TIC*talk*

TIC Tree Improvement Councils of British Columbia

A Timely Publication

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Inside this issue...

Our First Edition

This is the first publication of the Tree Improvement Councils Newsletter, TIC*talk*. The purpose of the paper is to provide a vehicle for information to the forest industry and the public on tree improvement in B.C. TIC*talk* will be published twice a year and distributed to TIC members, Regional and District offices, forest licensees, and interested individuals.

The contents will include information about the business of the Councils; issues faced by the industry; the latest in technical innovations, equipment, and management techniques; as well as general information on tree improvement. Future issues will include regular feature articles on Tree Improvement Councils member companies/ agencies and their areas of operation; and the showcasing of specific Forest Districts, their forests, problems, and how tree improvement is involved in the district. Another regular article will highlight the commercial species in B.C.—their characteristics, land base, and state of tree improvement. These articles are intended to educate and inform the reader about the nature of our industry.

We are fortunate in B.C. to have an active forest research community with some of the best names in the industry in morphology, physiology, pest management, and genetics. We will be asking them to contribute articles about their work.

TIC*talk* will also include information on meetings of related groups and organizations as well as advertising for upcoming courses, seminars, and conferences. All contributions are welcome.

The Tree Improvement Councils of B.C.

The Tree Improvement Councils (TIC), initiated in 1979 on the Coast and in 1981 in the Interior, were formed to make recommendations to the Chief Forester in an advisory capacity about tree improvement program objectives, strategies, and priorities for seed orchards and tree breeding operations. Representatives include senior staff members of participating private industry, provincial and federal governments, universities, and private research organizations. The Councils meet jointly, twice a year, to coordinate activities for gene-resource management of forest trees, including gene conservation of all species, and for improving genetic diversity and adaptation for commercial species.

Coastal and Interior Technical Advisory Committees (TACs) have also been formed to advise the Councils on technical matters and provide advice to seed orchards. They provide a means of communication between orchards and research organizations to ensure that research needs are known and results are applied. TACs include technically qualified representatives of the above-mentioned organizations.

Under the umbrella of the TIC, nine major commercial species are involved in breeding programs, with 56 existing seed orchards producing a projected 100 million genetically improved seedlings by the year 2000.

TICBits: What's Happening in 1996

- MacMillan Bloedel Ltd. will soon be abandoning the **amabilis fir** orchard (#135) due to the lack of a supporting breeding program. Over the years certain clones have shown greater resistance to **balsam woolly aphid** than others. MB offered these trees (approx. 150) to the Ministry and they have since been transplanted in the MoF Cobble Hill Seed Orchard. These clones may offer an excellent opportunity for future research into possible resistance mechanisms. Contact David Reid @ (604) 652-5600.
- David Reid, Coastal Seed Production Officer, informs us that he still has copies of the 5th **Coastal Tree Improvement Council** (1993-4) **Progress Report** that was released last August. Get them while they last. Call David @ (604) 652-5600.
- The newest release of the **Orchard Information System** (OIS - Version 2) is now available. This update is the result of work by Gord Morrow (Bowser S.O.), Chris Walsh (Kalamalka S.O.), and Brian Barber, Seed Policy Officer (Silv. Prac. Branch). Contact Brian @ (604) 356-6207.

The newest release of the Orchard Information System is now available.

- Interior spruce and lodgepole pine orchards for the **Finlay seed planning zones** are being established at the Mt. Newton Orchard site near Victoria. Clones in these orchards represent parent trees in the top 30% of the family rankings based on information from six-year-old progeny tests. The lodgepole pine initially responded poorly to field grafting so potted grafts were then used. Orchard Manager, Tim Crowder, says that these grafts have been responding well. Contact Tim @ (604) 652-4211.
- Gene pool preservation for lowland interior spruce in the **Fort Nelson seed planning zone** has now been undertaken. To date, 153 selections have been made and established in the spruce clone banks at Prince George. Contact Maarten Albricht @ (604) 549-5670.

The first interior western white pine orchard in British Columbia has now been established at the MoF Bailey Road Orchard site near Vernon, B.C.

- The first interior **western white pine orchard** in British Columbia has now been established at the MoF Bailey Road Orchard site near Vernon, B.C. This 1.5 generation orchard was established from scion material from the best white pine blister rust clones available from Idaho. This orchard is intended to supply a secure source of resistant seed for the Interior. Contact Chris Walsh @ (604) 549-5669.
- The **Seed Planning and Registry System** (SPAR, Release 3.0) was completed and migrated to production on March 11,1996. Improvements include easy-to-follow menus, direct access to Lot Allocation screens, update capability on the Latest Sow Date screen, improved Seed Lot Query and Orchard Search features, and modified Seed Reports to meet seed planning needs. Future enhancements will include updates to transfer guidelines to meet Forest Practices Code requirements, implementation of cutting lots, and new seedling request and seed-use summary reports. Contact Lesley McAuley @ (604) 356-6208.

Internet

- For those interested in forestry on the Internet, a mailing list called **"FOREST"** is available by subscription through the Centre for Scientific Computing in Espoo, Finland. You can subscribe by sending the following message (without the quotes) "SUBSCRIBE FOREST YOUR NAME" to **listserv@listserv.funet.fi**. This list is an excellent place to view forest issues from a global perspective.
- For those looking for a reference guide, **"The World Directory of Forest Geneticists and Tree Breeders"** is sponsored by the **"Dendrome Project."** This directory provides names, addresses of researchers and related specialists according to key words, and areas of interest. This guide, handy for anyone looking for information on specific topics, may be reached at **http://s27w007.pswfs.gov/**.

Forest Practices Code and Tree Seed:

Working Towards the Highest Genetic Gain

submitted by Brian Barber, Seed Policy Officer/MoF, Silviculture Practices Branch

The first in a series of reports on policy issues related to tree seed and tree improvement.

This article is the first in a series of reports I will deliver on policy issues related to tree seed and tree improvement. The growing number of issues related to seed production and clonal propagation and deployment cannot be tackled all at once nor within the confines of one article. For this issue I will focus on the use of seed orchard seed as it represents the "raison d'être" for those involved in the tree improvement field.

Two regulations attached to the *Forest Practices Code of B.C. Act*: The Tree Cone, Seed and Vegetative Material Regulation and the Silviculture Practices Regulation cover the collection, registration, and use of seed for reforestation. Certain requirements that existed prior to the Code, such as the use of seed orchard seed and seed transfer guidelines, are receiving greater attention owing to new provisions for the Ministry of Forests to issue penalties for non-compliance. These regulations are largely based on the results of tree breeding and provenance programs and have been developed to maximize the productivity of our provincial timber resources.

Section 2(1)(b) of the Silviculture Practices Regulation requires persons who establish a free growing stand, where planting is prescribed, to use the best genetic quality (seed) source available. This has been modified from the previous requirement to "use seed orchard seed" to account for vegetatively propagated materials, and recognize the differences between seed orchards and the seedlots produced from them. As testing and breeding programs advance, "inferior" clones are removed from the orchards and parents with higher genetic worth are incorporated or used to establish new advanced "second generation" orchards. Through this process, seedlots with higher genetic worth in volume, wood density, and/or pest resistance can be produced. The *Seed and Vegetative Material Guidebook* (p. 17) offers a guide on how to select seedlots with the highest genetic worth. These guidelines will be refined over time as protocols, used to determine the genetic worth of seedlots, are further developed and applied to all provincial orchards. The district manager is responsible for assessing compliance with this regulation. The Ministry, however, recognizes there are many circumstances which have resulted in Licensees procuring large quantities of 'woods run' seed. In an effort to resolve this issue, a ministry-industry working group will be providing recommendations prior to August 1, 1996

Silviculture Practices Branch will be working to resolve this and other outstanding issues in the coming fiscal year. We are striving to improve the knowledge among the forest community of the underlying principles of tree improvement and appropriate seed use by developing and delivering workshops and a video (depending on FRBC funding). In the near future, I envision that silviculturists will recognize the inherent genetic worth of improved seedlots and make a conscientious effort to use them over "woods run" seed lots. To this end, I ask that all members of the TIC work cooperatively in promoting our product: seed orchard seed.

British Columbia's Forest Districts

Invermere Forest District

submitted by Richard Dominy, Silviculture Planner/MoF, Invermere District

The Invermere Forest District is well known for its wildlife diversity and highly productive wildlife habitat.

Of the productive forest land, more than half is currently not economical or feasible to harvest.

Covering an area of just over 1 million hectares in southeastern B.C., the Invermere Forest District is one of seven districts in the Nelson Forest Region. Located next to the Alberta-B.C. border between the Cranbrook and Golden Forest Districts, Invermere Forest District is in a mountainous region. Its main physical features are the southern portion of the Rocky Mountain Trench, which bisects the District north to south; the Continental Ranges of the Rocky Mountains to the east; and the eastern Purcell Mountains to the west. The trench is divided by the meandering Columbia River which flows north from Columbia Lake (source of the Columbia River) through Lake Windermere, creating wetlands of international significance. Entering the trench just south of Columbia Lake, the Kootenay River flows south through the district. The mountain landscape consists of peaks and ridges, rugged narrow valleys, snowfields, and lakes.

Mountains influence the climate of the region. Air flows from the west and descends the eastern side of the Columbia Mountains and into the Rocky Mountain Trench. The air then rises again over the Rockies. Since the Columbia Mountains act as a barrier to air from the west, a strong rainshadow effect exists leeward of these mountains. Occasionally during the winter, the Rocky Mountain Trench acts as an access route for cold Arctic air that leads to colder temperatures in the trench than in surrounding mountains. In general, the climate is hot and dry in summer and cold in winter.

The Invermere Forest District is well known for its wildlife diversity and highly productive wildlife habitat. Some of the highest value wildlife winter ranges in all of North America are within this timber supply area. Elk, moose, mule and whitetail deer, bighorn sheep, mountain goat, mountain caribou, grizzly bear, black bear, wolverine, cougar, bobcat, lynx, small mammals and rodents, amphibians, reptiles, insects and many resident and migratory bird species all depend on the habitats within the district. This wildlife contributes to the significant biodiversity of the area.

Today, forestry and tourism continue to contribute significantly to the local economy along with the mining and agriculture industries.

Timber Harvesting

About 51% of the provincial land in the Invermere Forest District is either not managed by the Ministry of Forests or is not forested. Of the productive forest land, more than half is currently not economical or feasible to harvest due to environmental sensitivity, low timber productivity, rough terrain, wildlife habitat requirements or non-merchantable timber. Therefore, only 23% of the timber supply is within the timber harvesting land base. The district covers a total area of 1 018 351 hectares with 233 759 hectares comprising the harvesting land base. The range of commercial species is as follows: spruce/subalpine fir (16%), deciduous/cedar/hemlock (1%), lodgepole pine (44%), and Douglas-fir/western larch and ponderosa pine (39%). There is an irregular distribution of forest ages within the harvesting land base with lodgepole pine forests over 80 years old covering more than 20% of the timber harvesting land base. The age-class distribution is as follows: 1-20 years old (15%), 21-60 years (13%), 61-80 years (15%), 81-140 years (34%), and over 141 years (23%).

Effective March 1, 1996, the new AAC for the Invermere Timber Supply Area is 591 000 cubic metres. The previous apportionment is shown in the table on page 5.

Reforestation

The current rate of reforestation within the Invermere District is ± 3.5 million trees per year, covering ± 2 500 ha. The trend is away from "backlog" reforestation, with 80% of the planting being classed as current. This trend should remain constant for the future, with the planting rate remaining at approximately 3.5 million seedlings. Planting is conducted through contracts by the Ministry of Forests' Small Business Forest Enterprise Program and the two major licensees: Crestbrook Forest Industries Ltd. (Canal Flats and Parson Division), and Slocan Forest Products Ltd. (Radium Division).

Reforestation is also moving toward maintaining biodiversity within the forest structure by conducting multiple species plantations, including the introduction of hardwood species (aspen and birch). Currently there is work being carried out for the improvement of seed production from western larch, and there is renewed interest in ponderosa pine.

The well-known Fires of 1985, including Ram (16 676 ha), Spen (11 194 ha), Black (2845 ha), Giby (3154 ha), Brew (1251 ha), and various smaller fires totalling ± 37 500 ha, created special reforestation needs and requirements. This included access, removal of snags, and design of multi-year planting contracts to reduce overhead for planting the ± 10.3 million trees within the accessible fire areas. Within the next few years most of the plantable areas will be reforested.

At present, the only seed orchards producing seed for the East Kootenay seed planning zone are improved spruce (interior hybrid) located at the Kalamalka Research Centre. However, several seed orchards are being developed for our use. They include western larch (target production date 2001), and the start of lodgepole pine and interior Douglas-fir orchards.

Within the next few years most of the plantable areas, created by the Fires of 1985, will be reforested.

AAC for Invermere Timber Supply Area
prior to March 1, 1996

	Cubic metres	% of AAC
Forest licences (Crestbrook Forest Industries and Slocan Forest Products Limited)	545 169	82.9
Timber sale licences < 10 000 m^3	12 142	1.9
Small Business Forest Enterprise Program	81 579	12.4
Woodlot licences	6 700	1.0
Subtotal (allocated)	**645 590**	**98.2**
Unallocated (Forest Service Reserve)	11 674	1.8
Total = current AAC	**657 264**	**100.0**

Training Courses in 1996

Seed Planning and Cone Collection Workshops

submitted by Ron Planden, Seed Planning Officer/MoF, Silviculture Practices Branch

This summer, the Seed Production, Planning and Policy Section of the Silviculture Practices Branch will offer two workshops geared for seed planning and cone collection.

A one-day pilot workshop in **seed planning** will be offered to provide clients with training on policy; seed, cone, and vegetative planning; seed transfer guidelines; and registration procedures based on the *Forest Practices Code Seed and Vegetative Material Guidebook*. Further workshops will be offered later in the year upon assessment of the pilot course.

The presentation of the **cone collection workshops** will be determined by the need to collect cones based on the crop year.

These workshops will describe how to identify collectable stands, organize and conduct collections, and carry out related administrative procedures. Topics to be covered include cone and seed crop development, collection planning, cone collection and handling, and specific seed production and collection characteristics of B.C. conifers.

These workshops will describe how to identify collectable stands and organize and conduct collections.

Workshops will be offered in **July and August** in the following locations depending on the current year's cone crop: **Nanaimo, Kamloops, Nelson, and Smithers**. For more details please refer to the B.C. Forestry Continuing Studies Network Catalogue.

For more information contact
Ron Planden @ (604) 387-8467

Species of British Columbia

Western Larch *(Larix occidentalis)*

submitted by Barry Jacquish, Research Scientist/MoF, Kalamalka Forestry Centre

Western larch trees are generally long lived and grow to be the largest of the world's larches.

Larix species form a major component of the expansive boreal and subalpine forests in the northern hemisphere. They are able to survive, grow, and reproduce in often cold and wet environments because of their unique morphological and physiological adaptations. These adaptations include a deciduous leaf habit, unique leaf characteristics, a conical crown architecture, high rates of net photosynthesis and nitrogen retranslocation, and low water use efficiency. Three of the world's 10 species of *Larix* are native to North America: western larch (*Larix occidentalis*), subalpine larch (*L. lyallii*), and tamarack (*L. laricina*).

The beauty of western larch forests is outstanding in the spring when their lush green foliage appears.

Like all species of the *Larix*, western larch is a very shade-intolerant pioneer species that thrives in open-grown, full sunlight conditions with little vegetative competition. Western larch trees are generally long lived and grow to be the largest of the world's larches. Western larch is also one of the most productive timber species in the upper Columbia River Basin of western North America. It usually regenerates easily after disturbances such as fire and demonstrates very rapid early growth. It often outgrows its associates for about 90 years, after which it is overtopped by more shade-tolerant species. On many sites, growth rates of 1 metre per year are not uncommon and on productive sites, maximum tree height can easily reach over 55 metres. Western larch has exceptionally good form, readily self-prunes, and produces a clear, straight bole. It is relatively free of serious insect pests and disease, and is only moderately susceptible to root diseases such as *Armillaria*. Consequently, silviculturists are increasingly interested in planting larch on sites infected with root rot. Western larch performs well in plantations and readily responds to stand tending treatments such as pre-commercial thinning and fertilization.

Throughout southeastern British Columbia, western larch forests provide excellent habitat for wildlife, and are valued for their watershed protection, recreational value, and aesthetics. The beauty of western larch forests is outstanding in the spring when their lush green foliage appears. However, western larch forests reach their full splendour in early October when their leaves turn a brilliant gold. At this time of year the beauty of these forests is unsurpassed. Commercially, western larch is a minor player in the provincial commercial harvest, although in the Nelson and Kamloops Forest Regions it is an important timber species with a commercial harvest of about 500 000 cubic metres annually.

The wood of western larch has a high relative density and modulus of elasticity; is straight-grained, hard, and durable; and is moderately resistant to decay. These characteristics make western larch a preferred structural product and especially prized for value-added products such as glue-laminated beams. Compared to other western conifers, western larch will produce relatively higher proportions of mature wood with relative density levels similar to old-growth, from managed second-growth stands or plantations. It should be noted, however, that western larch wood can be difficult to dry and is susceptible to greater shrinkage than other native conifers.

Throughout most of western larch's natural range, seed production is a serious problem. Flower crops are typically sporadic and infrequent. Also, male and female flowers burst bud very early in the spring, and are vulnerable to the late spring frosts that commonly occur in the southern Interior. To further complicate western larch's reproductive effort, its developing seeds are prone to insect predation, and mature seeds, once shed, are a preferred food for small mammals. In total, these factors often result in low seed yields and, in many areas, inadequate natural regeneration in seed tree cutblocks.

The Ministry of Forests western tree improvement program was established in 1987 to provide a reliable supply of high-quality seed for planting. Initially, two breeding zones (East Kootenay and West Kootenay/Shuswap-Adams) were delineated based on biogeoclimatic information and administrative boundaries. In total, 250 and 359 parent trees were selected in the East Kootenay (EK) and West Kootenay/Shuswap (WK) zones, respectively. The selection

strategy was based on five phenotypically superior trees per stand, the collection of open-pollinated seed for progeny testing, and the collection of scion material for establishing grafted seed orchards and clone banks. Two wood cores were also collected from most trees for wood relative density determination.

To evaluate each parent tree's genetic worth, or breeding value, seedling families were established to evaluate long-term field performance. Two series of progeny tests were established on eight sites in the East Kootenay breeding zone and included 250 EK families, 31 WK families, and 51 U.S. Inland Northwest families. Tests in the West Kootenay/Shuswap-Adams zone were planted on five sites and included 217 families. Further sites are planned for a second series of tests for this zone and will be fully established by 1996.

In 1989, two soil-based clonal seed orchards were established at Vernon to provide seeds for planting on low- to mid-elevation sites in the two breeding programs. The East Kootenay and West Kootenay/Shuswap-Adams seed orchards contain 176 and 147 clones, respectively. As reliable test information becomes available from the progeny tests, genetically inferior trees will be removed from the orchards. Seed production from these orchards is expected to begin in 1998 and, by the year 2000, should result in sufficient seed to produce 1.7 million seedlings per year.

As reliable test information becomes available from the progeny tests, genetically inferior trees will be removed from the orchards.

For more information contact
Barry Jacquish @ (604) 549-5577 or
Chris Walsh @ (604) 549-5669

Cone and Seed Pest Management in B.C.

submitted by Robb Bennett, Provincial Seed Pest Officer/MoF, Silviculture Practices Branch

The Seed Pest Management Group of the B.C. Ministry of Forests (Silviculture Practices Branch) coordinates cone and seed insect and disease research in the province and provides extension services to the provincial seed production community. Current research is targeting aspects of the biology of organisms that have a major impact on B.C. seed production (e.g., spruce cone rust, spruce cone borer, *Leptoglossus* seed bug, Douglas-fir cone gall midge, spruce cone moth, fir coneworm, pitch moth, root collar weevil, and gall aphid) with the aim of developing or improving integrated management systems for these organisms.

Extension services include diagnosis and assessment of insects and diseases affecting cone and seed production in seed orchards and natural stands (including crop assessment), advice on pest management, operational trials of new pest management products, regular on-site monitoring of seed orchard pests and beneficial organisms, and delivery of cone and seed pest management workshops. All persons involved in seed production activities (including natural stand collections) in B.C. can take advantage of these services.

The Seed Pest Management Group recently welcomed entomologist Ward Strong into the fold. Ward started handling interior pest management activities from Kalamalka Forestry Centre (Vernon) in January 1996. His experience includes owning or managing several pest management companies including MonAgro Consulting (Langley) and the Pro-tect Department of the East Chilliwack Agricultural Co-op (Abbotsford). He has also researched pest management at Simon Fraser and Oregon State Universities. Ward will considerably increase our ability to provide the Interior with better service.

Current research is targeting aspects of the biology of organisms that have a major impact on B.C. seed production.

For more information contact:
Coast: Robb Bennett @ (604) 652-6593
Interior: Ward Strong @ (604) 549-5576

Who is on the Tree Improvement Councils?

Vernon Seed Orchard Company

submitted by Ron Pearson, Orchard Manager

The orchard is located on 78 hectares of rich agricultural soil overlooking Okanagan Lake.

The Vernon Seed Orchard company (VSOC) began operations in 1989 in Vernon, B.C. and its orchards are located on 78 hectares of rich agricultural soil overlooking Okanagan Lake. This land is held on a 35-year lease from the City of Vernon. VSOC is a joint venture involving forest companies operating throughout the central and northern parts of British Columbia. The companies in the cooperative include Northwood Pulp and Timber Ltd., The Pas Lumber Company Ltd., Weldwood of Canada Ltd., and West Fraser Mills Ltd. Collectively, they employ over 10 000 people in B.C. and have total net sales of $2.5 billion annually. The companies manufacture numerous products including lumber, softwood and hardwood plywood, veneer, pulp, paper, and linerboard. A number of building supply centres are also operated in B.C. by one of the companies under the "Revy Home and Garden" and "Revelstoke Home Centres" names.

The total combined annual allowable cut of all joint venture operations is approximately 10 million cubic metres per year.

Forestry operations for the four companies extend from 100 Mile House in the south, north to Prince George and Chetwynd, and west to Terrace. The total combined annual allowable cut of all joint venture operations is approximately 10 million cubic metres per year with field operations taking place throughout 12 seed planning zones. Total reforestation needs are approximately 47.5 million seedlings per year: 22 million spruce, 24 million lodgepole pine, and 1.5 million Douglas-fir.

Eight 1.5 generation seed orchards are being established at the Vernon site. They consist of three lodgepole pine, three Douglas-fir, and two Interior spruce orchards. At full production, these orchards are designed to produce an estimated 75–80 million seeds annually. This is expected to satisfy approximately 80% of the VSOC members' seedling needs in addition to meeting the seed commitment to the Ministry of Forests of up to 25% of the production from each orchard. After completion of the 1996 planting program, approximately 19 000 ramets will have been established in the orchards. Initial establishment will be completed by 1998.

Seed production to date has been small, totalling 65.7 kg of seed. This has come from two crops (1994 and 1995) in the Bowron Lake Spruce Orchard #214, which was established in 1990. These two crops were produced with the help of cone induction methods involving the use of hormonal injections (gibberellic acid) and through drought-stress treatments. Most of the other orchards will need a few years until they reach sexual maturity. The orchard site is located far from any contaminating sources of local pollen. The VSOC will rely on pollen management techniques, such as pollen collection and reapplication, to enhance seed production.

For more information contact
Ron Pearson @ (604) 542-0833

1995 Seed Orchard Crop Information

The tables on pages 9 and 10 summarize the 1995 cone crop for coastal and interior seed orchards, respectively.

The yield summaries for the interior seed orchards were extracted from the Seed Planning and Registry System (SPAR).

The information for the coastal seed orchards are first draft summaries compiled by David Reid, MoF Coastal Seed Orchard Production Officer, based on the following estimated average yields.

Species	kg/hl	seedlings/kg
Fdc	0.388	47 000
Hw	1.010	238 000
Cw	0.955	294 000
Se	0.523	204 000
Ss	0.694	213 000
Cy	1.446	29 161

1995 Seed Crop Information (cont'd.)

Full seed crop information is not available in this layout

1995 Seed Crop Information (cont'd.)

What's Happening in Research?

Genetic Diversity is Not Reduced by Tree Improvement in Interior Spruce

submitted by M.U. Stoehr, Research Scientist/MoF Glyn Road Research Station

Genetic improvement in many agricultural crops has resulted in spectacular levels of increased yields. However, this increase in yields has come with a trade-off. The genetic base of many high-yielding varieties and hybrid lines has been severely reduced. There are concerns that tree breeding will lead to similar reductions in our forests, where a narrowing of the genetic base would be more severe than in agricultural crops as one generation of forest trees is exposed to biotic and abiotic stresses for much longer periods of time. Conifers are much more genetically variable than most other organisms. But due to the nature of artificial selection, where relatively few parents are selected from a very large base population, a reduction in genetic diversity is still possible. This possibility is increased when these "few" parents (usually more than 150 parents per breeding zone) are placed in a seed orchard and are expected to mate with every other tree in the orchard. This assumption of a perfect orchard in terms of inter-mating is almost always violated due to year-to-year variation in pollen and cone production and temporal differences in flowering phenology.

To evaluate the genetic diversity in seed orchard seed, we undertook a cooperative study with Pacific Forest Products, comparing genetic diversity levels in three watersheds of the Shuswap-Adams (SA) low elevation breeding zone of interior spruce: the parent trees of the SA low seed orchard, a seedlot harvested from this orchard, and an operational plantation established from that seedlot. Genetic diversity was evaluated using isozymes, which are proteins that vary among trees, reflect genetic differences, and are not influenced by the environment in which a tree is growing.

The results of the study showed that the orchard parents were very similar to the comparison trees from the natural populations and were just as genetically diverse. The orchard seedlot also had high levels of genetic diversity, but some pollen contamination from surrounding orchards at Kalamalka must have occurred, as we observed markers in the orchard seedlot that could not have originated from within the SA low orchard. Genetic diversity levels in the plantation were still high (as high as one would expect in natural populations of the SA low breeding zone) but a bit lower than in the seedlot used to raise the seedlings. The reduction in genetic diversity between nursery and plantation was probably due to culling in the nursery (and not mortality in the field) as survival in the plantation was high.

These results demonstrate that tree improvement of interior spruce does not reduce genetic diversity. Seed orchards are designed to capture almost all of the genetic diversity that is present in a particular breeding zone and can deliver this diversity and the expected genetic gain.

The next phase of our research is to evaluate genetic diversity in quantitative traits such as height growth and root collar diameter in seedlings raised from orchard seedlots from the SA low orchard collected in different years. This information will give us some indication of the temporal variation in our orchards.

For more information contact
M.U. Stoehr @ (604) 952-4120

Conifers are much more genetically variable than most other organisms.

Seed orchards are designed to capture almost all of the genetic diversity that is present in a particular breeding zone.

Meetings

- The **Tree Improvement Councils** met at the Richmond Inn on **March 26, 1996**. Topics on the agenda included FRBC proposals, initiation of a global strategic plan for tree improvement in B.C., reports from Coast and Interior members, review of 1995/96 long-term planning strategy for the TIC, and reports on the Tree Seed Needs Surveys done in 1995 for both the Coast and Interior.
- The **B.C. Seed Orchard Staff Group** will meet at Mesachie Lake, B.C., from **June 18-20**. The meeting will cover many topics on the general theme of genetics, and will include such topics as "The shape of hardwood orchards" and "Genetic diversity and deployment." For more information contact **Don Carson @ (604) 749-6811.**
- The **Northwest Seed Orchard Managers Association** will be holding its summer meeting at Cottage Grove, Oregon (20 miles south of Eugene) on **May 7, 8, 9.** Topic for this year is "Current and future seed needs and seed transfer." For more information contact **Judith Danielson @ (503) 942-5526** .
- The **Western Forest Geneticists Association** will be holding its annual meeting in Newport, Oregon from **July 29 to August 1, 1996**. The theme for this year's meeting will be "Natural patterns of adaptation" and "Maintaining adaptability under domestication." For more information contact **Sally Aitken @ (503) 737-6579**. Concurrent with this meeting, the Quantitative Forest Geneticists Group will meet at the Hotel Newport on the afternoon of July 29.

Reminder!!

National Forest Week is May 5 through 11!

This year's theme is "Sustainable Forests: Rooted in Science!"

Support your local activities

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