

Genecology and Seed Transfer Committee - FINAL REPORT

Approved by the Genecology and Seed Transfer Committee – September 12, 2008

Committee membership

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1.0 Background

At its December 12, 2007 meeting, the Forest Genetics Council (FGC) struck a committee to review the needs of genecology research and seed transfer policy development, and to make recommendations on a business structure for program delivery that integrates with existing FGC business structures. The following terms of reference were subsequently developed and agreed to at the June 11, 2008 meeting of Council:

TOR 1 – Ranking method

Develop a method for ranking genecology research priorities and seed transfer policy needs.

TOR 2 – Administrative system for funding

Develop a system for funding genecology research priorities, with FIA Forest Genetic Conservation and Management funds, that is directed, efficient for researchers, and has a low administrative cost.

TOR 3 – Reporting and performance indicators

Recommend a system of performance indicators that can be used by the FGC for setting objectives, tracking project progress, and reporting.

TOR 4 – Budget development and review committee structure

Recommend a committee structure to oversee, on behalf of Council, the development of budgets, reporting, and stakeholder input.

At the present time, genecology research projects are funded through section 350 of the Tree Breeding Subprogram, or through genetic conservation projects undertaken by the UBC Centre for Forest Conservation Genetics.

1.1 The problem

Under current business structures, genecology¹ research and seed transfer policy development face the follow difficulties:

- Genecology research priorities are not ranked separately from breeding program priorities, resulting in some genecology research needs going unmet.
- Council is unable to set targets and track progress at a provincial level.
- Seed transfer policy developments are not eligible for support.

¹ Genecology is the study of natural genetic diversity and how it relates to geography and climate.

- Genecology research funds are not accessible to researchers outside the Ministry of Forests and Range (MFR) and the UBC Center for Forest Conservation Genetics.

1.2 Committee process

Four meetings were held by conference call on May 6th, June 2nd, July 4th, and September 12th, 2008. Actions between meetings were carried out by individual committee members and by others asked to provide information. Minutes were prepared listing action items and summarizing decisions. This report was approved by Committee members on September 12, 2008.

1.3 Importance of genecology research and sound seed transfer policy

Scientifically sound and administratively efficient seed-transfer policy is an important component of forest management. Benefits include well-adapted forests (resilience), better productivity, assisted migration under climate change, and operational efficiency. Good policy also provides a framework by which operational activities are structured, including seed planning unit size, breeding program and seed orchard target areas, operational seed inventories, and genetic conservation.

Genecology research provides the scientific foundation upon which seed-transfer policy is built. Genecology research also identifies tree populations with desirable characteristics that can be used in breeding and seed orchard programs. With changing climates, genecology research will support the development of operational responses in the form of assisted migration of tree populations to maintain well adapted and productive plantations. Finally, an understanding of genetic diversity patterns through genecology research allows efficient genetic conservation.

2.0 Terms of Reference 1 – Ranking method

Task: Develop a method for ranking genecology research priorities and seed transfer policy needs.

The methodology currently used for ranking seed planning units (SPU) for breeding and seed orchards is not suitable for genecology and seed transfer work. SPU rankings are primarily value-based, whereas genecology and seed transfer ranking criteria must also include factors associated with stand resilience, genetic conservation, and climate change. In addition, understanding naturally occurring genetic diversity is a species-level endeavor, and seed zones cannot necessarily be pre-assumed in the process as they are for SPU ranking. As conservation information and needs are highly dependant upon a thorough understanding of genecology, it is recommended that a priority ranking system should be developed which includes value, resilience, conservation, and climate-change criteria.

Council's broad mandate includes adding value to commercial species through breeding and seed orchards, as well as genetic conservation for all tree species indigenous to BC. For non-commercial tree species, the value-based criteria that are appropriate for commercial species have little meaning. Therefore, it is proposed that commercial species should be ranked separately from non-commercial species.

For commercial species, the following criteria are proposed and placed in a matrix for ranking purposes. A ranking spreadsheet in draft form appears in Appendix 1. Commercial species will include non-indigenous species with significant commercial potential in BC (i.e. noble fir and Siberian larch). More potentially-commercial non-indigenous species may be added over time.

- A. Species range size in BC (in hectares)

- B. Commercial importance: an index value (from 0 to 10) developed using the 5-year average number of hectares regenerated (from RESULTS), wood value, and other criteria (development underway at the time of report preparation).
- C. Future importance: a subjective value (from 0 to 10) developed through expert opinion.
- D. Conservation status: an index value (from 0 to 10) based on the UBC Center for Forest Conservation Genetics listing of the conservation status .
- E. Climate-change impact: based on ClimateBC model results for 2050, measured as hectares change in suitable range size from the present.
- F. Regional needs: a subjective value (0 to 10) based on local issues and questions associated with seed transfer.

A value score is developed for the above criteria by first converting all scores so they fall within a 0 to 10 range (10 is high priority), and calculating a weighted mean score using assigned weightings for each criterion. The ranking table shown in Appendix 1 is in draft form, and will require further populating of data. However, this framework will provide a system for setting priorities.

For tree species that are not currently harvested and commercially planted (non-commercial species), but are within the scope of Council's Genetic Conservation Subprogram (part of the Conservation Catalogue developed by the UBC Centre for Forest Conservation Genetics), only conservation criteria have meaning. As the purpose of the Catalogue is to identify species and areas with possible threats to genetic conservation, it follows that non-commercial species with threats will receive high priority for genecology research. As a result, it is recommended that the Genetic Conservation TAC be tasked with advising Council on genecology research priorities for non-commercial species.

2.1 Use of ranks to determine program priority and funding

The ranking system described here is intended to provide a system for determining the relative importance of species for genecology investment purposes. However, it is recommended that other information should also be used when making decisions on funding allocations, including:

- existing information on genecology,
- the scope and quality of existing research trials,
- the specific annual funding needs of quality, on-going projects

It is recognized that valuable projects will arise that do not easily fit within the program ranking structure (i.e. multi-species trials or work of a more theoretical nature that could apply to all species and zones). Projects of this type are discussed further in section 3.3.

3.0 Terms of Reference 2 and 4 – Administrative systems and review committees

3.1 Committee of the FGC to oversee genecology research and seed-transfer policy development

It is recommended that Council form a permanent committee to be called the Seed Transfer Technical Advisory Committee (STTAC). The STTAC should report directly to Council and sit at the level of other technical committees such as the Genetic Conservation TAC or the Pest

Management TAC. This committee should take recommendations to the CTAC and ITAC for review, information sharing, and advice.

The primary roles of the STTAC should be to:

1. Recommend short and longer-term measurable objectives for genecology research and seed transfer system development (see section 4.1),
2. Advise the FGC on seed transfer systems, policy, guidelines, and associated research.
3. Lead business planning for the development and delivery of funds to genecology research and seed transfer projects and provide recommendations to the FGC regarding annual budgets and priorities.
4. Review and recommend genecology and seed transfer research and development proposals and budgets (excluding conservation-related projects associated with the Genetic Conservation TAC); see section 3.3.
5. Review recommendations for changes to seed transfer standards.

The chair of the STTAC should be appointed by the FGC, but it is not necessary for the chair to be a member of the FGC. The STTAC should have a membership of from 6 to 10 people, and members should broadly represent the stakeholder groups that are part of the FGC membership. The Chair of the STTAC should have the discretion to appoint members, and should be responsible for developing and maintaining business procedures for the Committee. The Committee should follow normal business procedures, including pre-set agendas, recorded minutes, and voting on important or controversial issues. The STTAC should report to Council from time to time as required, and provide Council with project and budget recommendations at Council's March budget meeting.

3.2 Development of a new FGC subprogram

It is recommended that a new subprogram of Council be formed to aid with the management of funds directed at genecology research and seed-transfer policy development. This subprogram should be called the Seed Transfer (ST) subprogram, and should be overseen by the STTAC.

3.3 Genecology and seed transfer project development, review, funding, and reporting

It is recommended that the STTAC initiate an annual call for proposals for genecology and seed transfer projects. Priorities should be developed as described in section 2.

Timing: The call for proposals should be released in December of each year, with review of proposals in February. A final project list and budget should be provided to Council at its mid-March meeting.

Types of proposals: Proposals should fall into two categories; **NEW**, and **ONGOING**. New projects should require a more comprehensive proposal and workplan that will allow reviewers to evaluate the project from the perspective of its objectives, study design, cost, and probability of success. Ongoing projects should include projects currently underway that are funded through the Tree Breed subprogram of Council, and, in time, multi-year projects that were previously approved by the STTAC. It is intended that the application process for ongoing projects will minimize administrative burden for proponents, with only a brief description of work planned, budget, etc. (see table 1), unless there is a significant departure from a previously approved plan. Proposals for ongoing projects must also include a progress report.

Table 1: Recommended components of genecology and seed transfer funding proposals for new and ongoing projects.

Proposal sections	Ongoing projects	New projects
Project objective	X	X
Relevance to FGC objectives	X	X
Background on need		X
Method		X
Data analysis model		X
5-year budget	X	X
Activity timeline	X	X
Progress report	X	

Projects that involve multiple species or are more theoretical in nature may not be easily ranked using the process described in section 2. Such projects may be important and it will be incumbent upon the STTAC to identify such projects and try to provide support. To this end, it is recommended that an annual **Project Eligibility List** be developed to guide applicants in a call for proposals. The ranking process and expert opinion should be combined the development of the Project Eligibility List.

3.4 Call for proposals and proposal evaluation criteria

A call for proposals should be modeled after the Operational Tree Improvement Program (OTIP) call, with similar timing, committee review process, and structure. Call development responsibility should fall to the FIA Forest Genetic Conservation and Management Program Coordinator. The Project Eligibility List described above should be central to the Call for Proposals to guide proponents, to aid reviewers when determining relevance, and to keep investments directed at priorities.

Proposal evaluation should be based on the following criteria:

- **Need** – this criterion should be applied as a threshold; if the project is not needed or eligible according to the Project Eligibility List in the annually developed call, then it will not qualify for funding irrespective of the scores received under the next two criteria. Need should also be used as the primary criterion for ranking acceptable proposals when funding is limited.
- **Technical merit** – this criterion should include study-design quality, probability of success, and other factors associated with the overall scientific quality of the proposal.
- **Proponent ability and resources** – this includes the experience and ability of the proponent to successfully undertake the project and to meet project objectives, the proponents record for meeting project milestones and providing progress reports (for ongoing projects only), and the resources the proponent can garner in support of the project
- **Value** – project value relative to it’s cost and to potential alternative projects.

3.5 Development of funding requirements

In the current fiscal year (2008/09), approximately \$350,000 is being directed to genecology research within the Tree Breeding subprogram. It is expected that these funds would be diverted from the Tree Breeding subprogram to a new Seed Transfer subprogram, and there would be no net change to the overall FGC budget. However, needs change over time, and there should be no pre-set expectation that this amount will remain stable. It should rise or fall as required to meet FGC objectives, within the constraints of the total funding to all subprograms. It is recommended that annual budget developments flow from needs identified through STTAC deliberations and the results of an annual call for proposals, in a manner similar to what is currently done with Operational Tree Improvement Program (OTIP) projects.

3.6 Record-keeping and continuity for long-term trials

Many genecology trials require the maintenance of records, field trials, and data for many years. Such trials often transfer from one researcher to another over time, and require an institutional commitment that often goes beyond ephemeral funding structures. As the FIA funding associated with this subprogram area is intended to effect long-term benefits and change to forest management on Crown lands in BC, and as FIA funding is provided by the Province of BC, it is important that the Ministry of Forests is involved with the record keeping associated with any long-term genecology field trials.

The Ministry of Forests Research Branch has the continuity, structure, and resources to maintain records for long-term field trials. Therefore, a **requirement** of all genecology research that involves long-term (> 4 years) field trials should be the collaboration of a Ministry of Forests Research Branch scientist who will commit to setting the project up under the Experimental Project (EP) record keeping system of the Research Branch. Shorter-term projects should be exempted from this requirement.

4.0 Terms of Reference 3 - Reporting and performance indicators

Performance indicators are an integral part of business planning and reporting in the overall FGC-led program. Performance indicators are generally required at two levels:

1. Provincial-level indicators that provide broad measures of progress and are useful for evaluating overall program performance.
2. Project-level indicators that provide simple targets and measures for project proponents and reviewers.

4.1 Provincial-level performance indicators

A provincial performance indicator for genecology and seed transfer must, as closely as possible, address the specific operational intent of this type of endeavor. In general, genecology research is conducted to generate information that is used to, a. reduce seed transfer risk (resilience), b. increase genetic conservation efficiency (conservation), and c. improve forest productivity (value). Genecology information is typically delivered to operations through seed transfer standards that attempt to maximize administrative efficiency, while minimizing the risk of planting seed in areas where it is poorly adapted.

Complicating this set of needs for genecology information is the expectation of a continued climate change. Over time, it is expected that seed transfer zones and seed transfer standards must be adjusted to allow the matching of seedlots to appropriate climatic envelopes.

From the perspective of the public and of foresters managing planting programs, there is a need to know that seed transfer standards are, a. developed with information from comprehensive and high-quality research and experiential knowledge, b. considering and accommodating likely climatic changes, and c. administratively efficient. From the perspective of senior managers in the MFR (Deputy Minister, Chief Forester) and the FGC there is a need to know how many of the species and seed zones in BC meet these three criteria, how many are likely to meet the criteria in the future, and what level of resources are required to meet targets. Therefore, the following provincial level performance indicator statement is recommended. Actual numbers will require further technical work to develop. This performance indicator can also be used by the FGC to set objectives, to help determine resource needs to meet objectives, and to report on progress

Recommended provincial performance indicator:

“By <year>, <X> percent of species by seed zone combinations will have science-based seed transfer standards that consider climate change”

This performance indicator can be reported in graphic form in similar way to existing FGC performance indicators for the percent select seed use and the average genetic worth of seed used.

Underlying the use of this performance indicator is the assumption that projects are developed and carried out to a high scientific and technical standard. Maintaining high standards is the responsibility of all involved, and will be the focus of proposal review committees and of managers overseeing the projects. Competence, in this regard, is generally assumed by senior managers.

4.2 Project-level performance indicators

Performance indicators for individual genecology research projects must be meaningful to project managers, reviewers, and those administering funding. Existing performance indicators used within the Tree Breeding Subprogram have proven satisfactory and it is recommended that these indicators continue to be used. In addition, a performance indicator is needed for reporting and seed transfer policy recommendations, and for changes to the Chief Forester Standards for Seed use. Table 2 lists suggested performance indicators. These should be refined by the STTAC as part of the process of developing a call for proposals.

Table 2: Example of project-level performance indicators for genecology research, reports, recommendations, and changes to the Chief Forester Standards for Seed Use.

Work breakdown category #	Performance indicator description	Indicator
252	# of genecology research test sites established	# of field sites
253	# of genecology research test sites maintained	# of field sites
254	# of genecology research test sites measured	# of field sites
255	# of genecology research test sites assessed or measured for wood quality or pests	# of field sites
256	# of genecology research test sites for which data were analyzed	# of field sites
257 (new)	# of project reports	# of reports
258 (new)	# of species / seed zones receiving recommendations regarding seed transfer standards	# of species by seed zone combinations
259 (new)	# of species / seed zones receiving review of seed transfer standards	# of species by seed zone combinations

The performance indicators listed in Table 2 should be used to aid the development, budgeting and review of proposals for genecology research and seed transfer standard review. As is currently done with other subprograms of Council, these indicators should be required in budgets and reporting for all projects, and summarized in annual reporting to Council and in the FGC Annual Report.

5.0 Seed Transfer subprogram; mandate, set-up, and timing

The mandate for a Seed Transfer Subprogram of the FGC is to direct resources to priority genecology and seed transfer projects, to oversee business planning, and to provide recommendations. Specific responsibilities for the proposed Seed Transfer TAC are set out in section 3.1 of this report.

Projects funded through this subprogram should support FGC-approved objectives related to understanding the genecology of British Columbia tree species and developing recommendations for the effective movement of tree seed.

It is recommended that a new Seed Transfer Subprogram is structured in September, 2008, with business planning and budget development starting in the fall of 2008. An initial call for proposals should be developed and released by December 1, 2008, at the same time as the Operational Tree Improvement Program (OTIP) call. Projects currently funded through the Tree Breeding Subprogram should seek needed funding through the Seed Transfer Subprogram, beginning in the 2009/10 fiscal year. This funding mechanism will aid the evaluation and support of genecology research that is not closely linked to tree breeding programs, allow greater participation by researchers from outside the Ministry of Forests and Range (MFR), and allow broader input to priorities and program direction.

Appendix 1 – Ranking genecology research needs

The purpose of the following matrix is to objectively rank genecology research priorities, as discussed in section 2.0 of this report. This matrix requires further development of data, and discussion on criteria weightings. **Note that the ranks developed here must be screened against existing research prior to the development of a genecology research call for proposals.**

- Research priority categories**
1. High priority
 2. Medium priority; short-term testing only
 3. Lower priority; limited short-term testing only
 4. Low priority; no investment at the present time

Criteria for program categorization (10 = very high; 1 = very low):		Criteria weightings		
		Criteria	Weighting	Adjustment procedure
A. Species Range size	Species range size within BC (ha)	A	0.05	Scale from 1 to 10; largest range = 10
B. Current commercial importance	To be developed as in index score that includes regeneration amount and value criteria	B	0.2	Scale from 1 to 10; largest # planted = 10
C. Future commercial importance	Subjective estimate of future commercial importance. (from 1=low to 10=high importance)	C	0.2	Subjective 1 to 10 score
D. Conservation status	Conserv. status from UBC CFCG catalogue (threatened = 10, questionable = 5, adequate = 0)	D	0.05	10, 5, or 0 scores from catalogue
E. Climate-change impact on range	Expected potential change in range size (ha) by 2050	E	0.2	Rank by expected change in ha; scale from 1 to 10
G. Regional needs	Need for genecology info within part of the species range in BC (1=low to 10=high)	F	0.25	Subjective 1 to 10 score
		total 1.0		

#	Species	Cells for scoring criteria						Cells for adjusting scores to fall within the range of 0-10						SCORES	
		A. Spp. Range (ha x 1000)*	B. Commer. importance	C. Future importance	D. Conserv. status	E. Cl.-change impact	F. Regional needs	A. Spp. range	B. Commer. importance	C. Future importance	D. Conserv. status	E. Cl.-change impact	F. Regional needs	Wtd. Mean TI Score	Priority
1	Douglas-fir coast	6,974	75,028	10	0	1395	5	1.6	1.4	10	0	0.4	5	3.7	6
2	Douglas-fir int.	10,665	56,907	8	5	8532	8	2.4	1.1	8	5	2.4	8	4.7	3
3	Ldgpl. pine (int.)	32,745	517,700	10	0	2947	4	7.5	10.0	10	0	0.8	4	5.5	2
4	Ldgpl. pine (cst)	5,599	60	1	0	280	3	1.3	0.0	1	0	0.1	3	1.0	21
5	Interior spruce	43,716	352,262	10	0	34973	5	10.0	6.8	10	0	10.0	5	7.1	1
6	Western larch	3,249	28,963	7	0	10559	10	0.7	0.6	7	0	3.0	10	4.7	4
7	W. white pine	3,206	5,278	5	0	6733	2	0.7	0.1	5	0	1.9	2	1.9	16
8	Redcedar	13,900	45,280	8	0	15289	5	3.2	0.9	8	0	4.4	5	4.1	5
9	Yellow cedar	12,246	6,301	5	0	4409	4	2.8	0.1	5	0	1.3	4	2.4	12
10	Western hemlock	18,271	8,765	6	0	13886	4	4.2	0.2	6	0	4.0	4	3.2	9
11	Sitka spruce	7,115	4,393	4	0	996	2	1.6	0.1	4	0	0.3	2	1.5	18
12	Pacific silver fir	12,608	3,879	4	10	4413	6	2.9	0.1	4	10	1.3	6	3.2	10
13	Grand fir	1,734	310	2	0	5792	2	0.4	0.0	2	0	1.7	2	1.3	20
14	Noble fir	0	302	2	0	0	2	0.0	0.0	2	0	0.0	2	0.9	22
15	Sub-alpine fir	27,720	6,016	5	0	-2495	6	6.3	0.1	5	0	0.7	6	3.0	11
16	Cottonwood	9,309	170	3	0	1769	2	2.1	0.0	3	0	0.5	2	1.3	19
17	Big-leaf maple	2,280	0	2	0	6019	6	0.5	0.0	2	0	1.7	6	2.3	15
18	Red alder	4,791	648	3	0	2875	6	1.1	0.0	3	0	0.8	6	2.3	14
19	Paper birch	7,381	12	3	5	3469	5	1.7	0.0	3	5	1.0	5	2.4	13
20	Aspen	17,463	126	6	0	1921	7	4.0	0.0	6	0	0.5	7	3.3	8
21	Ponderosa pine	1,928	4,148	5	0	8502	7	0.4	0.1	5	0	2.4	7	3.3	7
22	Siberian larch	0	0	2	0	0	6	0.0	0.0	2	0	0.0	6	1.9	17

Appendix 2 – Process flowchart

The following flowchart illustrates the process for the flow of information, decisions and funding associated with a Seed Transfer Subprogram under the Forest Genetics Council of BC.

Process for genecology and seed transfer projects:

1. FGC sets provincial targets and direction
2. Priorities set using; a. Genecology priority matrix data; b. Expert opinion; c. Knowledge of existing projects
3. Call for proposals developed to address priority research areas
4. Review of proposals by Seed Transfer TAC
5. Budget recommendations to FGC / FGC decision / incorporation in FGC Business Plan.
5. Contract administration by TIB
6. Reporting using performance indicators
7. Summary report to FGC
8. FGC Annual Report uses provincial-level performance indicator.

