July 2001

North West Tree Improvement Cooperative

Annual Report 2000

OREGON STATE UNIVERSITY
COLLEGE OF FORESTRY

Members of the Northwest Tree Improvement Cooperative for the year 2000

Avery Interests
Boise Cascade Corp.
British Columbia Ministry of Forests
USDI Bureau of Land Management
Canadian Forest Products, Ltd.
Cascade Timber Consulting, Inc.
Crown Pacific, Ltd.
Hampton Tree Farms, Inc.
John Hancock Life Insurance Co.
International Paper Pacific Timberlands, Inc.
Longview Fibre Co.
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Oregon Department of Forestry
Plum Creek Timberlands L.P.
Pope Resources
Port Blakely Tree Farms L.P.
Quinault Indian Nation
Rayonier Timberlands Operating Co.
Roseburg Resources Co.
Simpson Timber Co.
South Coast Lumber Co.
Starker Forests, Inc.
Stimson Lumber Co.
The Campbell Group
The Timber Company
Timber West Forest, Ltd.
USDA Forest Service, Region 6
University of Washington, Pack Forest
Washington State Department of Natural Resources
Western Forest Products Ltd.
Willamette Industries, Inc.

NORTHWEST TREE IMPROVEMENT COOPERATIVE

Annual Report

2000

Mission of the Northwest Tree Improvement Cooperaive

- Oversee cooperative breeding of Douglas-fir, western hemlock, and other species of the coastal forests of the Pacific Northwest
- Guide technical aspects of implementing these tree improvement programs
- Analyze and interpret genetic test data
- Store test data and breeding records
- Provide expertise and training in tree breeding

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Introduction

The year 2000 marked several major events for cooperative tree breeding in the Pacific Northwest. Thirty-four years after cooperative tree breeding got under way in the region and 15 years after its formation, the Northwest Tree Improvement Cooperative moved to the Department of Forest Science at Oregon State University in April 2000.

It is appropriate at this time to recognize key people such as Roy Silen, Joe Wheat, Jess Daniels, Mike Bordelon, Greg Johnson, Randy Johnson, and Dan Cress, who helped cooperative tree breeding last this long and make such an impact in the region. Hopefully, moving to OSU will see NWTIC reach new heights and continue serving growers of genetically improved forest trees.

This annual report documents the work done by this organization and its dedicated group of tree improvers. The NWTIC staff hopes to provide cooperators with a similar report each year.

Table 1. Status of current or planned cooperative second-generation Douglas-fir breeding populations – October 2000.

	Status	Crosses		Test Sites	
		Target no.	No. completed	Target no.	Target date to complete planting
WA—North Cascades	Crossing	100+	9	6	2002
WA—Puget Sound	Crossing	60-70	42	6	2005
WA—South Cascades	Crossing	172	68	6	2005
WA—Coast (Swiss Needle Cast elite)	Planning	50 -100	-	4-6	
Vernonia/Ryderwood	Planting 5 sites in 2001	404	392	10	2003
North Oregon Cascades	Planting 6 sites in 2001	383	306	12	2003
Trask (Oregon Coast + Coast Range; includes Swiss Needle Cast elite)	Crossing	764	212	24	2005
South Central Coast	Crossing	310	219	8	2003
Gold Beach	Planning	165	-	6	2007
TOTAL		2408+	1248	82+	

Activities of NWTIC this Year

Cooperative Second-Generation Douglas-fir Breeding and Testing

Douglas-fir has long been "king" in the plantation forests of the coastal Pacific Northwest and the mainstay of breeding programs in the region. Over a 30-year period, companies and agencies effected a truly massive effort, testing more parent trees and planting more progeny trees than for any comparable species or region in the world.

The transition to second-generation breeding started around 1984 and is described further in the Background section. The year 2000 was significant because the first two cooperative trials of the second-generation breeding population of Douglas-fir in the region were sown. These were both Oregon-based programs, and seeds were sown at the Sylvan Vale nursery near Campbell River, British Columbia, on behalf of the Vernonia/Ryderwood and the North Oregon Cascades (NOCTIC) metacooperatives. Over 39,000 seedlings (from 392 crosses) and 35,000 seedlings (from 306 crosses) were raised, respectively, for the two trials. Five sites have been selected for the Vernonia/Ryderwood trials and six for the NOCTIC trials. A third metacooperative, the South Central Coast program, prepared to sow its breeding population at the end of 2000. In four other second-generation programs, crossing is in progress (Table 1).

Recognition is due to Greg Johnson (Willamette Industries) for his dynamic and effective leadership of the Vernonia/Ryderwood and NOCTIC metacooperatives. Bill Randall (Daniels and Associates) played a key role in coordinating crossing, site selection, and site establishment. We look forward to reporting the successful planting of these trials, as well as further progress on other second-generation programs, in next year's report.

HEMTIC—Cooperative Hemlock Improvement

This was one of the busiest years for the Hemlock Tree Improvement Cooperative (HEMTIC). After many years of crossing, a complete second-generation breeding population was sown at the IFA nursery at Nisqually. The sowing consisted of 342 full-sib families belonging to the Mainline Local Diallels (in which parents from first-generation local breeding zones were crossed) and 166 full-sib families belonging to the Elite Partial Diallels (in which top parents were crossed across first-generation zones).

Because of good seed quality, generous redundancy in sowing, and excellent tending by IFA nursery staff, this has been an extremely successful crop. While about 58,000 trees were needed for the family-ranking tests, over 104,000 reached pack-out size. This allowed HEMTIC members to also plant pure-family blocks and to plant satellite trials inland of the main HEMTIC zone.

After recognizing the workload involved in planting of sites in both Oregon and Washington, compared

HEMTIC crop in nursery, June 2000.

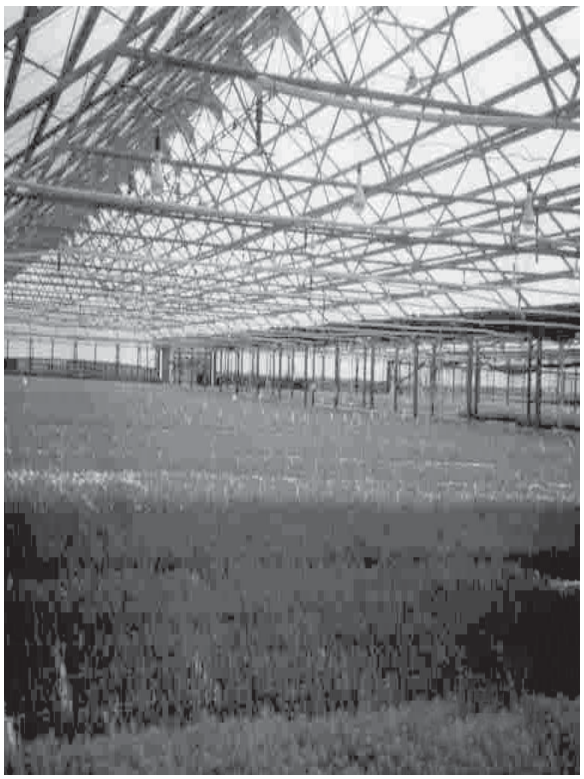
to the time available by members, HEMTIC awarded Tom Williams (Williams Forestry) a contract to oversee site selection, sowing, pack-out, and test establishment. Tom and others visited 30 candidate sites placed at their disposal by HEMTIC members in Washington and Oregon. Compliments to all involved for a productive and successful year of hemlock improvement!

Genetic Gain Verification Trial

In 1992, NWTIC approved a study to quantify genetic gain obtained by cooperative breeding programs of coastal Douglas-fir. This resulted first in the Molalla Genetic Gain trials planted on six sites, each with three levels of genetic improvement (and two levels of spacing), planted in four to six large blocks in 1997. These six sites were all visited in fall 2000. While some concerns about competing vegetation and browse needed to be addressed, the sites are progressing well. It is likely these trials will be measured in 2001, at the end of their fifth growing season.

The second phase of the Genetic Gain trial centers around the Noti breeding zone, in the Oregon Coast Range. Crosses were made among 20 highly ranked parents and among 20 average parents, chosen from 331 first-generation parents. Seed from these crosses were sown along with unimproved seed at Weyerhaeuser's Rochester nursery. By fall a crop of over 36,000 seedlings had been raised. During the summer and fall of 2000, five test sites controlled by NWTIC members were selected.

Thanks are due to Brad St. Clair for overall leadership of the project, and to Rich Kelly, Dave Walters, and others for time spent on site selection. NWTIC also thanks the Bureau of Land Management, Longview Fibre, Port Blakely, Roseburg Resources, and Willamette Industries for providing sites for these two trial series.



Good growth at the Mill City site of the Molalla Genetic Gain trial, summer 2000. The trees were in their fourth growing season.

Data Management

An important benefit to NWTIC from affiliation with OSU is having its data managed by staff based at the university. Given that over 29,000 parent trees were selected and over 4 million progeny trees were planted and measured at a cost of several million dollars, we needed an efficient, safe, and reliable database. The College of Forestry manages data from numerous research projects and is well equipped for such a task.

NWTIC staff started by reviewing the past system of managing data as well as data management strategies used by other tree improvement cooperatives, such as those at North Carolina, Florida, and Texas. They then studied such aspects as user needs, volume of existing and anticipated data, hardware and software requirements, ways to exchange data with cooperators, and security arrangements. The proposal for the new NWTIC database was approved by the membership at the October 2000 annual meeting.

Work has progressed furthest on the parent-tree Geographic Information Database. We expect to get data from 29,671 parent trees. Of these, we had some data from 25,584 by the end of 2000 (86% of the total) and complete data from 17,119 (58% of the total). Parent-tree records are complete for 40 of 115

first-generation breeding zones. Cooperators are being asked to fill in gaps on parent-tree information. The process of transferring progeny data to the database is also underway.

Data Analyses

The move forward to second-generation breeding has made data analysis and interpretation even more important, especially for Douglas-fir. There is also a long-standing need to rogue seed orchards and establish new orchard blocks. During 2000, data from 31 first-generation breeding units (zones) were analyzed; these involved 7,549 parents, about 978,000 progeny, and 231 test sites. The units range from the Skagit program just south of the Canadian border to Prospect in southern Oregon. These results were mainly on age 10 and age 15 assessments. The analyses contributed to second-generation breeding plans and crossing guidelines for seven first-generation breeding zones.

It should be kept in mind when monitoring these numbers over time that data from a given measurement on a given test series may be analyzed more than once. On occasion NWTIC has released a preliminary ranking to let cooperators start crossing, and then has revised rankings as the datasets were completed—for example, in cases where individual cooperators assess their sites in different years.

Tour of Forest Tree Improvement in the Southeastern United States

From November 6 to 12, 2000, a group of 21 tree improvers from NWTIC and other organizations in British Columbia, Idaho, and North Carolina toured industrial forest-tree improvement sites in Georgia, including seed orchards, operational plantations, progeny tests, nurseries, and research trials. We also attended an annual contact meeting of the Cooperative Forest Genetic Research Program (based at the University of Florida), where six North American forest-tree improvement cooperatives were represented.

We came away with a wealth of information and some lasting impressions of the Southeast, as well as possible applications to the Pacific Northwest. For example, we noted:

The scale and impact of tree improvement and forestry are immense. The results of tree improvement are translated into over a billion genetically improved seedlings planted each year. Volume gains of up to 35% are expected by the use of control-pollinated seed from second-generation selections. The net present value of tree improvement has been estimated at between $150 and $600 per acre.

A combination of tree improvement and aggressive silviculture (site preparation, weed control, and thinning) can knock 10 years off an already short southern pine rotation.

One measure of the push for gain is the widespread deployment of single-family blocks derived from the very best parents. For example, probably more than 10 million seedlings derived from the champion loblolly pine parent (7-56) are planted every year. Seedlings from this one family are deployed in six or more southern states. Seed are often collected by parent clone, with seedlings raised and deployed in pure-family lots.

Local adaptation and seed zones are not a preoccupation of southern foresters. For example, there is

Participants of NWTIC tour, November 2000.

one breeding zone for slash pine, covering an area of 10 million acres. Decisions on seed transfer are helped by large provenance trials planted in the 1950s, tests of outstanding first-generation parents planted in the 1970s, and the Plantation Selection Seed Source study planted on a number of sites in 1995.

To document the lessons from this memorable tour, NWTIC has compiled an informative book of notes. The book is available to NWTIC members.

Sitka Spruce Proposal

There has been interest for several years in developing genetically improved Sitka spruce for planting in coastal Oregon and Washington. This interest has been encouraged by genetic resistance to the white pine weevil, as demonstrated by the breeding program in British Columbia. NWTIC staff, along with Randy Johnson (USFS PNW Research station) and Chal Landgren (OSU Forestry Extension) worked on a proposal for a Sitka spruce breeding program and began a discussion with breeders in British Columbia on gaining access to weevil-resistant spruce.

Membership Changes

It is a pleasure to report that the Research Branch of the BC Ministry of Forests rejoined NWTIC as an active member in 2000. However, the University of Washington, Pack Forests, announced its withdrawal at the end of 2000, and there had been no effective participation by Fred Van Eck after the death of the owner of the company.

Cooperators

Greg Johnson (Willamette Industries) completed a term as chair of NWTIC in October 2000. Randall Greggs (Simpson Timber Co.) is NWTIC Chair at the end of 2000.

The following members were elected to the NWTIC Steering Committee in September 2000:

- Howard Dew (Cascade Timber Consulting),
- Randall Greggs
- Greg Johnson
- Jessica Josephs (Rayonier)
- Jim Smith (The Timber Company)

Other NWTIC representatives for 2000 were:

- Pete Mastenbroek (Avery Interests)
- Don Wales (Boise Cascade)
- Charlie Cartwright (BC Ministry of Forests, Research Branch)
- Liang Hsin (Bureau of Land Management)
- Patti Brown (Canadian Forest Products)
- Jim Unsell (Crown Pacific—Hamilton Division)
- Steve Loy (Crown Pacific—Olympic Division)
- Beth Fitch (Hampton Tree Farms)
- Jeff Madsen (International Paper, Pacific Timberlands)
- John Davis (John Hancock Life Insurance)
- Erik Lease (Longview Fibre)
- Ron Durham (Menasha)
- Joe Steere (Miami)
- Rosemary Mannix (Oregon Department of Forestry)
- Loren Hiner (Plum Creek Timberlands)
- Bryan Schulz (Pope Resources)
- Brandon Austin (Port Blakely Tree Farms)
- Dave Walters (Roseburg Resources)
- Marc Halley (South Coast Lumber)
- Dick Powell (Starker Forests)
- Margaret Banks (Stimson Lumber)
- Jim Hargrove (Quinault Indian Nation)
- Dave Hamlin (The Campbell Group)
- Tim Crowder (Timber West Forest)
- Stan Humann (University of Washington, Pack Forest),
- Sheila Martinson (USDA Forest Service, Region 6)
- Jeff DeBell (Washington State DNR)
- Annette van Niejenhuis (Western Forest Products).

Staff

Keith Jayawickrama was hired as NWTIC Director at the end of June 2000, and Denise Steigerwald as NWTIC Data Manager in August 2000. Prior to arriving in Oregon, Keith was a scientist at ***Forest Research***, Rotorua, New Zealand, and Denise was a research assistant at the University of Colorado at Boulder. Dan Cress continued his relationship with NWTIC, through a personal services contract with OSU, as Geneticist/Technical Coordinator; OSU plans to formalize the Technical Coordinator role as a staff position around June of 2001. Tom Adams served as facilitator and advisor during this key transition period.

Background

The Northwest Tree Improvement Cooperative (NWTIC) is an umbrella organization serving the cooperative breeding of Douglas-fir and western hemlock done by 32 forestry companies and agencies in the coastal region of northern California, Oregon, Washington, and British Columbia.

Cooperative tree improvement started in the region in 1966 through a partnership between Roy Silen (USDA Forest Service Pacific Northwest Forest and Range Experiment Station) and Joe Wheat (Industrial Forestry Association).

The NWTIC was launched in 1985 to continue the services provided until then by the IFA/PNW Progressive Tree Improvement Co-op. From 1985 to April 2000 the NWTIC was directed and serviced by private forestry consultants (Daniels and Associates, Regenetics Forest Genetics Consulting).

Cooperative Tree Breeding

The current model of cooperative tree breeding dates back to 1951 in the southeastern United States. The model has been so successful that it has been adopted in many other countries.

Members of a cooperative pool their resources to identify genetically superior trees through parent tree selection and progeny testing. Cooperating lets them get high levels of genetic gain while keeping their costs down. They also benefit from the exchange of ideas, experience, and technology. These cooperatives are usually based at a university or research provider, and usually delegate technical functions (such as breeding strategy and data management) to cooperative staff.

Companies and agencies in Oregon, Washington, and California formed many first-generation local cooperatives, starting with the Vernonia cooperative in northwest Oregon in 1966. The participants in this first cooperative were Crown Zellerbach Corp., Longview Fibre Co., Oregon Department of Forestry, and International Paper Co.

By 1979, 33 companies or agencies were involved, with a combined ownership of 6.2 million acres; there were 74 breeding units in 19 local cooperatives. Most of these were for Douglas-fir, but there were a few western hemlock cooperatives as well.

Roy Silen with the Vernonia progeny test crop, 1969

Second-Generation Breeding

A task force was formed in 1984-85 to explore requirements for a second-generation program. Key participants were Bob Campbell and Roy Silen (USDA Forest Service PNW Station), Mike Bordelon (Oregon Department of Forestry), Rich Kelley and Liang Hsin (USDI Bureau of Land Management), and Tim White and Greg Johnson (International Paper).

The South Central Coast program was formed around 1986 to consolidate the Umpqua, Mapleton, Coquille, Noti, and Reedsport first-generation breeding programs. Around 1987-88, Vernonia developed a second-generation breeding plan combining the original Vernonia breeding unit, International Paper's Ryderwood program, and the Vernonia Southeast program. However, breeding for both South Central Coast and Vernonia was delayed for a number of reasons.

The Breeding Zone Restructuring and Restructuring Cooperatives (BZERC) strategy was developed in 1997. The Molalla and Snowpeak programs were combined into the North Oregon Cascades (NOCTIC) metacooperative in 1998 based on the BZERC strategy, becoming the first Douglas-fir metacooperative. Also in 1998, the Vernonia program was converted into a metacooperative, with slight changes to the breeding plan to align it with BZERC. The Trask metacooperative, combining the BLM, Burnt Woods, Dallas, Sunday Creek, Nehalem, Alsea, Hebo, and The Timber Company programs, was formed in 1999. In the process of combining first-generation programs, several previously independent programs (e.g., Washington State Department of Natural Resources, The Timber Company) joined NWTIC and contributed their independently improved selections.

A Regional Western Hemlock Tree Improvement Cooperative was formally inaugurated in 1992 to further second-generation breeding of this species. In addition to companies and agencies from Oregon and Washington, it included four organizations from British Columbia. In addition to NWTIC support, this program has benefited from a combination of British Columbia breeding expertise (notably that of John King and Charlie Cartwright), a large number of selections tested in Oregon and Washington, and the commitment of hemlock enthusiasts such as Jim Hargrove and Ron Haverlandt. The first second-generation hemlock test was planted in 1997.

Over 100 cooperative second-generation tests are planned for Douglas-fir and western hemlock. We hope to finish test establishment by 2007. These tests will contain the best parents and progeny from over 25,000 tested first-generation parents.

How The NWTIC Operates

All members are represented on a Policy Committee, which meets at least once a year to be updated on progress and to approve an operations plan and budget. The membership elects a smaller Steering Committee to advise on administrative and policy issues. A volunteer Technical Committee advises on technical issues.

NWTIC staff work closely with research groups such as the Pacific Northwest Tree Improvement Research Cooperative, the USDA Forest Service Pacific Northwest Research Station, and the Research Branch of the British Columbia Ministry of Forests to promote research needed by operational tree breeding in the region. NWTIC looks first to such groups to produce the necessary technical advances, but has commissioned research projects on occasion.

Publications of Interest

Here are some reports and publications of interest to members, and publications derived from cooperative datasets.

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Webber, J.E. 2000. Western hemlock: a manual for tree improvement seed production. Research Branch, BC Ministry of Forests, Victoria, British Columbia, Canada.

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