed users is relied on to fully understand local needs.

*Feature:*

## Lodgepole pine class A vs B seed; early growth and cold hardiness

The threat of tree maladaptation due to climate change has led to increased interest in studying climate-related adaptive traits among seed sources and how selective breeding might change those traits.

A trial using lodgepole pine orchard seed (Class A) and wild seed (Class B) was implemented by PhD student Ian MacLachlan as a part of the UBC AdapTree project. This work evaluated the effects of selective breeding on growth and climatic adaptation by comparing Class A seed from six seed zones with Class B seed from the same zones. The AdapTree project, building on a long record of FLNRO field-based provenance research, seeks to better understand these tree population differences at both the level of tree response (phenotypic) and in the underlying DNA.

MacLachlan established common-gardens trials on the UBC campus in Vancouver (for short-term phenotypic data collection) and at the UBC Alex Fraser Research Forest near Horsefly (for longer-term evaluation). Each trial contained ~1200 seedlings grown from both orchard and wild-stand seed representing the six zones, or seed planning units (SPU), from central and southern BC. Data for a large number of growth and phenology traits, including height, growth rate, shoot dry mass, bud break, bud set, growing period duration, and fall cold injury were collected.

Results from the UBC trial show a strong response in all growth traits to selective breeding. Orchard seedlots had up to 50% increased height growth (Figure A) and >100% increased shoot dry mass relative to wild stand seedlings. Bud-break timing differences were small and inconsistent, while summer bud set of the orchard lots was delayed from three to eleven days. Fall cold injury showed no differences between the seed sources in artificial freeze tests at -16°C. When expressed as a regression of injury on the mean annual temperature (MAT) of the seed source, no significant differences between Class A and Class B seed were detected (Figure B).

These findings validate extensive long-term field trials and genetic selections that focus on tree growth and tree health. Health is an aggregation of cold hardiness and a trees ability to withstand a variety of pest and environmental factors (cold, snow, etc.). As a result, selected populations used in seed orchards are faster growing trees that are also able to thrive in the rigors of the field environment.

Climatic clines in growth traits are most strongly associated with temperature-related variables. Class A seedlings show steeper clines with MAT than class B seedlings, indicating that the strength of local adaptation for this trait increases as a result of selective breeding. Clines in MAT for cold injury (Figure B) are strong in both wild and selected seed lots, but there is no statistically significant impact on MAT clines for cold injury due to selective breeding.

The results of this project shows that selective breeding increases the growth rate of lodgepole pine seedlings, adding support for Provincial policy on the use of Class A seed for reforestation. Orchard seed supports the attainment of 'free to grow' status sooner, and appears to have equivalent levels of fall cold hardiness to wild seed from the same source populations.

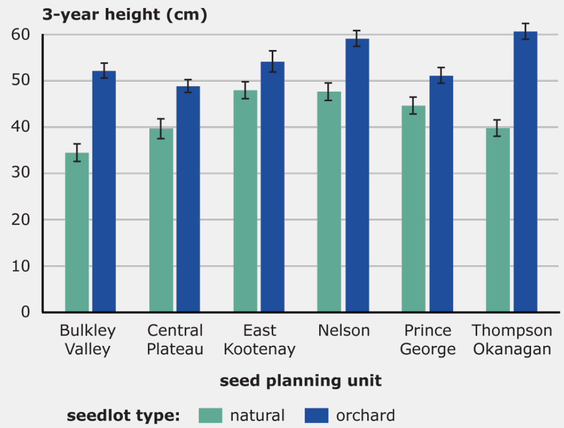



**Figure A**. Three-year height by seed planning unit for natural stand and orchard seed sources for six seed planning units.

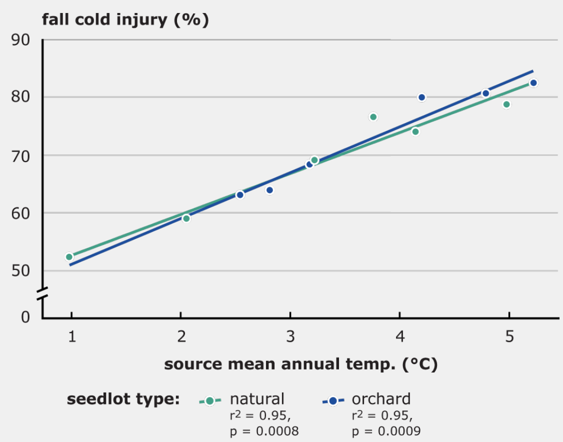



**Figure B.** Fall cold injury relative to seed source mean annual temperature for natural stand and orchard lots from six SPU.

## 3.5 Coordinate stakeholder activities

### Objective

Coordinate stakeholder activities and secure the resources needed to meet Business Plan priorities.

### Performance

During the period of this report, the FGC led completion of:

- an activity plan and associated budget recommendations for the Land Based Investment Strategy Tree Improvement Program for 2015/16,
- a published Business Plan and full set of species plans for 2015/16,
- a published FGC Annual Report and Projects Report for 2013/14,
- ongoing management of committee work and collaboration on issues,
- development of a Strategic Plan for 2015-2020, including community-of-practice and stakeholder surveys seeking input on priorities.

Council met four times during the fiscal year, including a meeting at Western Forest Products Ltd. seed orchard and nursery facilities in Saanichton, BC. During the year, Industry Co-Chair Larry Gardner of West Fraser Timber resigned from Council due to a change of employment responsibilities. Mark Tamas, Tolko Ltd. was appointed as Industry Co-Chair. A milestone agreement was also reached between the FLNRO and SelectSeed Ltd., in which SelectSeed will provide support for a succession tree breeder position within the Tree Improvement Branch for three years. Other business, including the development of a full suite of activities and accompanying budgets was developed to guide FLNRO spending under the LBIS Tree Improvement Program.

Douglas-fir cones in an orchard operated by PRT Growing Services in partnership with SelectSeed Ltd. and producing for the Nelson low elevation seed zone.

*(Photo J. Woods)*

## 3.6 Monitor and report progress

### Objective

Monitor and report progress in genetic resource management activities.

### Performance

This objective was met through the development and publication of a comprehensive Business Plan for 2014/15, including species plans that outline breeding programs, seed orchards, historic seed use and production, and other data relevant to an efficient multi-stakeholder provincial program. Performance indicators for objectives set out in the FGC Strategic Plan are reported in this document. Project level reporting is summarized in the Tree Improvement Project Report for 2014/15.

**Table 2**
Seed orchards in BC, summarized by site.

| Site and owner[5] | Number of seed orchards | Total #of ramets established | Ramets under contract with SelectSeed Ltd. |
|---|---|---|---|
| Vernon Seed orchard Company Ltd. | 17 | 30,762 | 8,335 |
| Kalamalka Seed orchards (FLNRO) | 17 | 18,635 | |
| Skimikin Seed Orchards (FLNRO) | 15 | 18,605 | |
| PRT Growing Services Ltd. | 6 | 11,897 | 9,805 |
| Kettle River Seed Orchards | 2 | 7,730 | 7,730 |
| TimberWest Forests Ltd. | 7 | 5,757 | |
| Tolko Ltd. | 4 | 5,910 | 4,980 |
| Sorrento Nurseries Ltd. | 2 | 5,065 | 5,065 |
| Western Forest Products Inc. | 12 | 3,558 | |
| Saanich Seed Orchards (FLNRO) | 6 | 3,592 | |
| Prince George Tree Improvement Stn. (FLNRO) | 3 | 3,198 | |
| Small private (2 sites) | 6 | 1,966 | |
| Canadian Forest Products Ltd. | 1 | 700 | |
| **Total** | 95 | 117,375 | 35,915 |

Douglas-fir pollen buds ready to shed their pollen. Pollen management in seed orchards is one of the keys to obtaining good seed production.

*(photo J. Woods)*

[5] Excludes yellow cypress hedge orchards for rooted cutting production owned by Western Forest Products Inc. and the FLNRO, Cowichan Lake Research Station.

# 4.0 2014 Orchard Seed Crops

Cone and seed crops were again low for most species in 2014, with the exceptions of redcedar and western larch (Table 3; Figure 5). This was the fourth consecutive year with poor interior spruce crops. Lodgepole pine seed production was down, at least partly due to high levels of western conifer seed bug. A trial testing the pesticide Matador substantially increased the number of viable seeds per cone, offering hope for a management tool that can increase lodgepole pine seed production.

The total 2014 harvest of 872 kilograms of seed is sufficient to grow approximately 75 million seedlings.

**Table 3**
Summary of 2014 seed crops from provincial orchards.

| Species | Seed produced (kg) | Seedling equivalents (million) |
|---|---|---|
| Interior spruce | 142 | 16.7 |
| Lodgepole pine | 109 | 12.3 |
| Western larch | 276 | 20.8 |
| Interior Douglas-fir | 65 | 2.1 |
| White pine | 15 | 0.3 |
| Western redcedar | 45 | 12.5 |
| Sitka spruce | 2.4 | 0.4 |
| Coastal Douglas-fir | 207 | 8.0 |
| Western hemlock | 10 | 1.4 |
| Ponderosa pine | 0.4 | 0.02 |
| **Total** | 872 | 74.5 |

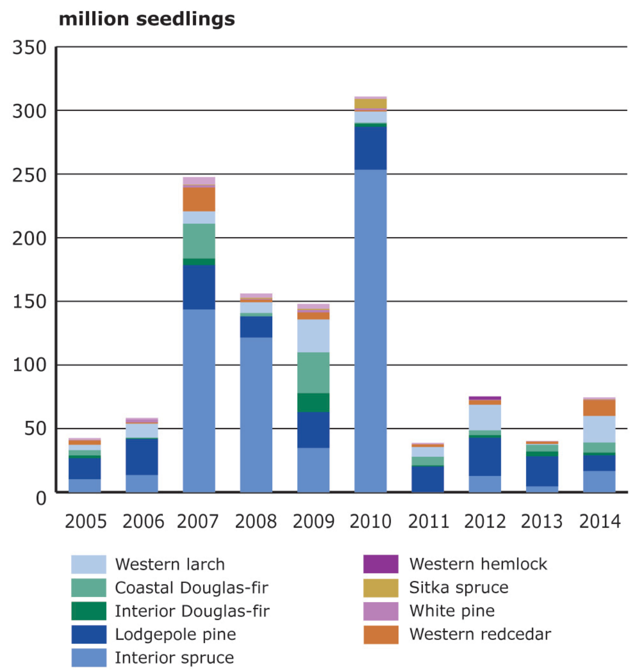



**Figure 5**
Orchard seed production by species and year.