Alberta Forest Genetic Resources Council

2008

Annual Report

Message from the Chair

Given the potential impacts of mountain pine beetle and climate change, as well as the fallout from the global economic crisis, there is clearly a role for forest genetics research and practice that will reinforce forest resource conservation and management. To this end Council moved ahead with substantial progress on all of its strategic initiatives, and some of the results are described in this annual report.

Without question, the most exciting development occurred in the area of integrating forest genetics with growth and yield. In the past year, the provincial review by Dr Jim Flewelling has proven a major step towards achieving this badly-needed integration. Several members of council were actively involved in the Alberta Sustainable Resource Development-sponsored review, and Council will be consulted regarding implementation of recommendations stemming from the report.

We were also very pleased to receive approval for a grant from the Open Funds Initiative of the Forest Resource Improvement Association of Alberta. Leveraged with the generous funding support of government and industry, this will support our plan to develop some educational tools to help forest practitioners apply an understanding of tree genetics in their day-to-day operational and regulatory work.

We will miss two long-serving members, both representing the scientific sector, who stepped down from Council. Dr John Spence of the University of Alberta and Dr Ken Mallett of the Canadian Forest Service provided many years of strong contributions. We welcomed three new members to Council in 2008: Willi Fast, of The Forestry Corp., Dr Ted Hogg of the Canadian Forest Service and Dr Janusz Zwiazek of the University of Alberta.

Cliff Smith, *Chair*
Alberta Forest Genetic Resources Council

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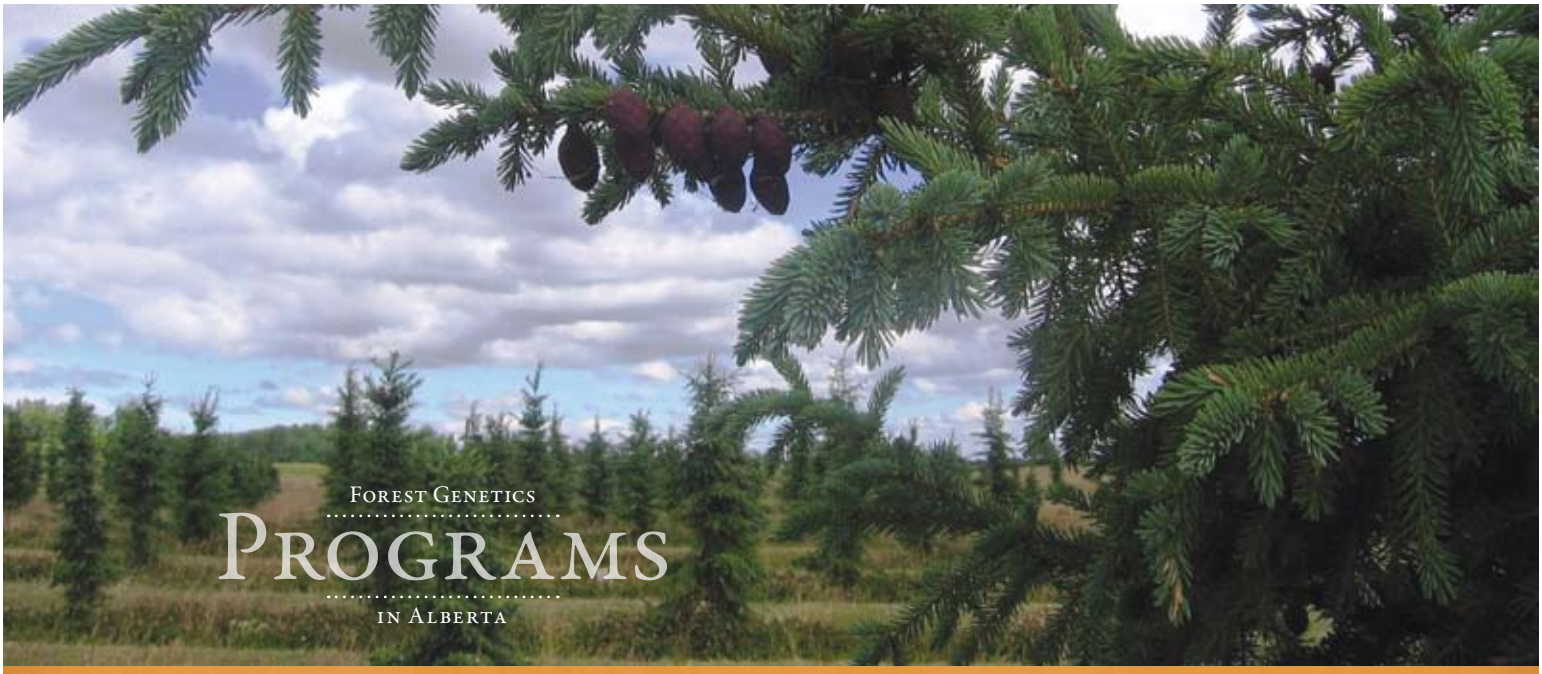


Forest Genetics Programs in Alberta

The challenge of changing climate continues to influence the development and management of forest genetics programs in Alberta. Conservation of genetic diversity and maintenance of adaptability to natural environments are among the primary objectives of all native species programs.

Programs for public land deployment involve two deciduous and six coniferous species native to Alberta; no exotic species are included. All programs are based on traditional methods of selection and breeding, and no genetic modification (GM) is involved. Most programs involve cooperative arrangements among various agencies, including Alberta Sustainable Resource Development and forest companies.

A broad genetic base has been accumulated, and thousands of wild genotypes have been preserved by grafting in *ex situ* reserves. In conjunction with the Alberta Genetic Resources Conservation Plan, a system of *in situ* reserves is also being initiated for all species involved in breeding programs.

Coniferous program development started in 1976, and there are now 22 programs. Increased wood production through faster growth is the main objective, with other traits of interest including wood quality and disease resistance. Progeny tests associated with the older programs are yielding fast-growing healthy individuals for inclusion in the next generation's breeding and orchard populations. Coniferous programs are summarized in the chart on this page.

Programs in aspen and aspen hybrids, balsam poplar, and hybrid poplars are under development by forest products companies. More than 450 poplar selections for a variety of traits have been made, and six test sites have been developed. Public land field trials are scheduled for 2009. Deployment of hybrid poplars on private land began in 2000; public land deployment of native hardwoods is expected to begin soon.

Provincial genetics policy for forest trees in Alberta was enacted in 2003. A major revision is underway, and changes will be implemented in May, 2009. These standards establish a framework for program development and accrual of benefits, while ensuring that genetic diversity, adaptation and conservation objectives are met.

Species	Number of programs	Parents in programs	Parents under test	Genotypes in orchards	Trees in orchards	Total seed produced (kg)	Hectares planted
Douglas-fir	1	45	0	39	129	0.07	0
Western larch	1	27	0	18	84	2.5	0
Jack pine	1	71	68	58	528	0.3	0
Lodgepole pine	7	1,928	1,633	645	10,991	294	14,116
Black spruce	3	269	179	221	5,390	3.0	0
White spruce	9	1,275	932	843	8,900	1,553	7,958
Grand Total	**22**	**3,615**	**2,812**	**1,824**	**26,022**	**1,853**	**22,074**

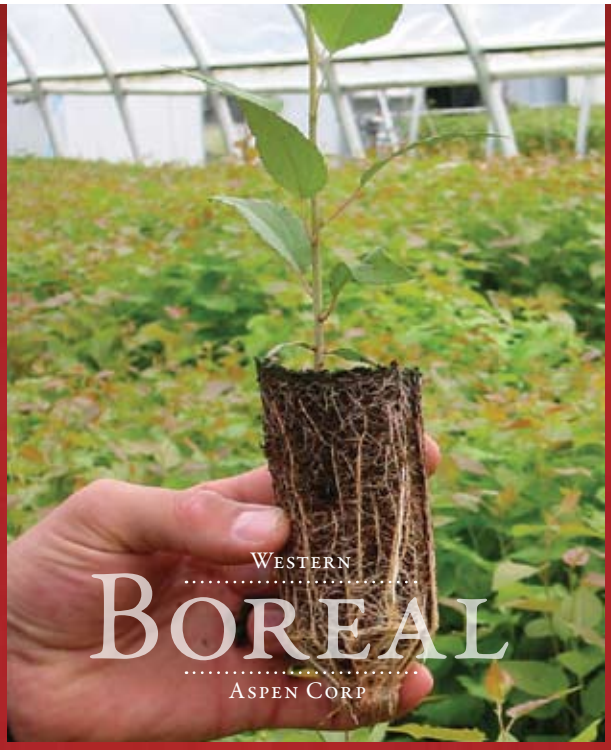
Reclamation at the Muskeg River Mine

Throughout the design, operation and reclamation of the Muskeg River Mine, the Athabasca Oil Sands Project and Albian Sands Energy Ltd. use a best-practice approach to environmental management. This includes the objective of returning the land to an equivalent capability, using the latest technologies and innovative environmental policies.

One of the primary environmental goals for Albian Sands is to reclaim disturbed lands to a self-sustaining boreal forest that is integrated with the surrounding area. To attain this goal, the following techniques are employed:

- Direct soil placement – taking the top layer of soil from an area and placing it directly onto another area being reclaimed, instead of stockpiling it. This allows viable seeds and roots to quickly re-establish on the new areas rather than dying or decomposing while in storage piles.
- Forest floor transplanting - removing a thin layer of top soil with the plants intact and relocating it in a new location anticipating that the plants will survive and thrive.
- Salvage and replacement of top- and sub-soil layer – the replacement of a top layer of natural soil with important micro-organisms, seeds and rootlets that allow the reclaimed land to return to its natural ecosystem faster than it would if a top layer of natural soil was not used.
- Coarse woody debris – placing logs, stumps and branches on reclaimed areas to provide a long-term source of nutrients for soil development and an environment for small wildlife and other fauna.
- Soil bioengineering - using early planting of tree and shrub cuttings to facilitate early root establishment and avoid erosion and gullies on slopes.
- Variable topography – designing a reclamation area to include a variety of undulations and mounds and encouraging the establishment of greater vegetation and wildlife diversity.

There is no guarantee that all plant species will return to the reclamation landscape "on their own," so Albian Sands and other companies strive to ensure that a constant high-quality supply of seeds and seedlings is available for use in reclamation by oil sands operators.



The Western Boreal Aspen Corp (WBAC) focuses primarily on genetics and silviculture of aspen for deployment on private and public land in Alberta. Members actively support research and participate in policy development.

The group works with native trembling aspen, aspens from Europe, Asia and North America, and hybrids, as well as with balsam and hybrid poplars. Current members are Ainsworth Engineered Canada LP, Daishowa-Marubeni International Ltd. and Weyerhaeuser Company. New members are welcome.

Aspen

A provenance trial of trembling aspen was established in 1998. Forty-three seedlots from six provenances ranging in latitude from 47.3 °N (Minnesota) to 58.4°N (Ft. Nelson, B.C.) were planted on six sites. Analyses of eight-year data indicate that transfers southward perform poorly, and that relative performance declines with the magnitude of transfer. Transfers northward perform well, even when the transfer exceeds 10 degrees of latitude. There appears to be little provenance variation in Alberta materials.

First generation breeding is complete, with crosses between 30 male and 30 female parents in each of two breeding regions. Seedling progeny tests include 33,400 trees on nine sites covering more than 30 ha at a wide range of latitudes and elevations. This is perhaps the largest and most comprehensive aspen testing program in the world.

WBAC has established about 20 ha of clone trials on 10 sites, including 350 source-identified wild Alberta trees. Variation in growth rate is large. Early results support transfer results from the provenance trials.

Aspens from Europe, Asia and North America have been tested as species, land races, provenances or hybrids in over 14 ha of trials. Analyses confirm the benefit of northward transfer. Some trees exceed 7.5 m in height at five years of age!

Trials to investigate many aspects of aspen silviculture and propagation have also been conducted.

Poplar

WBAC has established four balsam poplar clone trials with 300 source-identified Alberta trees, to provide information and superior materials. The trials will also provide guidance for clonal transfer guidelines and breeding zone and deployment limits.

With support from the Alberta Forestry Research Institute, WBAC hybridized native balsam poplars with *P. ussuriensis* and *P. simonii* from China using imported pollen. Eight crosses from the two hybrids yielded 76 clones.

Mountain Pine Beetle and Conservation Strategies

Funding from various sources was continued in 2008 to monitor and control mountain pine beetle (*Dendroctonus ponderosae* Hopkins) in genetic orchards and field trials, and to make contingency seed collections.

The Alberta Tree Improvement and Seed Centre (ATISC) of Alberta Sustainable Resource Development installed Verbenone pouches (scent traps) in June to 15 at-risk pine field trials at seven test sites from Whitecourt through Pincher Creek. Pouches were also installed in the pine clone bank at ATISC. Lindgren funnel traps were installed at the ATISC site and the Crop Diversification Centre South orchard site at Brooks to monitor for beetle presence.

Industry used the pouches to protect an additional 15 pine field trials in the Swan Hills and Rocky Mountain foothills from Hinton to Grande Prairie. Pine orchards at two sites were also protected. Detection surveys in field trials in the fall of 2008 and Lindgren funnel trap monitoring over the summer did not detect the beetle in any of the field trials or orchards for the year.

Industry is using Forest Resource Improvement Association of Alberta grants to conduct pine contingency seed collections in five at-risk seed zones on behalf of Alberta Sustainable Resource Development.

In response to the mountain pine beetle threat, ATISC is also conducting pine conservation seed collections to conserve a geographically-representative sample of populations. This has been made more urgent with the recent listing under the Alberta Wildlife Act of whitebark and limber pine as endangered species in Alberta.

Although successful seed collections for limber pine have been ongoing for approximately a decade, whitebark pine seed collections have proved much more difficult and have only been possible with beetle-program funding assistance in 2007 and 2008. Successful whitebark collections have now been made from Table Mountain in the southwest, DeVerber Mountain in Willmore Wilderness Area and the Cline River valley west of Nordegg.

Three limber pine collections have been made at Windy Point west of Nordegg, Crowsnest Pass and the Porcupine Hills. Conservation collections for lodgepole pine are continuing with one collection completed and approximately 15 planned for the winter of 2008-2009.

Integrating Tree

Improvement

Growth and Yield

In early 2006, the Alberta Forest Genetic Resources Council, in collaboration with the Foothills Growth and Yield Association, the Foothills Research Institute, and the Forest Resource Improvement Association of Alberta, co-sponsored the Post-Harvest Stand Development Conference in Edmonton.

A primary objective of the conference was to develop an action plan by which Alberta's forest practitioners could secure recognition of, and gain benefits from their long-standing investments in forest tree improvement.

For the benefits of tree improvement to be realized in forest management plans by way of increased yield projections for genetically improved plantations, demonstrated genetic gains must be incorporated into existing growth models and projection tools. This phase of management planning is challenging and complex, and requires collaboration among experts in forest genetics and growth and yield in order to develop technically defensible solutions.

To build on the momentum from the Post-Harvest Stand Development Conference, an *ad hoc* committee representing Alberta's forest industry, Alberta Sustainable Resource Development (ASRD), and Alberta's forest growth and yield and forest genetics communities was asked to chart a path forward. On the advice of the committee, ASRD was asked to engage an identified expert in forest growth and yield to review Alberta's existing tree breeding and forest growth projection programs and to make recommendations for integrating genetic gain into growth models for management planning.

Dr Jim Flewelling was contracted by ASRD to complete a comprehensive review and recommendations report, with the document submitted in August, 2008. The report is available upon request from Alberta Forest Genetic Resources Council. ASRD's response to the report was expected in late December, 2008.

Alberta Forest Genetic Resources Council has played a key role in advancing the incorporation of genetic effects into tree growth projection models, and is confident that the Flewelling Report will serve to guide further advances in this exciting area of forest management in Alberta.

Increased utilization of trembling aspen and balsam poplar for the production of pulp and wood products in Alberta has led to a recent emphasis on hardwood genetic research at the University of Alberta. Much of this research is carried out with the support (financial and otherwise) from industry partners including Alberta-Pacific Forest Industries Inc. (Al-Pac), Ainsworth Engineered, Daishowa-Marubeni International Ltd., Footner Forest Products Ltd., Western Boreal Aspen Corporation and Weyerhaeuser Company.

Ecological Genetics

MSc students Tim Gylander and Haitao Li have investigated ecological genetics of trembling aspen based on provenance trials and remote sensing data under the supervision of Andreas Hamann. First results indicate trade-offs between adaptive traits and productivity. There are broad geographic trends across western Canada, with the more productive provenances from the southwest being less drought resistant, as well as breaking and setting bud later than the less productive provenances from the northeast.

Drought Physiology

The province's record drought in 2001-2002 and widespread dieback of aspen in central Alberta has inspired much research into hardwood drought physiology. Faculty members Uwe Hacke, Mel Tyree and Janusz Zwiazek all have one or more graduate students addressing various aspects of poplar and aspen drought physiology with the ultimate goal of screening for drought resistant or tolerant genotypes. A workshop organized by Barb Thomas (Al-Pac) in May 2008 brought together researchers from across Canada to discuss this topic.

Climate Change

PhD student Michael Mbogga and research associate Xianli Wang have developed climate change adaptation strategies under the supervision of Andreas Hamann, investigating how planting stock should best be deployed across the landscape to ensure genetic diversity and forest health. These projects make use of bioclimate envelope modeling to match genotypes with future planting environments. Uncertainty in climate projections is dealt with by finding management options that work under most climate change scenarios.

Forest Pathology

In response to a recent outbreak of Septoria canker (stem deformity) on poplar plantations in northern Alberta, PhD candidate Jared LeBoldus is investigating interactions of pathogen isolates with hybrid and native balsam poplar clones under the supervision of Peter Blenis and Barb Thomas. First results indicate that Septoria isolate and hybrid type have small effects and resistance screening programs can focus on clonal selection based on screening with single Septoria isolates.

Communications and

Outreach

Progress continued during the year on the primary communications goal of enhancing awareness of Council's expertise and capability among forestry practitioners, regulators and political leaders.

The 2007 Annual Report was created and distributed to more than 230 contacts in government, academia and industry across Canada. A Research Priorities paper was developed and made available on Council's website (www.abtreegene.com). The paper is included, along with speaking notes and illustrative slides, in a presentation package that is ready for use when Council speaks to senior government leaders.

A press release announcing the appointment of Willi Fast to Council received media attention and is also available on Council's website. Council's letter in support of conservation efforts in aid of whitebark pine and limber pine was also uploaded to the website, and again afforded a vehicle to have Council's activities recognized in the mass media.

A new Fact Sheet explaining some of the goals and practicalities of Maintaining Genetic Diversity is now available on the website.

Our third communications goal is to deliver web-based educational tools for forestry professionals and, ultimately, grade school teachers and students. Council was very fortunate in late 2008 to receive funding from the Open Funds Initiative of the Forest Resource Improvement Association of Alberta. This $50,000 grant is leveraged with $20,000 in industry and government contributions. It will help develop some educational tools to help forest practitioners apply an understanding of tree genetics in their day-to-day operational and regulatory work. A secondary objective is to conduct a needs assessment for genetics material that would engage grade school students in the science and careers essential to modern-day forestry.

Sincere thanks to our communications and outreach sponsors in 2008:

Ainsworth Engineered Canada LP

Alberta-Pacific Forest Industries Inc.

Alberta Sustainable Resource Development

Albian Sands Energy Ltd.

Canadian Forest Service

Daishowa-Marubeni International Ltd.

GreenLink Forestry Ltd.

Millar Western Forest Products Ltd.

Manning Diversified Forest Products Ltd.

Northland Forest Products Ltd.

Poplar Council of Canada

Sundance Forest Industries Ltd.

Timberline Natural Resource Group

Tolko Industries Ltd.

Vanderwell Contractors (1971) Ltd.

West Fraser Timber Co. Ltd.

Weyerhaeuser Company

Alberta Tree Improvement and Seed Centre

Dr Narinder Dhir, founder of Alberta's provincial forest genetics and tree improvement programs, retired in October, 2008 after 33 years of service. Prior to his retirement, it was determined that it would be timely to undertake a strategic review of the status and role of the Genetics and Tree Improvement Unit program. This review is ongoing, with the objective of determining program adjustments and staffing requirements to meet new challenges such as the threat of mountain pine beetle attack and adaptation to climate change.

The Standards for Tree Improvement in Alberta, which were implemented in 2003 after extensive stakeholder discussion and involvement, are currently undergoing a comprehensive five-year review with stakeholder participation. It's expected the revised standards will be implemented for May 2009.

Administrative support Tammy De Costa, Narinder Dhir and Cliff Smith

After participating in the founding of CONFORGEN, a national initiative to coordinate tree gene conservation work and reporting, the Alberta Tree Improvement and Seed Centre has undertaken a major quality control review of its research and conservation seed archive. Information will be moved to a new data base and seed specifically stored as conservation lots will be reported to the Canadian Forest Genetic Resources Information System, a national tree gene conservation database project coordinated through CONFORGEN.

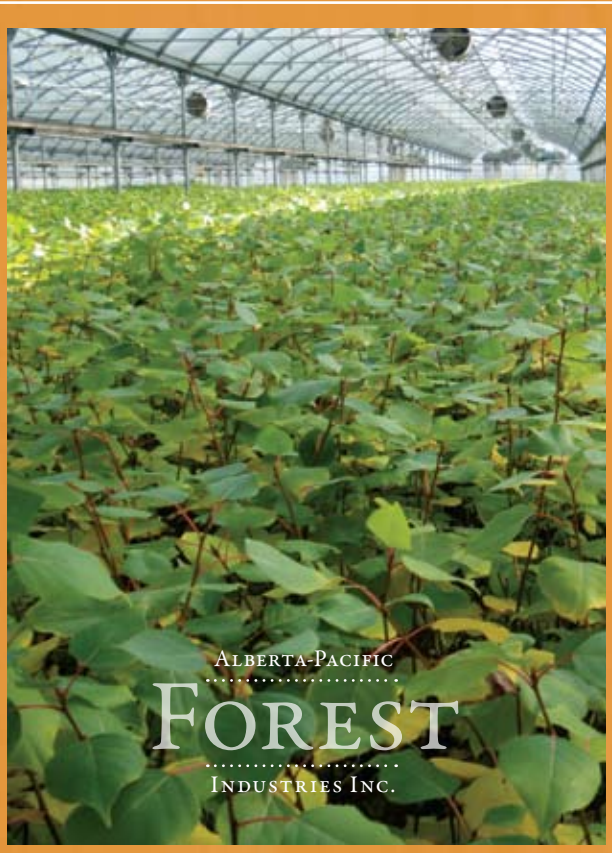
Forest Genetics Alberta Association

Forest Genetics Alberta Association (FGAA) serves four partners – Manning Diversified Forest Products Ltd., Northland Forest Products Ltd., Alberta Tree Improvement and Seed Centre (SRD) and Tolko Industries Ltd.

Key tasks in 2008 were to continue development of test sites, plan for additional progeny testing, do initial trial measurements and analysis and continue establishment and expansion of orchards. Tara Filliol was hired as manager, replacing Lee Charleson who moved to a new position in B.C.

Formal project partner agreements for the northwest region are now in place for both the Region J lodgepole pine and Region G2 white spruce projects. Work is continuing on the Controlled Parentage Program (CPP) plans, with revisions to the G2 CPP completed and revision of the Region J plan in progress. Agreements were signed for the northeast Region E1 white spruce and Region P1 jackpine projects.

Design graft capacity for all four project orchards is over 90 per cent filled. New selections for the Region J lodgepole pine project are planned and orchard redesign is underway to expand the orchard by 180 positions as a mountain pine beetle contingency seed supply measure. All four orchards have produced collectable seed crops and the emphasis now is on graft maintenance and development to enhance seed production.



With more than four years of breeding in hybrid poplars completed, results from Alberta-Pacific Forest Industries' new genetics trials are beginning to show encouraging results. Many of the selections are more than three metres in height after three years. Al-Pac has begun making early selections of the most promising individuals and has initiated testing for disease resistance (in particular *Septoria musiva*), and rootability.

Eight years of research have led to cessation of fertilizer applications on Al-Pac tree farms. The hybrid poplar clones currently growing in the prairie region do not appear to be nitrogen-limited under current conditions.

A permanent and temporary sample plot monitoring program has been developed for Al-Pac poplar farms that now cover more than 6,000 ha in plantations from Westlock to Bonnyville. Volume and taper equations have been refined for the hybrid poplar clones now deployed operationally, with new data being added as the trees mature to a full rotation of 18 years. Above- and below-ground carbon equations have been developed to assist with verification and accounting of carbon credits available from the farms. Deployment of a selected hybrid aspen clone on private lands has also begun.

Canadian
Forest
Service

The dieback of aspen forests has been studied by Ted Hogg and his colleagues at the Canadian Forest Service, in partnership with the forest industry and Environment Canada, since the 1990s. In 2000, the research was expanded to include a network of 150 plots across western Canada, where aspen forests are being monitored as part of a study called *Climate Impacts on Productivity and Health of Aspen*.

Results to date show that the severe drought of 2001-2002, in combination with insect outbreaks, has led to extensive dieback of aspen forests across the prairie provinces. As of 2008, drought conditions are again affecting large areas of Alberta, posing renewed concerns for the future health of aspen forests in the province.

There are increasing concerns that droughts are becoming more severe in many areas of the world, and these changes pose a challenge for the future management of our forests, especially in the most drought-prone regions of Alberta. New strategies, such as the selection and deployment of more drought-tolerant genotypes of aspen and other trees, could become key to maintaining healthy and productive forests for the future.

Alberta Forest Genetic Resources Council

Please contact us if you have any questions or comments regarding this Annual Report!

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ISBN: 978-0-7785-7743-0 (Printed Edition)
ISBN No. 978-0-7785-7744-7 (On-Line Edition)
Pub No. T/205

Editorial/production management:
MediaMatch West Communications Inc.
Photos courtesy of: FGAA, WBAC, Dr. Barb Thomas, Isabella Point Forestry, ASRD, MediaMatch West Communications