Progress Report II

The Challenge Dialogue System™

Forest-Tree Genetic Resource Conservation and Management (GRM) in British Columbia

A Challenge Dialogue with the Public and Stakeholders

This Progress Report describes and assesses the feedback received from *A Challenge Dialogue with Members of the Public and Key Stakeholders Forest Tree Genetic Resource Conservation and Management (GRM) in British Columbia.* A complete list of all comments received is available in a separate document: *Challenge Paper II – Consolidated Feedback*. This document along with all of the previous documents and other background material on the GRM Challenge Dialogue are available on the Dialogue website: http://www.for.gov.bc.ca/hti/grm_dialogue.htm.

This Progress Report along with your detailed comments will be used to help shape a face-to-face Dialogue workshop in mid-October and the GRM Strategy toward the end of this year.

Comments on this second Progress Report are welcomed. Please send them by email to officelink@shaw.ca.

The Executive Sponsor is for this Dialogue is Jim Snetsinger, Chief Forester, BC Ministry of Forests and Range. The Co-Champions are Dale Draper, Tree Improvement Branch; Alvin Yanchuk and Michael Stoehr, Research Branch; and John Elmslie, Co-Chair, Forest Genetics Council of British Columbia.

We, the Co-Champions for this Dialogue, wish to express our sincere gratitude to everyone that took the time to provide feedback. Continued support from key staff in the Tree Improvement Branch is also gratefully acknowledged.

The Action Team members guiding and supporting the project are Brian Barber, Jack Woods, Keith Jones, Terje Vold, George Sranko, and Michele Baker.

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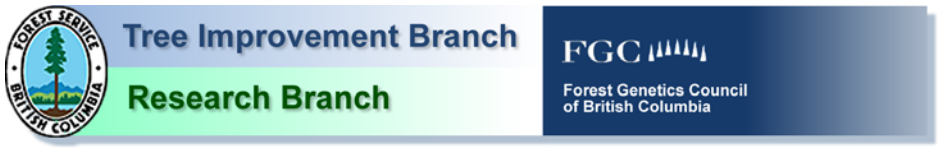

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Executive Summary

This is the second *Progress Report* (II) for the Forest Tree Genetic Resource Management (GRM) Challenge Dialogue. The feedback summarized in this report is in response to a *Challenge Paper* with the public and stakeholders. It was preceded by a Dialogue with the GRM Community of Practice (COP). This report provides a synthesis of the feedback following the same structure as the Challenge Paper. It indicates where the respondents were aligned with the views expressed in the Challenge Paper, areas where there was confusion, areas where further information may be warranted and areas of disagreement.

The purpose of the Challenge Paper was to prompt a conversation around the following Challenge — **Through a focused dialogue open to interested stakeholders/members of the public, create a collective vision and strategy for GRM in BC that supports sustainable forest management (SFM)**

There were 54 respondents to the Challenge Paper[1]. They included practicing foresters and managers from government and industry, researchers, consulting firms, academia and forest executives. The breakdown of the responses was: 16 from the BC government (14 from MFR[2]), 1 external provincial government (Quebec), 8 from industry, 5 from the federal government, 13 NGOs (5 external to BC, 3 US), 6 from the private/consulting sector (3 with strong industry backgrounds) and 4 from academia. The quality of the feedback overall was rich and diverse. From Co-Champions perspective it is evident that a meaningful connection with key stakeholders and members of the public has been made with this second stage of the Dialogue.

Key Messages from Feedback

Reflecting on the feedback, we have made some high level observations. These observations, along with the other insights described in this report, will be used help design the main elements of a strategy development Workshop in mid-October 2007 with the GRM COP and key stakeholders.

The Co-Champions of the Dialogue are encouraged by the many comments received. It is clear that people felt the Dialogue was important and valuable. Several people noted the improved quality of the second Challenge Paper over the first. This improvement is largely because the second paper incorporated many of the ideas brought forward by the COP in the first round of Dialogue. A number of respondents indicated they were interested in staying engaged in the Dialogue and the GRM strategy development. A few individuals felt that the current genetics program is fine the way it is, while a few others wondered if the proponents of the Dialogue were not too set in their ways to truly embrace the program changes that are implied from this Dialogue. In response to this concern, the Co-Champions wish to underscore that they are indeed committed to making the changes necessary to address the current and future GRM challenges we face.

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[1] All of the feedback has been compiled un-attributed into a document titled *Challenge Paper II Consolidated Feedback* which is available on the GRM website at www.for.gov.bc.ca/hti/grm_dialogue.htm.

[2] Note – MFT is the new abbreviation for the BC Ministry of Forests and Range. In the direct quotes however, you will still see reference to MoFR.

The Co-Champions have initially identified six (6) challenge themes from the feedback summarized as follows.

1. **Scope of the GRM vision and strategy** – the dimensions to this included commercial, non-commercial, non-tree species, land base to include, exotics, biotechnologies, broader socio-economic context.
2. **Climate change** – the complexity and uncertainty of climate change and its affects on genotypes, populations, species and ecosystems, seed transfer, decision tools, and the level and nature of our response to this management challenge.
3. **Integrating and balancing the three prime objectives for GRM — genetic gain, conservation and resilience** in a manner that is complementary to SFM including **improved policy and incentives for GRM** which will encourage operational activities that support such objectives.
4. **Better linkages and integration** of GRM with future forest management scenarios and the need for improved linkages with the Future Forest Ecosystems Initiative; ecosystem conservation and biodiversity initiatives; land use planning; forest planning and practices legislation and policy; silviculture; research; forest inventory and growth and yield; timber supply; information management and decision support.
5. **Roles and responsibilities** – clarifying roles and responsibilities within the GRM COP.
6. **Improved strategic communication –** concerns that the public is not sufficiently aware of forest tree genetics to comment knowledgably and the need for improved communication across the COP, key stakeholders and the public about GRM today and into the future.

Next Steps in the Dialogue

Our intended next steps are to:

- Prepare a first draft set of GRM Strategy elements in September;
- Design a GRM Strategy Workshop which will be held in mid-October that will bring forward this elements as initial straw dogs;
- Prepare a *Workshop Workbook,* which will include the draft GRM Strategy elements, organized into a progression of workshop sessions;
- Conduct the mid-October GRM Workshop (location TBD but likely Richmond);
- Take the outputs from the Workshop and prepare and circulate for review and feedback a full draft GRM Strategy and Action Plan; and
- Based on review and feedback, prepare a final draft Strategy by December 2007.

1. Purpose of this Report

This Progress Report is intended to provide:

- A synthesis of the feedback on the GRM Challenge Paper with the Public and Stakeholders;
- Prompted by the Challenge Paper, a sense of where respondents had alignment of views, areas where there was confusion and where further information may be warranted, and points of divergence or disagreement;
- Additional questions, ideas and suggestions that participants brought forward;
- Some preliminary interpretations of the feedback from the Co-Champions and Action Team as they move forward with the Dialogue; and
- Proposed next steps to close-off the Dialogue process as we move our attention in the Challenge Dialogue to developing a GRM Strategy and Action Plan.

2. The Challenge Paper

The purpose of the Challenge Paper was to prompt a conversation around the following Challenge —

> **Through a focused dialogue open to interested stakeholders/members of the public, create a collective vision and strategy for GRM in BC that supports sustainable forest management (SFM)**

The participants in this dialogue included practicing foresters and managers from government and industry, researchers, consulting firms, academia and forest executives.

The intent of the Level 2 Dialogue was to build on the findings from the Level 1 Dialogue and to extend and broaden the conversation to groups and individuals that have a stake and interest in GRM, but normally operate outside the immediate GRM COP.

The Challenge Paper organized the information into four main content areas, each inviting specific responses from the participants (input requests). These areas were:

- Scope of Challenge and Goals
- Background – GRM Business Objectives and Benefits; GRM in BC and the BC Chief Forester's Stewardship Vision and Framework
- Assumptions
- Proposed Linkages – to SFM and the Future Forest Ecosystems Initiative
- Questions – background, assumptions and questions in eight subject areas of GRM.

3. Feedback Received

There were 54 respondents to the Challenge Paper. The quality of the feedback overall was rich and diverse. The breakdown of the responses was: 16 from the BC government (14 from MFR), 1 external provincial government (Quebec), 8 from industry, 5 from the federal government, 13 NGOs (5 external to BC, 3 US), 6 from the private/consulting sector (3 with strong industry backgrounds) and 4 from academia. All of the feedback has been compiled un-attributed into a document titled *Challenge Paper II Consolidated Feedback.* It is available on the GRM website at www.for.gov.bc.ca/hti/grm_dialogue.htm.

From Co-Champions perspective it is evident that meaningful connection with key stakeholders and members of the public has been made with this second Dialogue. We assume that, among those who have not yet provided feedback, many will still want to follow the Dialogue and the development of the GRM Strategy and Action Plan. Your comments on this Progress Report II, as with the previous Dialogue documents, continue to be welcomed. Please feel free to provide your comments on this report by sending your input by email to officeline@shaw.ca by September 28, 2007 (if you wish to have them considered at the mid-October Workshop). Your input will continue to be used to help shape the GRM Strategy. It will also be used to help guide other GRM work we are doing. We are most appreciative of the time you have taken to provide your views.

We commit to honour and respect your contribution by:

- Working creatively to expand and sustain this open, frank Dialogue;
- Providing our perspectives on the excellent suggestions, ideas and questions you have raised;
- Further assessing and prioritizing the issues raised;
- Assisting participants as they gain alignment and help us develop a GRM Vision, Strategy and Action Plan that will be used to guide the overall program; and
- Using your feedback to help shape the first draft GRM Strategy which will be the focus of a mid-October GRM Workshop.

We invite you to hold us to these commitments.

4. Summary of Key Messages from the Dialogue

4.1 Reminder of Key Messages from the Level 1 Dialogue

As a reminder, here are the key messages that arose from the Level 1 Dialogue with the GRM COP.

- **Climate change** — appears to be the top threat or driver in the view of the GRM COP. There is strong alignment around the urgency of the challenges facing GRM with respect to climate change and the risks (i.e., extreme weather events, extension of ranges for pests, biological stress, etc). A large majority of respondents identified "risk reduction" in the face of changing environments as the top activity in need of more attention and resources.
- **Assessing our future direction is timely** — Respondents emphasized that there are no simple answers to the complexity of the challenges confronting the forests and people of BC. There was general agreement that the current genetics approach has served us well, but it is now timely for review and renewal through the development of a GRM vision and strategy for the province. Many respondents viewed this Dialogue as an important step in developing this strategy.
- **Improved collaboration and coordination important** — Some respondents expressed concern that relationships among various stakeholders, primarily industry and the current MFR initiatives (e.g., Future Forest Ecosystems Initiative), could be improved through better communication, by breaking down the "silos" and by more recognition of the role industry plays in GRM.

4.3 Key Messages from the Level 2 Dialogue with the Public and Stakeholders

We were encouraged by the many comments which indicated people felt the Dialogue was important and valuable. Several respondents acknowledged the improved quality of the Level 2 Challenge Paper over the Level 1 Challenge Paper which was aimed at the GRM COP. This improvement was, in large part, because it incorporated many of the ideas that were put forward in Level 1 Dialogue. A number of respondents said they were interested in staying engaged in the Dialogue and the GRM strategy development. This expressed interest was from participants both internal and external to BC.

A few individuals felt that the current genetics program is fine the way it is, while a few others wondered if the proponents of the Dialogue were not too set in their ways to truly embrace the program changes that are implied from this Dialogue. In response to this concern, the Co-Champions wish to underscore that they are indeed committed to making the changes necessary to address the current and future GRM challenges we face.

Reflecting on the considerable feedback received for this Level 2 Dialogue (some 90 pages),we have identified six (6) initial challenge theme areas from the Dialogue feedback. They are: scope of the GRM vision and strategy; climate change; objectives for genetic

conservation and resilience; the previous prevailing focus on genetic gain; linkages and integration of GRM with other forestland management business areas; future forests and SFM context for the GRM strategy; improved strategic communication; and roles and responsibilities; and, genetic conservation in relation to biodiversity. Here are their descriptions.

1. **Scope of a GRM vision and strategy:** Many respondents felt that the GRM strategy should not be limited to commercial tree species. Non-commercial tree species today have important societal values and may well have important economic value in the future, particularly in consideration of climate change. What is non-commercial today may well be commercial tomorrow. Other dimensions of scope included: inclusion of land outside the Timber Harvesting Land Base and inclusion of private land (i.e., GRM should consider BC's entire land base); consideration of exotics species, particularly those indigenous to adjacent jurisdictions in the US; fuller use of biotechnologies; consideration of non-tree genetic resources, particularly with respect to conservation; and lastly the suggestion that the GRM Dialogue needs to place greater emphasis on socio-economic related values.

2. **Climate change:** As in the Level 1 Dialogue, climate change is a dominant driver in the minds of many stakeholders. References to the complexity and uncertainty of climate change and its affects on genotypes, species and ecosystems were a common refrain. Many associated climate change with the need to find an appropriate level of balance between genetic gain and resilience (ecosystem). Others offered strong support for reviewing and changing existing seed transfer rules in light of changing climate conditions. Tied to this, some people suggested the use of more flexible and parameterizable decision support tools over rule-based approaches. There was also the view that the science of climate change will be changing constantly and therefore management tools will need to be flexible and adaptive to new knowledge. Many echoed the view that change should be cautious, incremental, supported by research and adaptive. Paradoxically several participants advocated quick action; one or two people advocating bold fundamental changes to our thinking and practices.

3. **Integrating and balancing the three prime objectives for GRM — genetic gain, conservation and resilience** in a manner that is complementary to SFM including **improved policy and incentives for GRM** which encourage operational activities that support GRM objectives. Several respondents felt that more explicit objectives and targets for conservation and resilience are needed. They would help to ensure a more balanced delivery of the three key business outcomes for GRM – gain, resilience and conservation. Objectives for resilience and conservation were advocated in a way that would complement measurable targets employed for genetic gain using select seed. Having more explicit management objectives could also guide investment decisions better (e.g., using FIA funding) and SFM policy and practices. They might also be reflected in FRPA policy and practices in the future.

   Several respondents felt that gain should be only part of the focus of GRM; that gain needs to be put into better perspective with conservation and resilience objectives. Concerns raised included whether aggressive select seed use might have an adverse impact on genetic resilience and biodiversity and whether the timber supply

gains projected on the basis select seed use are in fact being realized operationally. For example, what is the effect of natural ingress of wild seed stocks? Some participants felt that we are not effectively monitoring the deployment and effectiveness of select seed in the forest by tracking actual reforestation practices and the results (and from these making appropriate management adjustments) (see also theme '4').

4. **Better linkages and integration of GRM** with future forest management scenarios and the need for improved connections with the *Future Forest Ecosystems Initiative* and ecosystem conservation and biodiversity initiatives; land use planning; forest planning and practices legislation and policy; silviculture; research; forest inventory and growth and yield; timber supply; information management and decision support. Several respondents saw a disconnect between GRM activities and other forestland management business areas and initiatives (as noted in theme '4'). Several felt that stronger effort needs to be made to improve management linkages so that GRM is more integral to the delivery SFM objectives and therefore effective.

   While the *Chief Forester's Stewardship Vision and Framework* was acknowledged as an important start by most respondents, it also raised a number of questions about what we want our future forests to look like (scenarios) and how they would be managed sustainably. A few participants asked if the framework applies to existing forests or some desired future forest conditions yet to be defined. Some noted the importance of employing an adaptive management – continuous improvement cycle more consciously as an integral part of the framework. The term 'natural' in the CF vision statement implied to some that GRM cannot address exotic species let alone genetically modified trees. The Co-Champions will share and discuss these points with the Chief Forester and MFR executive.

   A few respondents advocated strengthening the linkages between genetic conservation and biodiversity. For example there is a need for a stronger association between GRM's genetic conservation work and the provincial biodiversity strategy work being undertaken by MOE and Biodiversity BC. These stronger relationships would help to provide a more integrated and cohesive provincial view of biodiversity from coarse filters to species on through to genetic expressions of biodiversity. It would also help to improve SFM biodiversity reporting using criterion and indicators. This would, in turn, help to improve communication on the status of in situ and ex situ conservation (see also theme '6').

5. **Roles and responsibilities:** Many respondents expressed or implied their support for clarifying roles and responsibilities within the GRM COP. This would include ensuring stronger linkages between key GRM program areas (see also theme '4'). In the area of governance, some advocated expanding the FGC's mandate so that it embraces more fully GRM's three primary objectives. This was balanced against others who felt that MFR should address genetic conservation and resilience and leave FGC to focus on gain. Additional concerns included improved accountability and the need to enhance relationship to people and organizations with valuable expertise outside the province. These thoughts often were advanced in parallel with strong overall support for the current genetics programs in BC. A number of

respondents recognized the strong science-based nature of the current programs as well as the long-standing cooperation that exists among key players.

6. **Improved strategic communication:** Some respondents wondered whether the public is sufficiently aware of the province's genetic resource asset and the current forest tree genetics business area to be able to comment knowledgably about its conservation and sustainable management. Feedback from some stakeholders suggested the need for more effective communication of GRM. For example, some responses to questions on criteria and indicators implied that nothing much is being done in this area to adequately inform these conversations. On the other hand, others felt that monitoring and reporting is already being done well. Whatever the case, the prevailing view was that improved strategic communication about GRM would be beneficial now and certainly in the future.

5. Challenge Paper Level 2 Feedback by Input Request – Initial Synthesis of Feedback

This section summarizes more detailed feedback from those who responded to the specific input requests in the Challenge Paper. The following synthesis is based on all 54 responses. Please refer to the *Challenge Paper* for further context and its content details.

Qualification — Please note that we have attempted to provide the reader with a rough "quantitative" sense of the responses, particularly for those questions of a 'yes' / 'no' nature. This approach was possible for written responses, but less so for responses acquired through interviews. Please keep this in mind with the tallies presented below.

5.1 Scope of Challenge and Goals

Overview

Input Request 1 covered the first and second section of the Challenge Paper. They included respectively "An Invitation to Join the Dialogue" (introduction) and "What Do We Seek to Accomplish"; then "Scope of Challenge and Goals."

As a reminder, the Challenge statement was: ***Through a focused dialogue open to interested stakeholders/members of the public, create a collective vision and strategy for GRM in BC that supports sustainable forest management (SFM).***

Following is an overview of the responses received in relation to the four questions asked.

What additional clarification would help you better understand the Challenge?

There were 24 responses to this question. Half of these responses answered 'yes'. For those that answered 'no', the reasons varied but the two main reasons were concerns

with the narrowness of the scope and the need for greater clarity on the larger (sustainable) forest management context for this Dialogue.

What ideas did the Challenge statement spark in your mind?

There were 30 varied responses to this question. A few of the more common response topics included comments on the complexity and uncertainty related to climate change, again the apparent narrowness of the scope of the Dialogue, the challenge of striking the right balance between gain, conservation and resilience and the value in working more closely with neighbouring jurisdictions.

Are we missing any important considerations?

There were 27 highly varied responses to this question. Across at least half of the responses there was a theme that sees GRM linked integrally to the challenges of forest management and hence having to grapple with the inherent complexity of ecosystems and how their management may be made even more complex given the uncertainties of climate change. Other important considerations noted included — building stronger context regarding the high rate of change that is occurring today environmentally, economically and socially; the relationship of GRM to biodiversity objectives and the conservation of the whole forest more broadly; challenges with in situ conservation strategies and climate change including how they would play-out with landscape level management; linkages of GRM to higher level plans; stronger integration of GRM with silviculture; more information on changing natural tree ranges; and benchmarking BC's GRM program with other jurisdictions and learning more from these parties.

What other outcomes or expectations do you have for this Challenge Dialogue (as in "I would consider this Dialogue a success if...")?

There were 29 responses to this question. No one expressed opposition to the four outcomes listed in the Challenge Paper (page 2).

A number of participants hoped that the Dialogue would raise overall awareness and hopefully understanding and ownership of the importance of GRM including from a more integrated perspective. Some expectations were general, for example, that it — results in broad-based consensus; engages outside players; recasts problems in a larger context; defines a set of GRM principles; establishes a clear path forward and an action plan; and leads to greater cooperation among all players.

Other responses focused on the achievement of results in the forest, for example — a diverse resilient forest; better planning capability for reforestation to meet future needs; a fundamental rethink of our reforestation techniques; longer-term results that count (making today's decisions even more critical); more accurate (e.g., 70%) forecasts of climate change and stand development; and, exemplar SFM practices.

A few participants hoped the Dialogue would provoke some out-of-the-box thinking – to "think the unthinkable" or to bring forward novel ways of looking at forest management.

Below we have provided more detail on the responses received from Input Request 1. The information is organized by comments related to scope, definitions, the broader context for the GRM Dialogue and stronger linkages to silviculture (among other forestry program areas).

Scope

Thoughts put forward on the scope of the subject included the following seven(7) dimensions.

The strategy should address the present and the future forest. In the Challenge Paper it should say — *better adaptation and resilience needs to be thought about for the present forest as well as the future forest.*

The apparent restriction of the land base being included was a concern to several people, specifically they wondered — *why is the focus only on Crown land within the Timber Harvesting Land Base (THLB)?* They also noted that this land unit is not static.

> *What strategies will be developed to address adjacent private or non-THLB and impacts on managed forest ecosystems? Among the targeted customers of the strategy is the public — …they expect that a 'Strategy for the conservation and management of forest tree genetic resources' should not, at the very beginning, restrict itself to crown land.*

Many expressed concerns with the focus being only on commercial species pointing out that what may be commercial today may not be tomorrow for a number of reasons, including market changes and climate change.

- *Many of our genetic conservation priority needs are with species that are not currently commercial. Are we looking only at present or future "commercial" importance? If biofuels proves viable, the commercial importance "playing field" expands dramatically.*
- *The province should ensure that we have representative genetic resources from as many native species as we can practically manage. To concentrate on commercially viable species is to ignore that these priorities are set by markets which are capricious and ignorant of the critical relationships that make up healthy ecosystems*

Expanding this argument further one respondent questioned whether GRM should not include all trees, shrubs and herbs (non-tree). This line of thinking then raised the question with some participants of how GRM relates to provincial biodiversity and ecosystem and species conservation objectives.

- *Biodiversity considerations were not mentioned explicitly.*
- *While I understand that the scope of this work is for indigenous tree species in the THLB I do think the initiative would benefit from dialogue on other forest ecosystem genetic assets.*

A few participants were concerned that the Dialogue was unnecessarily restricted in terms of GRM biotechnologies — seed orchard technologies, GMOs, somatic embryogenesis and other biotechnology advances.

- *Why is the discussion limited to conventional seed orchard technology? … at a minimum we should have a knowledge of [GMOs] as one possible mechanism by which we can respond to environmental risks and hazards with the overall objective of trying to maintain a more persistent and yet resilient forest dominated ecosystems.*
- *I do not understand why (somatic) embryogenesis is not being pursued as a means of further exploiting the range of variation in genetic resources and as a means of conferring new genetic capabilities within a species or species sub-population?*

Two respondents felt the Dialogue should include a better discussion of exotics. This concern was expressed later on in the responses by four other participants. It is also discussed later on in this report where we discuss the responses to question 3.3. Somewhat linked to this view, a few respondents felt there was too strong of a BC orientation to the discussion, particularly when you consider that factors that influence forest management, hence genetic strategies operate, are beyond BC's borders.

> *If we restrict our vision to BC genetic resources only, our focus may be misdirected. Current genetic resources may not be that relevant to future ecological needs. If species migration through climate change does occur, some thought should be directed to new commercial species as well. Are we talking about native tree species only, or it includes exotics used for a long time in reforestation. What about species introduced since 20-30 years only (e.g., Norway spruce in BC?)*

A few respondents, one directly and a few implied, felt the Dialogue needed to expand more into the social (including ethics) and economic dimensions of the GRM strategy.

- *[I am] surprised by the narrowness of scope and the wholesale avoidance of the subject of ethics; the public interest would include the subject of ethics … any vision and strategy must be aligned with the public's ethical views.*
- *An argument could be made that the rates of change in environmental (climate change), economic (globalization) and social (First Nations) aspects of forest management are higher than in past decades, making it more important now to have a compelling vision and effective strategy for GRM.*
- *[Do the] stated goals of GRM supersede the historical balance of ecosystem management with the need for social and economic benefits - in other words, do we still primarily see forests as a resource to be harvested or an ecosystem to be managed?*

Definitions

A few respondents indicated that the inclusion of some definitions would be helpful for clarifying the interpretation of the nature and scope of GRM. One person included definitions for 10 terms — natural reproduction, selective breeding, cloning, clone,

genetic engineering, recombinant DNA, somatic cell, somatic-cell hybridization, somatic embryogenesis, transgenic, and transgenic plant.

Another person suggested that there was a need for clarification between terms like genetic diversity and biodiversity — *There is mention of genetic diversity and its effect on resilience. However, although genetic diversity and biodiversity are related, they are also different. Thus, the terms should not appear to be used interchangeably. Further, both should be discussed in some detail.*

Another respondent asked — *what does conserve mean with respect to gene conservation?* Another person said — *I question the accuracy of definition for Genetic Conservation: "Under Genetic Conservation – "allows plants to adapt" is incorrect; populations can adapt, but individuals either are or are not adapted.* Further *… some of our tree species with broad ecological amplitude have been shown to have low levels of genetic diversity.*

We were also informed of the term "inter situ" — *pedigreed genetic materials in genetic trials (provenance and progeny tests) as part of the breeding program*[3]

Two respondents raised questions about what the word "natural" meant with reference to the Chief Forester's Vision statement along with wondering what values are to be maintained under this SFM framework.

The Broader Future Forest – Sustainable Forest Management Context for GRM Dialogue

The Dialogue provoked some big picture contextual questions with respect to how we intend to manage forests into the future. Often included were questions about how we intend to address the complexities of climate change and new challenges brought on by the Mountain Pine Beetle in the interior or the forest management transitions on the coast. These thoughts led some to suggest that there is a contextual need in this Dialogue to understand and develop scenarios for alternative future forests.

- *Do we have a common understanding of the future forest condition that we are all working towards? Have we identified and articulated our assumptions – it would be nice to see the goals of this challenge grapple with some of these assumptions especially around what we are trying to grow and why and are we able to adapt those assumptions quickly as things change?*
- *I would like the public to be able to see what the choices are for the future of forests in BC. This requires us to have information on what are the range of possibilities. … Is what we have been doing in the past, adequate for us to make proper decisions for the future of BC forests?*
- *Is a forest GRM strategy capable of addressing anticipated or imagined future environments, on a forestry time scale? …can we forecast via models to develop a range of possible future scenarios that could focus strategic planning?*

[3] Alvin Yanchuk defined inter situ conservation in his 2001 paper in Can. J. For. Res

Sustainable Forest Management — The introductory section of the Challenge Paper cites SFM liberally throughout the various statements made and references forward to the Chief Forester's Stewardship Vision and Framework. As a result, there were a number of responses to the concept of SFM itself and in the context of GRM. While the feedback for Input Request 2 will address this in more detail in the next section, a few points are warranted here. The comments vary, for example — have we really thought through what we mean by this management model; concerns for the lack of clarity on how GRM can be linked to SFM if SFM remains largely conceptual, and doubt about the will and commitment of government to truly move to this kind of model.

- *The process the Chief Forester is undertaking in this project is, in my mind, the top priority. It is critical to do the thinking and to not shy away from difficult questions. In the context of GRM, particularly within the bigger context of SFM, the easy answer is unlikely to be the best one.*
- *How will strategies link to SFM if SFM vision, goals and objectives are not clearly defined and explicitly stated?*
- [Government and industry] *regard our forests as a source of generic no-name fibre or of cellulose feedstock, rather than as complex ecosystems providing multiple products, services and benefits… The consequences of either philosophy and operational approach—fibre farm or forest—are profound for a GRM strategy.*
- *Are we managing for industry and their needs of fibre production or are we going to manage for all interested stakeholders?*

Stronger Linkages of GRM to Silviculture

Several respondents raised concerns that GRM is not as strongly linked to the silviculture business area as it should be. The objectives of the two business areas need to work more hand-in-hand and as a continuum — a value chain if you like — with clear feedback performance loops. Often tied to this comes the question of balance between genetic gain and resilience. Implied in many of the comments was the need to improve relations and integration with a number of other forest management business areas.

- What's missing — *How genetic resource management should be integrated with other silvicultural options and obligations in a land-use and resource-emphasis context; i.e., how to have different goals and objectives in different places on the landscape.*
- *The focus seems to continue to be on fast growing trees, with less consideration for silviculture regimes and the variety of site conditions that we must deal with in the province. Pest resistance, drought resistance, frost resistance, etc. are all equally or more important. What we are really concerned about is the longevity of trees in the face of more variable environmental conditions – we could generally accept some reduction in growth in return for increasing the likelihood of persistence.*
- *There is incredible support in terms of expertise and program $ to select, breed, test, research, and re-select trees, and to produce seeds for reforestation. From*

there we basically turn that over to private enterprise (nurseries, site preparation, and planting crews) cash in our AAC chips and hope for the best. It doesn't seem efficient to put all this effort up front, but basically not invest very much into the establishment phase of a stand. …This is probably the point at which a stand is most susceptible to failure, so how can we not support research or continuous improvement efforts in this area?

Suggestions and Ideas

Several respondents brought forward suggestions. They are in the areas of gain vs. resilience, policy and practice, communications and partnerships. The direct quotes below speak for themselves.

Thoughts on gain vs. resilience

- *While faster growth may provide economic value considerations, perhaps there are other environmental/ecological reasons that plants (trees) have slower growth rates, and if we move to accelerated growth too broadly there may be unforeseen consequences on other parts of the overall biology of our forests and the values therein.*
- *The Challenge raised the question about balancing the need and interests of conservationists and tree breeders, whose interests could be seen as being very different. How much diversity is enough to maintain the diversity that may be needed to address the future unknown challenges?*
- *What we are really concerned about is the longevity of trees in the face of more variable environmental conditions – we could generally accept some reduction in growth in return for increasing the likelihood of persistence. This also suggests that there is a need to better characterize genotypes relative to a wide array of physiological attributes and to connect an understanding of these attributes to growth and survival in the variety of site and stand conditions…*
- An Analogy — *The [Challenge] statement is suggestive of the early goals of fish breeding and hatchery programs. Hatchery programs for salmon are now believed by many to have had a negative impact on wild stocks and actually decreased the "resilience" of natural systems.*

Policy and Practice — the prevailing view here was for greater flexibility and fewer restrictions and barriers.

- *Need for flexibility and adaptive prescriptions in the wake of the unknown.*
- *The Challenge should also be aimed at identifying policies and practices that are barriers to GRM.*
- *More incentives and freedom to manage GR, rather than more restrictions.*

Communications — One respondent suggested illustrating in simple terms where GRM plays a role throughout the SFM process as a way of improving the understanding of GRM among stakeholders and the public — *What are the key steps and implications? If nothing else, it will convince them they are already GRM practitioners. … if you really*

want a dialogue you'll also put the challenge into a form more digestible by the practitioner who doesn't really work in the world of org charts and boxes. What is GRM to the forest practitioner? Can we have a temporal illustration through the life of a stand?

Partnerships — A few respondents suggested building stronger relationships with neighbouring jurisdictions to share management experience, genetic material and to benchmark the GRM work in BC. In the direction of biodiversity, stronger linkages with MOE were recommended.

- *Improve partnerships with neighbouring jurisdictions particularly those that share management models, such as the Yukon and Alberta. Better links to Washington, Idaho and Montana.* From another: *We need to work with adjacent jurisdictions to share genetic material to achieve maximum flexibility.* And: *Look at other jurisdictions, states and countries to see what others have done to address the challenge…*

5.2 Background Statements

Overview

Respondents demonstrated strong interest in the background material, with 43 out of 54 providing some comment. More than half of these providing detailed comments on the topics presented, including seed transfer, genetic diversity and genetic gain, etc. These comments will provide a rich resource for the champions and COP during the course of the Challenge Dialogue and development of a GRM Strategy.

In response to the three questions posed in Input Request 2, a simple numerical analysis of the comments received shows the following.

Is there anything in this background section that you find confusing, inaccurate, or surprising?

There were 39 responses to this question; with 14 of these providing extensive comments. Eleven (11) explicitly stated 'No' they did not consider the material confusing, inaccurate, or surprising.

What questions does this background material raise for you?"

There were 33 responses; with 12 of these providing extensive comments.

In your view, are there any other key background topics or points that should be explored?"

There were 27 responses; with 6 of these providing extensive comments.

The following key themes emerged from the responses received to these three background questions.

Scope of GRM

Consistent with reactions to the scope and challenge (Input Request #1), several respondents commented that GRM should include a wider range of species and not just commercial tree species, particularly in view of the need to be more anticipatory and proactive in dealing with pressures like climate change. There were also several comments and queries about the role of GRM in relation to timber supply.

- *Native vs exotic species: "Why is tree improvement limited to native species? If the climate change scenarios play out as radically as predicted, then how can exotic species not be part of the tool bag?*
- *The comment related to tree species which stated "focus on those of commercial importance", raises some alarm bells. We must be very careful not to assume that the species and product lines most valuable today will continue to be so in 50 to 80 years from now. We have many examples of species that were weed species 10-20 years ago and are now commercial species.*
- *GRM conservation, genetic resilience and gain objectives seem to contradict goal of managing "natural" forests.*

Genetic Volume/Value Gain

Reinforcing views in the previous section, several respondents voiced the perspective that gain should be about increasing the value of all of BC's forest resources, not just on crown land, not just volume and not simply timber values.

- *Genetic volume and genetic gain should specify that it means increased volume, but also increased value or margin of wood products. GRM is a "value added" investment.*
- *As the land owner, the Crown, I wonder if we should not be looking at this front-end quality opportunity much more aggressively. As we look at the Coast where we are harvesting a significant amount of second growth now, it is fairly obvious that volume is not the solution. It is quality that gives us an edge. It is the quality stands that have the greatest value. It is not the stands that have a whole bunch of small trees and lots of volume.*
- *Do we really know enough about what we may lose when focusing on genetic gain? If we don't, we need to learn by doing via an active adaptive mgt approach. In other words, use of select seed to attain timber values needs to be well integrated with non-timber values*

Several respondents were concerned with the claim about genetic gain resulting in "reducing pressure on the land base."

- *…while select seed can benefit timber supply, this is extremely rare in the short term. There is no substitute for land in the long term or the short term, and in the short term existing merchantable (often old growth) stands are needed to sustain timber supply. No amount of genetics can change the latter fact, thus genetics will not 'reduce pressure on the land base".*

- *Reducing pressure on the land base is good in theory but doesn't work in practice. All GRM can do is ameliorate to some degree the reductions in timber supply.*
- *"Reduced" pressure on land base is misleading – the pressure will continue because the timber (or fibre) supply will never surpass the need. And some other needs for the land base will also increase over time. This is just another way of stating increased timber supply.*

Genetic Diversity

The comments related to genetic diversity pointed out that this concept is poorly understood and requires further discussion:

- *…there is a poor understanding of genetic diversity, how it is measured, how much we need and if we don't know what the future will be like - how do we know we have enough? I receive very little comfort in this area from current legislated effective population size requirements. There needs to be better communication and extension in the areas of genetic diversity as this is the very foundation of GRM.*
- *Concerned that trying to meet objectives related to volume gain may result in lost genetic diversity which could compromise a forest's ability to evolve and adapt. If promoting volume gain for economic reasons, what might we lose with respect to social or environmental values? We need to assess/consider this to support decisions.*

Genetic Resilience

The concept of genetic resilience raised several questions from respondents, indicating that there should be further clarification of the term and how it applies to GRM in BC. Comments received included:

- *The definition of genetic resilience as stated here is not the standard ecological definition of the concept. i.e. 'Resilience is measured by the magnitude of disturbance that can be absorbed before the system changes its structure by changing the variables and processes that control its behavior." So, the matching of a genetic stock with a suitable environment is simply a desirable management practice in a stable environment. It does not say anything about the resilience of the system per se*
- *The section on selection is inconsistent with the section on building resilient forests. In general, populations selected for specific traits are less likely to survive natural disturbance, although they may provide enhanced benefits for variable periods of time.*
- *And what about genetic resilience of natural forests? In some parts of the forest, maybe forest management practices should be revised to favour certain species that are more adapted to dry sites! Knowing that a northern migration of species will happen, it could also mean that in the forests located north, we should favour*

the maintenance of certain species that are marginal for the moment! This is another means of conserving genetic resources.

Chief Forester's Stewardship Vision and Framework

The Chief Forester's stewardship vision and framework was raised several times by respondents. Some pondered over whether the vision represented the current state of affairs or a desired future state. Several were concerned that the SFM framework was not an adaptive system and that there needed to be improved mechanisms for feedback and adjustment. Two respondents raised questions about what the word "natural" means in this context and what values are to be maintained under the SFM framework.

- *Because of the wording in the document, I am not clear if the Chief Forester's stewardship vision is a statement of present condition or if it is forward looking.*
- *How can the Chief Forester achieve his role of "oversight of key decisions governing SFM on Crown land when the mechanism that appears to be in place (FRPA) does not include some of the key elements of SFM?*
- *Framework needs feedback loops. Static SFM model won't get us anywhere. So many perturbations and changes (e.g., biogeochemical cycles, genetic drift, changes in disturbance regimes) challenges us to assess sustainability given changing ecosystems. Need dynamic model (e.g., limits to growth modeling)*
- *GRM plans are still timber production focused. This limits the opportunities to achieve the economic and social benefits of SFM. Avoid making "feel nice" statements beyond timber if this focus is to continue.*

Several respondents noted that the new GRM-SFM relationship Figure 2 was an improvement over the previous three-pillar diagram. In addition, there were some helpful suggestions:

- *In Figure 2, Conservation is not only about "Conserving the genetic legacy". I would say "Conserving the genetic legacy and potential for evolution, adaptation, and breeding"*

Seed Supply and Seed Transfer

There were numerous comments related to technical aspects of seed supply and seed transfer guidelines that are beyond the scope of this summary document (please refer to the detailed feedback material for these). There was a general acceptance of the material presented on this topic. Most comments urged expansion of the topic in the future. Several respondents mentioned the need for flexibility in the GRM system to be able to respond to emerging environmental and economic pressures. Other comments included:

- *Presently each licencee looks after their own respective needs by collecting class B seed or purchasing (acquiring) class A seed. It appears to be a non-collective process and it appears to me that nobody is monitoring the whole picture respecting seed banks, seed source, available supply and long term seed*

viability respecting growth and yield. Who should be responsible for designating and allocating seed production stands by TSA?

- *As the potential for our climatic conditions to change so significantly, do we have enough flexibility in our GRM systems to deal with changes in seed transfer zones and how flexible will they be when we may have to be make some tradeoffs between performance and survival as the climate changes?*

Genomics and Biotechnology

The topic of genomics and biotechnology was raised several times, with the perspective that it should be covered more thoroughly in the future (in the Challenge Dialogue) and should be given higher profile in future GRM strategies. Several respondents stressed the need for more emphasis on the role of genomics and biotechnologies, and considered the current approach outdated.

- *I hope the biotechnologies are applied in the field and not solely in the seed orchards. This scope is far too truncated to reflect on actual genetic diversity across the landscape.*
- *Genomics is better defined as the study of genes and gene function in the context of the genome. It is the context that matters in this case, insomuch as it allows research into functions and interactions of multiple genes, etc.*
- *The paragraph singling out genomics and other biotechnologies would be better presented in a section about technology platforms that apply to the objectives described immediately above (increased timber supply, pest resistance, wood quality, reduced pressure on land base) just as tree breeding does. Thanks to recent advances in association genetics, genomics can now also have applications in the understanding/management of natural tree populations.*

Reactive vs. Proactive Strategic Approach

There was a concern that the current approach is directed toward preservation of the status quo as opposed to positioning GRM to be more proactive in anticipating environmental change. This concern resonates with the intention of the Co-Champions (and many GRM practitioners) engaged in this dialogue to craft a strategy that is very much proactive and forward-looking.

- *Much more attention needs to be paid to managing the genetic resource in preparation for and in anticipation of environmental change. How can we better obtain and use knowledge of genetics to mitigate the potential impacts of climate change on forest resources and communities that depend on them?*
- *Historically most of the discussion was focused on genetic gain and disease resistance to some degree. In terms of conservation, I don't recall there being much discussed about the creation of populations that are more resilient to natural disturbance events, today of course the main one being those related to climate change. And there may have been some notion of managing genetic resources at the landscape level, but for the most part is has not really been*

dealt with much. The Challenge Paper however, leads one to believe that the program has already addressed this landscape level consideration. I am not sure that it has, or at least not as definitively as it is implied in the Paper. It implies the COP is way further ahead than I think they are.

- *It concerns us that many of our predictions of future growth are predicated on silviculture practices that are not happening today. Genetic improvements on their own are not a panacea.*

'*In-situ*' Role of Parks and Reserves

Several respondents mentioned concern that there was an overemphasis on the '*ex-situ*' aspect of GRM, and not enough on the '*in-situ*' role of parks and reserves. These views are reinforced later on when we discuss reactions to Question1.

- *The genetic conservation section is really just the standard nursery program with an opportunistic overlap with the protected area program. However the relative importance of the in situ reserves and other resilient management techniques should be seriously reconsidered in relation to the objective of this exercise.*
- *If parks and ecological reserves are in-situ storage, do we have an inventory of the genetic resources here? If not, it is needed to support the statements in the paper.*
- *The in situ aspect of GRM conservation seems to be very much the poor cousin to the ex situ effort. In that regard, are the right types of stakeholders engaged in this Dialogue for good input to the in situ discussion?*

As noted previously, one respondent commented on the need to include "inter-situ" in the discussion:

- *Under GRM in BC, Inter situ conservation again needs to be addressed.*

Suggestions and Ideas

- *In GRM Business Objectives – the first sentence should be amended to read "…are genetic conservation, genetic resilience, and genetic gain of commercial tree species."*
- *Under GRM in BC (pg 6)… the third bullet under goals should say "addressing modifications to seed movement under climate change scenarios."*
- *Throughout the document the word "adequate" should be changed to the word "appropriate". We need to be delivering a message that we are doing more than just enough to get by.*

Questions and Possible Areas of Confusion

- *How is deployment monitored at the genetic resource level (is it?)?*

5.3. Assumptions

Seven (7) key assumptions were outlined in the Challenge Paper (page 8). The following feedback was received.

Assumptions that require more clarification for you to understand

Of the 27 respondents to this request, 10 stated there was no need for further clarification. Seventeen (17) either requested or offered clarification or comment on some of the assumptions with examples noted below. In general, the feedback suggests the assumptions were understood with some suggestions or comments offered to improve clarity.

Assumption #4 received the most feedback — Climate **change is one of the key emerging issues that a GRM strategy must address. Seed transfer rules need to be reviewed so that they are responsive to expected climate change and provide genetic resilience in future forests (a key FFEI desired outcome).**

Some noted the importance of continuously re-evaluating seed transfer rules as information about climate change improves over time. Some responses to assumption #2 questioned whether the public even knows about GRM let alone supports it. Some feedback on assumptions #1 sought clarity on how GRM fits into SFM.

- *I think that it's critical that seed transfer rules will need to be constantly re-evaluated as climate change information changes in order to remain responsive.*

Assumption #1 — GRM is recognized as an integral and important component of SFM

- *GRM is one component of SFM. We need to understand and articulate how it links and interacts with all aspects of SFM.*

Assumption #2 — The public supports the need for protection and investment in the conservation and sustainable management of the province's genetic resource asset.

- *…it detours around whether the public supports the tree improvement program. It's given that no one will object to forest protection or genetic conservation investments, but what does the public know about or say about tree improvement?*

Assumptions with which you strongly disagree

Twenty-four (24) respondents addressed this request including 12 who stated that they did not strongly disagree with any of the assumptions. Several of the remaining 12 respondents offered suggestions, which did not suggest strong disagreement. Some clearly did disagree with one of the assumptions. For example, as illustrated below, some respondents questioned the publics understanding of GRM (assumption #1); our ability or desirability to manage gene resources (assumption 2); our ability to predict

climate change outcomes sufficiently to support seed transfer rule changes (assumption 4); the implication that GRM is too complex for one organization alone to address (assumption 5); and need to support government objectives (part of assumption 7).

Assumption #2 — The public supports the need for protection and investment in the conservation and sustainable management of the province's genetic resource asset.

- *I would question whether the public really understand the need, let alone support it.*

Assumption #3 — The "state of the forest," and hence its genetic composition and gene pools, is constantly changing and needs thoughtful management – particularly given climate change and recent disturbance events such as the Mountain Pine Beetle infestation.

- *I am a little concerned with assumption 3 – that we can manage the genetic composition and gene pools on our landbase – our landbase is very large and many areas are outside of our scope to manage…*

Assumption #4 — see above.

- *Climate change is definitely a huge emerging issue. At this time, however, we do not understand it well enough to be able to predict outcomes or to categorize it. We need to guard against making premature assumptions or decisions.*

Assumption #5 — There is a need for an encompassing and cohesive GRM strategy that enables GRM stakeholders (government, industry, NGOs, private firms, and universities) to work more closely together to address complex SFM challenges with GRM. This is a challenge that no single organization can address on its own.

- *Only MOFR has responsibility for the FUTRE public forests of B.C.!*

Assumption #7*:*

- *Compatibility with existing government objectives may not be possible, nor advisable; maybe government objectives will need to change in response to a revised GRM policy.*

Additional assumptions that you would like to add

Of the 26 respondents who replied, 6 had no suggestions, while 20 offered some suggestions for new assumptions or further comments in general. There was no obvious pattern to the suggestions offered – in fact, they ranged widely. Suggestions made by more than one respondent included better links to biodiversity; questions regarding compatibility of three GRM objectives; need for better information and knowledge through research; and the need to consider potentially new products from the forest .

- *Biological and genetic diversity at both the stand and landscape level leads to more robust and resilient forests.*

- *It needs to be explicitly stated that we are assuming that the objectives of meeting genetic gain, conserving genetic diversity, and enhancing resilience are compatible….It is assumed that what is good for the growth rate of commercially harvested conifers is good for the health and sustainability of the forest.*
- *Research is required for an accurate understanding of the state of genetic resources in BC, its evolution over time, and the genetics that provide resilience to a given genotype.*
- *Assumption in this document is one that is not stated at all – there is an assumption that there are no new products to come out of forest trees, that is to say there is no idea that discovery of tree functions will lead to new medical, agricultural or forest products. Really?*

5.4 Proposed Linkages

Two key linkages were profiled in the Challenge Paper as being particularly important to GRM: (1) the Chief Forester's Stewardship Vision and Framework for SFM, and (2) the Future Forest Ecosystems Initiative (page 9-10).The question asked was:

Does this way of thinking about how GRM supports the Chief Forester's Strategic Framework make sense to you? How could it be improved?

Based on the 33 responses, for the most part, respondents who replied felt the proposed linkages between GRM components and the Chief Forester SFM Strategic Framework make sense. Sixteen (16) respondents indicated that 'yes' they make sense with some providing supplementary thoughts. Of the 17 respondents who did not indicate 'yes', some offered relatively minor suggestions for improvement. These comments did not imply disagreement. Others offered more substantive ideas for improvement. There were also some comments which questioned the linkages or offered suggestions regarding Figure 4 (Linkages between GRM and SFM). Following are examples of some of the feedback.

- *This is a logical way of thinking but is a conventional and constrained bureaucratic approach, amounting to a tweaking of the existing way of doing things. Doing the same things but doing them harder and better is an unwise approach to unprecedented events and conditions. Therefore, rethink everything, starting with first principles.*
- *I think there should be a think-tank of sorts that is created to provide vision, discussion or a forum in which BC constantly prepares for the future.*
- *It seems so focused on trees and not forest ecosystems? Will there be a link to other forest ecosystem attributes besides fibre? Is GRM just about the trees?*
- *Without a connection to SFM goals, indicators and targets, it will be difficult to measure progress. The Chief Forester has to create these and then have GRM demonstrate how they are contributing.*

What opportunities do you see in the links with FFEI?

Feedback from the 22 responses generally underscored the importance of linking GRM with FFEI.

- *To have geneticists, ecologists and foresters all pursuing a common goal!*
- *Hopefully it will reduce the occurrence of one-off studies that have low utility and increase cohesion and utility (of the) work that is carried out.*
- *The linkages appear very tree harvest focused. Links to ecological and social values not clear or explicit.*
- *The two initiatives have to be linked together. Our future forests depend on what we plant in terms of species and genetic material. The resilience of our future forests starts with what we put in the ground.*

The second question in the Challenge Paper was **— Are there other key initiatives with which the GRM strategy should be linked?**

Of the 25 who responded, 20 provided a wide diversity of ideas. This suggests that the GRM Strategy needs to be linked effectively to a variety of important initiatives. Examples of a few of the many ideas offered include the following. Note, while some of the suggested linkages are not noted here, they will be used later when developing the GRM Strategy.

- **Genetic diversity and biodiversity** *… there needs to be a link made between the discussion of genetic diversity and biodiversity. Any initiative(s) with the latter should be linked here.*
- ***Forests for Tomorrow**, with its species selection emphasis, is a critical GRM link.*
- ***CONFORGEN** is a national genetic conservation initiative and CAFGRIS is a national information system on genetic conservation. They are both slowly moving forward and are currently linked with FGC.*
- ***Climate change initiatives** of government are key*
- ***MPB Action Plan***
- ***Biodiversity BC — Biodiversity Strategy***

5.5 Questions

#1. Genetic Conservation

1.1 Do you believe that forest tree genetic resources are adequately conserved through parks, reserves, forest management practices, and existing in situ and ex situ gene conservation efforts?

Of the 41 respondents, 13 answered 'yes,' but a number with qualifiers.

- *Unquestionably yes.*
- *Yes. However it is unrealistic to expect that every population of every species can be conserved.*
- *I would tend to say yes. …with climate change, some minor species with limited natural range might be at risk. In situ conservation might not be sufficient and human intervention might be necessary (facilitated migration).*

Fourteen (14) said 'no', a few of these though implication. Most of those that felt the current conservation approaches were inadequate provided reasons, several due to climate change or the concern that parks and protected areas are not explicitly measured or managed for conservation objectives.

- *not really – climate change seems to put this idea at risk.*
- *The analysis suggests that a significant number of the BEC variants are represented in the protected area system. However, an assessment of how well these areas will perform with climate change is an important consideration. Also, this is the zoo argument. Is it sufficient to have representatives only in protected areas or do we need to have the operational plans adjusted in recognition of the importance of genetic variation?*
- *No. I think that we have failed in our park systems to manage for values. Our parks are too small to think that we can just ignore them and we will somehow achieve our values.*
- *No. We don't have redundant representation which we need, and some representation is too small and/or fragmented to allow ecosystem functions to continue. Loss of ecosystem integrity and species mix via species simplification can lead to ecosystem collapse and facilitate spread of invasive alien species.*
- *Not enough attention to hardwoods.*
- *Although I may answer no to this questions, one must be realistic in terms of what is reasonable and affordable to conserve.*

Thirteen (13) said they 'didn't know' or implied this. Nine (9)of those that 'did not know' said it was because they had inadequate information to properly answer the question either in terms of inventory/survey data or targets against which such data could be evaluated.

- I don't *believe* or disbelieve, I don't have enough information.

- *Adequately conserved? Adequate enough to do what? What would be the metrics of success for estimating adequate conservation? I would suggest we need some sort of a priori target, perhaps 70% of existing natural genetic variability within each species is conserved through parks, reserves, forest management practices, and existing in situ and ex situ gene conservation efforts?*
- *Can't answer this question because we don't know what % of tree genetic resources are captured in existing parks, reserves, management practices etc.*
- *How do we know about conservation in parks with limited inventories?*
- *The feedback I recall via FGC discussions is that this ranges from being in very good shape for some species and very poor shape for other species.*

Questions

A number of the answers included legitimate questions about conservation.

- *Is the status of the clone banks, particularly with regard to select genotypes for future breeding, well documented?*
- *[What is the] status of banked seed for minor species not reviewed.*
- *Is any one person familiar with our capacity for genetic capacity in ex situ gene conservation efforts?*
- *I think that the forest management piece needs to be thought through more. What happens after 2 or 3 rotations of plus trees on given site? At what scale should we promote diversity; within stand or within landscape? How do retention harvest approaches interface with GRM?*
- *On which basis lies the assumption that BC's native tree species are not at risk? Gap analysis!*

Corrections Noted

One respondent noted some important corrections to the background material for this question.

- 2nd bullet – *in other initiatives, field tests are being considered part of inter situ, not ex situ, conservation.*
- 3rd bullet – *the UBC Centre for Forest Gene Conservation (CFGC)(NOT just Centre for Gene Conservation) is also doing a lot of work on climate change related issues for both in situ conservation and reforestation. This should be included here.*
- 4th bullet – *I would hope that it could say the MOFR and FGC are working with the CFGC to develop science-based criteria.*

1.2 What priorities and improvements can be made to better conserve BC's forest tree genetic resources?

Only one respondent felt that no major changes were necessary. Otherwise a rich assorted set of suggested improvements were offered by 22 respondents. Some of the obvious priorities across these responses included: completing the work of the UBC Centre for Gene Conservation including the development of plans to address gaps; the need to objectively measure and evaluate the situation, including a critical examination of the use of parks and reserves, and the development of strategies and targets; and the need to pay particular attention to Lodgepole Pine in light of Mountain Beetle affects. Following are some direct quotes to illustrate these categories of responses.

Assess Status, Develop Targets and Strategies to Achieve

- *Do we know enough about what genetic resources need to be conserved, at the species level and beyond (i.e. specific genotypes)? What is the current state of conservation?* Another said: *Do you have a comprehensive inventory of the genetic resources in the current BC forest? If not, how can you demonstrate and report on the state of the forest relative to GRM?*
- Status:
    - *Banked seed in all tree species; ensure banked seed from across range for species adequately represented.*
    - *Minor species in managed forest areas (outside of parks, reserves, etc). Banked seed for minor species not reviewed*
    - *Conservation status of threatened or minor species in neighbouring jurisdictions (Alberta, Yukon, Alaska, US PNW), and develop joint conservation strategies if appropriate.*
    - *Clone banks, particularly with regard to select genotypes for future breeding*
- Measures:
    - *[we need] methods to improve our ability to measure tree genetic resources – e.g., find out what is there.* Another said: *[we need to] set the criteria, indicators and targets and measure progress. Without these you don't know how well you are doing. It has to fit into the goals, indicators and targets of the Chief Forester's vision.*
    - *I wonder if ex situ, specifically seed bank samples, are comprehensive enough both in terms of size of samples and provincial representation*
    - *Given priority to the sustainability and adaptability of in situ gene resources at all levels, not just one ex situ seed bank and a few seed orchards.*

- Targets and strategy:
    - *Set conservation target and align seed supply efforts to match provincial wood supply strategy in terms of anticipating future rate and patterns of harvest.*
    - *Proactively consider gene conservation in the selection of reserves such as parks and protected areas (i.e. rather than just assessing how parks and protected areas contribute to gene conservation as a by-product of the decision).*
    - *Set the goals for the various reserves and manage where necessary to achieve those goals.*

Parks and Reserves

- *Current model of static reserves is doomed to failure due to dynamic changes such as climate change (e.g., if old growth we are counting on for biodiversity in a park burns)*
- *Parks and eco-reserves do not provide adequate coverage and proving grounds for the natural selection of trees to changing conditions; this should be part of the role that old growth management areas (OGMAs) and OGMA recruitment stands play in every Landscape Unit.*
- *The majority of Parks and Reserves are not administered by the MOF and therefore there is a disconnect between those managing the parks and those wanting to attach genetic conservation value to these parks.*

Lodgepole Pine Priority

- *Since lodgepole pines in BC are being impacted by MPB, both in natural stands and in MoFR genetic reserves, a great deal of attention needs to be paid to conserving as much of the genetic diversity of this species as possible.*
- *Priority should obviously be placed on protecting genetic resources of species that are most at risk and represent the most serious economic consequences (e.g., – lodgepole pine)*

Other Noted Suggestions and Ideas

- **Conservation of superior phenotypic trees** *— There is very little ground level conservation of superior phenotypic trees. No tree species are at risk of extinction, but their ranges and abundance will be dramatically altered.*
- **Seed collection archiving:** *A meaningful sub-set of all unique seed collections (including single-tree (with some exception)) within BC: could be archived at a central registry (TSC). Clearly, there would need to be exceptions to this (e.g., primary research goals being compromised etc.).*
- **Reduce simplification and fragmentation in the matrix:** *Maintain diversity (reduce simplification) and reduce fragmentation in the 'matrix' (lands*

surrounding protected areas) to allow species to react to climate change. We need to maintain a lighter footprint to allow species to adapt. From another: *Replacing non-commercial species with commercial species could affect the diversity of the forest.* And another: *Deploying a greater diversity of species, in more places, will help keep all of our BC species viable.*

- **Diversifying approaches and understanding:** *Consider using different approaches, including providing areas where several varieties of stocks are planted in the same area.* From another: *MOFR may also look at other ways (e.g., botanical gardens, national/international vehicles) to conserve BC's forest tree genetic resources.* Another: *Understanding the underlying processes or role that genes have on landscapes.*
- **Are we asking the right question?** One respondent suggested we may be asking the wrong question and offered 3 questions in its place:
    - *If we were to maintain the current species on the landscape over time, given the prospect of climate change, what phenotypes are most at risk where, and what changes, if any, in the genetic profile of species are needed to better ensure that existing species will continue to thrive?*
    - *How should this be developed and deployed and under what circumstances as we move forward in time?*
    - *To what degree are we better off starting to change the species profile in response to or in anticipation of the changes that we expect?*

#2. Genetic Resilience – Climate Change

2.1 Are we taking the correct approach in dealing with climate change?

One correction was noted for the background statements for this question — *'seedling' should be 'seedlings' in the second line, and in the fourth line, facilitated migration should reference movement of species as well as seedlots further north or higher in elevation.*

Of the 41 respondents, 28 answered more or less 'yes', most with conditions or supplementary thoughts. The balance of respondents (10) was unsure or used the question to raise related concerns. Three (3) participants said 'no.'

In general the comments reflected people's recognition of the complexity and uncertainty of the climate change challenge with respect to GRM. At least 8 of the participants supported the need for more research to decrease uncertainty, particularly on climate change modelling and ecophysiology. Tied to this there was a plea for better modelling capability and the use of models to development scenarios and to help design and inform multivariate decision support tools (as opposed to seed transfer rules).

On the management side, the prevailing view was that there is a need to act, but incrementally. Also there was the view by some that we need to hedge our bets — to consciously try different things, to be adaptive and to employ adaptive (experimental) management approaches where uncertainties remain high. Balanced against taking a

gradual approach, a few were anxious to see action. Here are a few selected quotes to illustrate this range of views. We have included more here to show the diversity.

- *It is a balanced and cautious approach, considering the uncertainty in predicting changes that might occur over large areas.*
- *We need to have better models developed though. Climate change will not be consistent throughout the province. We need to know what factors of local climates will change (i.e., precipitation patterns and seasonal distribution, average temperatures, extreme temperatures etc). How can we use GRM to adapt to these changes?*
- *Working out consequences from modeled scenarios is another approach that requires support. And then studying trees to understand suitability is required.*
- *No simple answer to this. Recognizing it is the first step. Working out consequences from modeled scenarios is another approach that requires support.*
- *Research effort needs bolstering given climate change so that we have benchmarks; we have a huge gap here and need a network of research data on the ground to allow us to examine the impacts of the decisions we make.*
- *The approach needs to be incremental. We are learning as we go and we need to do so consciously. I would build in right from the outset a requirement to review progress AND fundamental assumptions every 5 or so years. Adapting to climate change will mean adapting how we think about climate change as the data accumulates.*
- *I am not sure, but perhaps we should be hedging our bets. Rather than just relying on what the predictive model tells us to plant based on the predicted climate, plant a mix of species and genotypes so that our risk is reduced. We may not have 100% well adapted seedlings 50-100 years from now, but the most well adapted ones will be there at rotation. This may mean higher planting costs (more variety and more trees).*
- *Seed transfer rules as they now are presented, may not be a good long-term strategy for addressing climate change. The rules should be decision tools which take into account multiple variables, rather than single variable edicts. We need flexibility and diversity of deployment, as we really don't know what's going to happen even a few decades from now.*
- *If the intention is for this dialogue to result in more flexible guidelines for the use of seedlots and species, then yes, the overall initiative is pointing in the right direction.*
- *There is no mention of adaptive management approaches (adaptive experimental management). Are we planning to use this technique? For example to test different facilitated migration strategies.*
- *Work should get started so that as more reforestation takes place on the landbase, the application of these changes in policy and regulation can be applied. Let's start making some of these changes ASAP.*

Two participants wondered if what was expressed in the paper really constituted an approach per se.

- *What approach? Assuming we can predict the effects of climate change well enough to match the genetic stock seems optimistic, even assuming we are able to correctly identify what the requirements of a particular stock might be or what modified habitats will occur in specific areas of the province.*
- *Unclear what steps are being made, lots of planning it seems but little critical thinking on the uncertainty inherent in current GCM predictions of climate change effects? Facilitated migration is a sexy topic but rests squarely on the climate change predictions and for tree growth and survival this means accurate predictions of temperature but more importantly patterns, frequency and timing of precipitation and frost events. These are weakly handled with current GCMs applied to BC.*

Suggestions and Ideas

Here are some of the suggestions we received.

- *The microclimate faced by a tree during its seedling and sapling stages (when trees are expected to be most vulnerable) might be very different than the microclimate at rotation age; the goal is to keep the stand alive throughout that whole period.*
- *I expect that much of what is done in the future, in terms of climate, will be reactive, rather than pre-emptive. So, in my opinion, a focus on diversity (of both kinds), for the purpose of developing resilience, is vital in any discussion of dealing with climate change.*
- *We may be best off to focus on species and progeny that appear to have a wide ecological amplitude rather than simply pushing seed transfer boundaries around?*
- *The assumptions seem to be about seed zones and species. More knowledge would need to be developed in the long range to understand specific genotypes for best fit ex. genetic markers for adaptability characteristics (bud set; drought tolerance; tolerance to biotic threats etc).*

2.2 Is there some aspect of GRM that we should be paying more attention to?

2.3 Are we missing anything?

Since questions 2.2 and 2.3 were responded to relatively similarly they are summarized here together. Responses to these questions were varied, some being specific to climate change, while others indicated an interpretation of the question a little more broadly.

Specific comments regarding climate change

- **Measuring the climate change response:** *How will you know how existing genetic materials react to change? Baseline knowledge, modeling, at the species and genotype level; inventories; monitoring to verify/complete predictive models.*
- **Investigate other commercial species:** *We should investigate the use and propagation of other commercial species such as Noble fir.*
- **Extreme weather**: *Extreme weather appears to be part of this climate change, with snow-pack levels fluctuating broadly from year to year. Wind, arctic outbreaks, summer drought, UV radiation are other possibilities. Extreme weather may only influence regeneration success at critical early establishment or juvenile stages, or may be more critical at later stages.*
- **Research field trials:** *… look at stocks that can withstand a wide variety of climatic types or look at several mixtures of stocks that could be tested and monitored.* From another: *think cross-species DNA hybridization combined with field trials with environmental (climatic) variables could tell us a lot about patterns of gene expression that could be anticipated—and perhaps manipulated—in changing environments.* Another: *Need research base commensurate with operation practice. We tend to focus on meeting the policy objective but don't really know what is happening on the ground. We are just 'winging it' as we are not making a connection between research and operational practices.* Another: *I wonder if we might be able to design a more complex set of different combinations of "treatments" involving species x genotypes x ecosystem types so we can be testing more conditions concurrently (faster learning)?*
- **Breeding for greater "plasticity:** *Maintaining genetic diversity it one thing but breeding for greater "plasticity" – trees that can withstand wide environmental variations (trees with high tolerance amplitudes) – is another strategy. How can we increase this plasticity? To achieve greater plasticity we may have to sacrifice some growth (gain). So the question is — what are willing to sacrifice to have that greater plasticity in case things do change?*
- **GRM and application of species selection guidelines:** *Proportionality of species mixing needs to be carefully considered. An initially low natively adapted species representation ought not to be permitted to be an "overcorrected" makeover solution. Recommended and permitted species mixing tolerances must be restricted to moderate levels of manipulation. (It has been postulated that "Green Up" requirements have accelerated the misapplication of Pli to unsuitable sites). Potentially, the misapplication of species selection guidelines could be the greatest moderator of correctly or incorrectly deploying GRM resources.*
- **Free-to-grow information:** *RESULTS ok to tap into, but need post free-to-grow information, and need this integrated with other data sets to assess issues like forest simplification via use of single species for planting.*

- **Climate change will negate current gain:** *All the genetic gains from current seed use strategies noted in the paper will be negated by a changing climate in short order.*
- **Exotics should be considered:** *Species ranges and the effects of climate change scenarios are not confined by political barriers like the USA/Canada border.* From another: *you are missing part of the story on exotics. First taking a species coming from its northern range in the United States can hardly be considered exotic, if its range will naturally move north anyway correct. I am convinced that part of the answer in the southern latitudes of the province ultimately comes from the so called "North American Exotics."*
- **Lessons learned:** *We have a lot to learn from our agricultural industry on the prairies and in BC regarding genetic resource management. Let's build on their successes and be cognizant of the failures.* From another: *The location of planted seedlots is known. Historically, some seedlots must have been planted out of their acceptable range. Even if a small amount of effort were put towards reviewing the success/failure of these trees the learning potential is extraordinary.*

Questions

A few respondents advanced some important questions that will need to be addressed by the GRM Strategy. Here are some examples.

- *Are we projecting what climate change may do to potential insects and diseases and therefore being sufficiently forward looking at genetic resistance opportunities?*
- *One assumption seems to be that the knowledge necessary to make decisions on best fit is already available. Is it really? What about the knowledge necessary to predict patterns of climate change at the local scale?*
- *Does our research adequately test orchard genotypes through different establishment conditions and rotations by repeating tests in multiple years and under extreme conditions in other locations (beyond the current species limits)?*
- *What do we have to report on regarding Cy trials in the interior? Lw trials in the mid-interior?*
- *Do you model "facilitated migration" and associated gains based on isotherms?*
- *Aren't most climate change scenarios suggesting some seriously mal-adapted populations in our current forests, even where species shifts are not predicted?*
- *Have we done some analysis around what the probability of realizing the genetic gains we have been assuming we will achieve at rotation?*
- [We need to] *find out exactly what we should be managing- what is a genetic resource? — trees from different locations or ecotypes? a useful genetic trait e.g., gain ? a resilient trait (e.g., drought resistance)? Or, a genetically defined difference (e.g., isozymes, terpenes, DNA bands)?*

#3. Genetic Gain – Tree Improvement

3.1 Do you believe that current tree improvement practices are compatible with your view of SFM? If not, why not?

Of the 37 respondents, 18 believed that tree improvement practices are compatible with SFM, 8 were not sure, 4 believe they are not compatible, and 7 provided other comments such as on the supporting background statements. Examples of the diversity of views offered include the following.

- *Tree improvement is consistent with SFM because we use the existing gene pool to select for favourable characteristics of tree growth. Genetic modification is not a consideration. Secondly we are planting this genetically improved stock in "managed forests" for an industrial use.*
- *Yes and no. There is not as strong an ecosystem perspective as I would like to see. The GRM work is certainly not counter to the intent of SFM.*
- *No. TI* (tree improvement) *focuses on increasing gain by reducing genetic complexity of populations. This complexity contains the solution to populations being able to withstand climate change (genetic resilience = genetic diversity or complexity). A more precautionary approach would be: (1) greater emphasis on wild seed collections; (2) more use of natural reforestation; and (3) implementation of cone collecting and storage from harvest sites.*

3.2 Are FGC goals and objectives for select seed use consistent with your view of SFM?

Of the 30 respondents, most respondents (19) felt that the FGC goals and objectives are consistent 8 were not sure, whereas 3 believe they are not consistent with SFM.

- Yes, I believe that FGC goals and objectives for select seed use are consistent with SFM.
- *Stay the course and ensure that top seed goes to top sites and ensure that price reflects it's inherent value.*
- *The way these goals and objectives are described, we have no understanding of requirements related to quality and genetic diversity; just quantities..*
- *The goal 'increase select seed use to 75% of the provincial total sown by 2013' is once again a huge uncontrolled experiment. We are 'bidding the bundle' and just 'winging it' as we don't know implications.*
- *No. "Select seed" should only be used on lands designated as timber-emphasis.*

3.3 Should seed-use policies allow for the use of genetically modified trees and greater use of exotics to improve gains and/or as a strategy in response to climate change?

There was considerable feedback to this question from 36 respondents. There was a mixed and strong reaction to the use of genetically modified (GM) trees, whereas there was more support, albeit conditional, for the use of exotics.

Of the 35 respondents who reacted to use of GM trees, 14 responses indicate some support albeit often conditional, 6 were not sure, and 15 were against its use. Some respondents, regardless of their support or opposition, supported research on GM trees.

Support for GM use tended to center around potential timber supply benefits particularly given challenges associated with climate change and MPB epidemic. Opposition to GM was the potential to impact the genetic flow and composition of surrounding 'wild' forests. Some of those objecting were, however, supportive of GM research so that more is learned about the benefits and risks.

Of the 31 respondents who reacted to use of exotics, 20 indicated some support (depending on how 'exotics' is defined), 6 were not sure, and 5 were against its use. Most of the support for exotics was conditional on their use in restricted areas such as private lands or public lands where timber production is the primary objective. This support included the use of native species 'exotic' to a particular area or zone being used to facilitate migration in response to climate change. Opposition to use of exotics included the need to first better explore (research) the full use of native species.

- *The use of exotics and the use of elite seed sources should not scare us away from obtaining the amount of information we will need for future decision making for the forests of BC.*
- *Yes. We are crazy to restrict opportunities for exploring the potential of GM. Simply pandering to uniformed politically correct objections. GM can almost certainly offer more in our response to climate change and requirement for improved productivity and quality than anything we have in our toolbox today. We should be working with a full set of tools!*
- *Although I believe that use of GM plants in agriculture is wholly appropriate, I do not believe the same for silviculture, except perhaps, in intensively managed plantation forestry. Even in the latter case, the risk of spread of novel genes into wild populations is likely too high, since the "farmed" trees will have substantial gene flow with surrounding wild trees.*
- *As for "exotics", they should be allowed on a case-by-case basis, in intensive silvicultural situations, with substantial monitoring by regulatory agencies. Since most conifers are not "weedy" by nature, I don't perceive a major risk in their careful use.*
- *Somewhat ok with exotics but limited to sources adjacent to BC (e.g., northern-western US). Like to see more emphasis on species selection and diversity before considering use of exotics.*
- *Before exploring the use of exotic species, let's make use of the full range of native species, and use them under more diverse management regimes. Indeed, introducing exotics to public lands could be quite problematic with land use objectives, now or in the future; their use should be restricted to private lands, or if on public lands, to areas zoned for timber production.*

#4. Criteria and Indicators

4.1 What improvements can be made to the monitoring and reporting of GRM activities?

Based on the 23 respondents to this question, there was general recognition that this is an important function if done in a manner that promotes improved management and is inexpensive (e.g., that it can take advantage of existing information gathering).

Interestingly, some responses suggest that monitoring and reporting is already being done. Other comments however, imply nothing is being done. Clearly, improved communication about GRM monitoring and reporting efforts now and in the future is needed. Specific suggestions from the responses are provided below.

- *Keep the criteria as simple as possible e.g., seed transfer rules and numbers of parents in an orchard. Measuring can be expensive.*
- *Regular and extensive evaluations of operational (not experimental) deployments of genetic resources: evaluating hundreds (not tens) of provenances, the stretching of seed planning zones, the long-term survival and performance of improved seed.*
- *Existing benefits and opportunities from GRM such as genetic gain need to be monitored and reported to confirm they are being realized.*
- *A particularly important value is resistance – if it can be demonstrated that real gains can be made, this can demonstrably change business practices.*

4.2 What values or aspects of GRM do you feel should be tracked and monitored?

Many specific and diverse suggestions were provided by the 24 respondents. It indicates a strong desire to track and monitor key values or aspects of GRM, but also the need to develop a cost-effective approach that is broadly supported. Here are some of the ideas that were shared.

- *Need to monitor species diversity at the landscape level.*
- *Trees planted – by species; genetic class; SPZ; SPU; BEC zone; Assumed AAC increase – through use of select seed use by species, TSA, SPZ, SPU, BEC; Diversity measure? – effective population size; effective population size corrected for proportion of landscape it occupies (assumption is more or more diverse populations allows for more resilience); Genetic gain – by species, SPZ, SPU, BEC zone; Regeneration method – planting, natural regeneration and possible proportions as many stands will have both.*
- *Dollars invested in tree improvement program; survival, vigour, pest resistance, growth of stock derived from improved seed; regular sampling of operational plantations (from known seed lots) to evaluate predictions based on seed transfer guidelines and tree improvement research.*

4.3 Should the MFR or FGC develop measurable objectives for genetic conservation and resilience to augment FGC objectives for genetic gain?

There was strong general support expressed or implied from 25 of the 28 respondents for the FGC or MFR to develop objectives for genetic conservation and resilience. Three respondents were not sure. There were some differing views as to whether FGC or MFR should develop objectives for conservation and resilience. Comments included the following.

- *These are very important strategic goals and they should be recognized and progress toward them should be tracked.*
- *Of course! For all objectives, we need to monitor impacts to assess if unintended side effects, for example, on the environment occur.*
- *Performance measures that were developed when forming the UBC Centre for Gene Conservation likely provide a good source for developing measurable objectives for gene conservation.*
- *I think that the Ministry should take the broader view and focus on conservation and resilience is critical.*

#5. Policy Frameworks

5.1 How can the current GRM framework of legislation, CF standards and related government policy, products, and services be improved to more adequately serve the needs and expectations of your organization (supporting SFM)?

Of the 18 respondents who replied, a wide range of opinions were offered. They included — the importance of research, that we need to make changes now in response to climate change such as improved seed transfer rules, and the need to garner industry support. Here are some examples of the feedback received.

- *More access to funding for research. A private firm developing plant material for use on Crown land should not have to shoulder the entire cost themselves.*
- *Relax seed transfer rules to better respond to climate change. Policy needs to be derived out of structured scientific-based impact assessments.*
- *Get industry on side to ensure that we make the necessary changes as soon as possible.*
- *It is very hard to adjust and adapt with a regulatory environment – the system may be the challenge rather than part of the solution.*

5.2 Is the current framework for GRM adequate or constraining?

Of the 23 respondents who replied to this question, 12 thought or implied it is adequate, 5 believed it is constraining, and 6 were not sure or provided other comments. Below we provide a few examples to illustrate this range.

- *I think what we have in place is doing a good job for us at the moment but periodic review of what is working should always be pursued.*
- *The broad framework is constraining in that it does not promote investment in GRM adequately.*
- *Given current focus and awareness of GRM by most foresters, we continue to need rules via CF standards. If education of professionals improves regarding GRM, then perhaps outcomes could be stressed more than rules. The 'default' approach where rules are in place but can be overridden where a professional can provide GRM outcomes (e.g., like with riparian management) may work.*

#6. Seed Planning and Procurement

6.1 Should the FGC or MFR plans include provisions for seed planning and procurement for operational reforestation purposes?

Roughly two thirds of the 31 responses to this question answered 'yes', although only 9 were explicit. One 'yes' comment offered this view — *yes, there is a role for scientific and public agencies/authorities to guide the deployment of genetic resources and the conservation of genetic diversity*.

There were 5 explicit 'no' answers, and such responses included:

- *…those responsible for operational reforestation are best suited to gauge needs and plan for them. This suggestion seems to contract [contradict?] the Section 6 background statement that 'seed supplies…appear to be adequate.*'"
- *No. Just monitor the effectiveness of current systems to meet customer needs.*

One person advocated a clear distinction between the respective roles of MFR and FGC; *"MoFR planning and FGC procurement (but their mandate must clearly include wild stand sources). In either case, the planning or procurement functions must have stronger ties with field operations (e.g.,) more realistic supply and demand profiles."*

Whatever the support for specific roles for FGC and MFR, there appears to be general support for taking a coordinated approach. *There needs to be an overall coordinated approach between Ministry of Forests and Range and industry to ensure adequacy of seed planning and procurement for reforestation activities.*

Several respondents felt that the question was poorly worded and consequently their answers were non-committal (i.e., *Would suggest the role of these organization [FGC, MOFR] should be in the provision of standards and guidelines*).

One respondent commented that there was a conflict of interest evident for MFR *in that they are the policy makers, the compliance and enforcement agency, and subject to the policies when they implement reforestation plans. Under the current, flawed framework,*

MOFR needs seed to meet its obligations, and thus needs to plan and procure that seed." Similarly, the same respondent felt that "*FGC is in a conflict position when it competes in the seed procurement business or it subsidizes agencies if it takes on seed planning and procurement responsibilities*. From this perspective, the solution is for government to "*provide encouragement and incentive, confirming that all policy and planning promotes GRM; or at a minimum, does not interfere*.

Suggestions and Ideas:

- *If there is a potential problem the MOFR could consider an incentive (buy back) for companies who collect too much seed. This was done with the spruce program. When seed orchard seed came on the MOFR exchanged wild seed for improved seed. This could provide an incentive for licensees to properly plan. That being said I think the law says don't log unless you have a seed source.*
- *If there is a seed shortage in an area and no one seems to be collecting (hard to imagine) then the MOFR/FGC should invest in strategic collections, register the seed and sell it to re-coup collection costs. This could also be applied to areas currently not very attractive for collections, but could be under climate change scenarios.*
- *1st Background bullet for "GRM management framework" should include "research.*

6.2 If so, how would these plans and activities influence the rights, obligations and activities of others?

There were 18 responses to this question, covering a range of issues. Several respondents cautioned against adding new obligations. There was also emphasis on the need for strategic plans and clear mandates.

One respondent raised the idea of having a provision for renegotiation of costs:

- *One representation would be to use the best available seed at the earliest opportunity regardless of supplier. One outcome of this tactic would imply that the Ministry and orchardists agree a mechanism that must accept, and bargain for, risk costs associated with supplying seed on crown lands in potentially catastrophic times. This should include some provision for renegotiation of costs in the event of unlikely catastrophic events.*

Two respondents linked this role with the need for a vision or strategic plan;

- *Should MOFR have control? Probably, even if indirectly. Requires some vision, however, and none is stated in the document.*
- *MOFR should have a strategic plan for seed planning at the landscape level. Should serve as a guide only.*

Suggestions:

- *If we set an objective under FRPA, we could expect licensees to propose results and strategies.*

#7. GRM Management Framework

7.1 How can the current GRM management framework be improved? Is the framework adequate or constraining?

There were 17 responses to this question, and 8 of these felt that the current framework is adequate. Nine (9) felt there was room for improvement and offered various concerns and recommendations:

Concerns:

- *Seems to all be about increasing AAC, the current industrial model and its expectations, whereas it should be about sustainability….*
- *I don't understand the present framework all that well. It seems to be more focused on genetic gain than what we want from our future forests? Broader range of values? Reduce the risk to the Crown?*
- *Research does not figure prominently in this document; it assumes that somebody else is doing it but links and background information might be useful.*

Suggestions and ideas:

- *"Expand scope of cooperative effort to include cone collectors, forest nurseries, reforestation specialists and MoE.*
- *One area of improvement is to reduce overlaps where private seed orchards are providing adequate seed supplies (i.e. don't need duplicative ministry orchards). MOFR responsibilities should continue to be in setting standards and research."*

7.2 Do you think that the current management of GRM in the province is in good hands? If not, why not?

There were 25 responses to this question. 18 gave an explicit 'yes' to the question, 2 said 'no' and 5 were not sure or thought it was too early to offer an opinion. On the *yes* side representative comments include:

- *"Absolutely, we have some of the most talented tree breeding staff in the world and the SelectSeed mechanism uses business planning, market forces and inherent demand to efficiently direct seed orchard investment."*
- *"Yes, but care is needed to be more innovative and not so traditional. Be more strategic in planning and thinking."*

For the hesitant or non-committal respondents, representative concerns include:

- *Not sure, it really hasn't been happening for very long. It has been primarily focused on select seed. I see GRM as including both select and wild stand seed as well as natural regeneration (i.e. the genetic framework for our forests)*
- *Too early for me to comment on whether or not the current management of GRM is in good hands. Applaud the efforts thus far though.*

Of the 'no' comments the reasons included:

- *GRM would benefit from participation of more diverse views through the meaningful engagement of a broader public. Have non-government groups such as First Nations, ENGOs, and other "non-converted" agencies had meaningful opportunity for input at all stages?*
- *No definitely not. The FGC is a hindrance in all of this. The organization is not responsive and its policies are hindering development of new material. Take for instance one of there top priorities is still Low elevation Douglas fir in the Sub maritime seed zone. To my knowledge most of these site have already been harvested or have been taken out of the harvesting land base for wildlife considerations. So there is little need for improved seed now is there. Hardwoods are of much more importance but are rated the lowest priority.*

7.3 How can the respective roles of the Forest Genetics Council, the Ministry of Forests and Range, the forest industry, government and public agencies, academia and others be improved or linked to better deliver GRM?

There were 18 responses to this question, with a range of opinions and recommendations expressed. Several respondents were very supportive of current efforts:

- *Communication, representation and coordination is already excellent.*
- *The benefits of a co-operative approach are working. I don't think any significant changes are required.*

Suggestions and Ideas:

The suggestions from the comments can be sorted into the following four themes.

Improve linkages and connections outside of GRM community

- *The dialogue is a good step towards improving the linkages among the various agencies and interest groups in managing forests for current and future values.*
- *A working forum that brings stakeholders together is essential. It needs to be funded for activities that support the development of good working relationships among the participants and should have funding to direct research questions and other issues that arise.*
- *FGCBC has a very important role to play by bringing all parties together for better communication and coordination*

Better *acknowledge* contributions of partners

- ***The MOFR does not adequately value the contributions of partners in the GRM. This section would be better written*** *[emphasis in original] if it acknowledged all cooperators as contributing to all phases of GRM, instead of listing select activities with specific groups. Members of all identified groups*

have contributed to policy, to breeding, to seed production, to pest management, to seed testing and storage, to information management, and to related research.

Improve *representation* on committees

- *I would like to see more representation from non-MOFR and forest industry sources particularly from the scientific community (universities, NGOs) that understands the Forest Tree genetic resource, its environment, and their interactions - particularly as these interactions are, or are expected to be expressed at a landscape level.*
- *Representation from all areas to ensure inclusion of field professionals/practitioners – again, linkages through FFEI.*
- *Need a revamped FGC.*

Provide *incentives*

- *Without incentives, such as land tenures with certainty, and with the apparent MOFR centralized control, GRM generally is a non-starter for others to get involved or invest.*

#8. Linking GRM

8.1 Are there further opportunities for improving linkages between GRM and other programs and initiatives? If so, which ones?

There were 13 responses to this question. Of these, 3 provided no specific comment or suggestion. Suggestions included the following.

- *Genome Canada has an interest in, and a mandate to, increase the genetic knowledge of organisms important to Canadians. Linkages with Genome Canada (and its provincial/regional affiliates) may be very productive.*
- *Inclusion of other Stewardship branches in the dialogue earlier would have been beneficial.*
- *Opportunities between Federal/UNFAO/other "world view" exchanges should be encouraged particularly among our top scientific, industrial and policy decision makers.*
- *Forest Science Program; Genome BC (forestry and bio-energy strategies); Common Ground initiative*

8.2 Are there any other questions that you think should be asked?

There were 9 responses to this question. One respondent thought that it had been adequately covered and offered — *Thank-you for this opportunity to provide input and feedback!*. Other comments included the following.

- *What is the role of research? This is a purely academic question as companies do little. There are exceptions, but the scale of research is operational, and that is not going to cut it in the future. It is too limited in its goals. Consequently,*

management vision is limited by the tools at its disposal. If there is no requirement for research then what do people do? Guess?

- *No, other than question already raised earlier i.e. are we actually getting the projected gains from select seed given factors such as ingress of wild seed? If this is not being actively addressed, it should be.*
- *…what is missing is that mid-level plan. It is the planning level that coordinates activities within a TSA, for example, amongst licensees. It is at this management level where GRM can play a forest management role. GRM needs to find its way into this mid-level planning discussion.*

5.6 Next Steps, Workshop, Other Comments

What other suggestions do you have to make this Dialogue and its proposed outcomes effective?

There were only 14 respondents to this question. Some of the key perspectives included:

- Keep doors open as you continue. We need to keep this going, share knowledge, staying aware of actions and outcomes.
- Regular updates to TIB website.
- Adjust the "us" and "them" mindset; make this a collective vision and strategy.
- Focus on diverse involvement of COP.
- To be clear on the problem, identifying what's broken and how you intend to fix it.
- Suggest using examples of other jurisdictions such as New Zealand and several South American countries that have made huge strides in forest management primarily due to GRM.

Workshop

Would you be interested in participating in the Workshop on June 12, 2007?[4]

- Of the 27 who responded, approximately 50% would like to attend a workshop, 50% not or unable to (field work).

What expectations would you have for the Workshop ("I would consider the Workshop a success if..")?

There were 18 responses to this question. Some of the key expectations included:

- *Objectives associated with GRM vision and strategy is more thoroughly defined/articulated.*
- *Agreement on deficiencies and next steps*

[4] This date has of course now changed. The Workshop is planned for mid-October 2007.

- *Ongoing dialogue and work by the players; an understanding of what each is doing to reduce duplication and to provide knowledge sharing to shape our future decisions.*
- *Better understanding of GRM and the linkages to sustainable forest management*
- *Clearly defined links (or potential links) to the results of this strategy with other forested and non-forested ecosystem initiatives.*
- *FGC expanded its vision beyond seed production to oversee the most efficient use of our genetic resources (select or wild) on crown land to provide the greatest economic and environmental benefit and balance to the province without sacrificing the same for future generations"*
- constructive dialogue regarding changes to current reforestation practices to meet the demands of climate change — *how do we determine the best species and seedlots to deploy today, knowing that the ecology of the planting sites might be significantly different before the trees mature?*
- *Success if it resulted in strong and unanimous recommendations for the Chief Forester to immediately revise GRM guidelines to better respond to current pest and climate change trends.*
- *Make sure that it [the workshop] has broad representation from people outside genetics; include some really broad thinkers and listen to what they have to say; bring in some folk from outside BC (add some diversity).*
- *Its easier to see what failure would look like: a narrow view on traditional tree selection; and isolationist attitude that GRM can stand alone without reference to other aspects of SFM; an attitude that 'we already know what we are doing and have been doing it for years.*
- *"…there was a sense of optimism that GRM was a key program in the success of the province's positive transition to a healthy new forest emerging from current issues such as climate change, MPB and changing markets.*
- GRM Vision — *We understand how GRM fits in with a vision for our future forests. We have to know what to plant now so we can achieve that forest 80 - 100 years or more from now. Or we need to know what to select for now so 10-20 years? From now, we have seed that we can plant for our future forests.*

Do you have any other comments or questions you would like to raise?

Almost all of the comments here were positive and supportive of the work done thus far. Here are some examples.

- *A lot of work has gone into this project, and the revisions made to the original paper have made this document much stronger. B.C. is certainly a leader in GRM within North America. Good job all.*
- *Congratulations! This document is greatly improves clarity and focus, compared with the earlier version.*

- *The Challenge Paper is good, comprehensive and clear though seems to be redundant in many places. Good forward looking consideration of climate change.*
- *I applaud your efforts to solicit input from a broad array of stakeholders and wish you success in this endeavor.*
- *I do commend the various champions for taking this on. It is timely, interesting and should help develop vision.*
- *I am very interested in this initiative and look forward to your next correspondence/publication.*
- *Great effort, thanks for the opportunity to comment on this important topic.*
- *Having read the "Challenge Paper" with interest and having studied the web site of the Forest Genetics Council of British Columbia, I am convinced that the work of the Council, and ministry's Tree Improvement Branch and its associated partners, licencees and commercial arm (SelectSeed Co. Ltd.) are working at the frontiers of genetic science and ethics in forest ecology.*
- *Despite my critical tone, I do think that this is a very important exercise. Bringing some of the key players into a slightly better organized and more focused attempt to deal with climate change is probably among the most important things we can do.*
- *This is a valuable exercise.*
- *A strategic level conversation is fine, but the how does it translate to on the ground?*
- *A much better reference related to biotechnology than the one you have (Hadley et al 2001) would be Groover AT. 2007. Will genomics guide a greener forest biotech? Trends in Plant Science. 12(6):234-238. It is a concise, well synthesized update on recent progress of forest genomics and its application to breeding as well as to conservation and management of undomesticated populations.*

Three other thoughts offered are of particular interest.

- *Since I am in the business of training everyone from undergrads to post-docs I have reservations about my trainees' prospects. They are indeed very poor in BC. Most of my students get jobs out-of-province, even though they wanted to stay here.*
- *This questionnaire is an improvement over the first one – still a bit of a workout though. Information is spread pretty thinly at this point – feedback requirement could have been consolidated and reduced I think.*
- *Don't be so cautious in this process… – it is time to move on this.*

Finally, there was a set of substantial comments was centred around the postulation of 18 questions with the forward — *I believe need to be answered internally in the public interest. Some of them would benefit by wider public dialogue. Indeed, answers to some of them might help shape and direct GRM vision and strategy in the public interest.* The

details of these questions can be found under separate cover in the *Consolidated Feedback* document.

6. Next Steps in the Overall Dialogue

As noted several times in this report, the Co-Champions and Action Team are extremely grateful for the many thoughtful responses provided. The co-champions commit to further assessing the points raised through this dialogue with the intent of determining priorities and how best to address them. We appreciate you reviewing this Progress Report, even if you did not have a chance to respond to the Challenge Paper, and providing us with any further ideas and suggestions with particular focus on how they may better inform the draft GRM Strategy and the September GRM Workshop.

If you choose to respond, your comments on Progress Report II would be appreciated by **September 28, 2007**. Please send comments by email to **officelink@shaw.ca.**

Our intended next steps are to:

- Prepare a first draft GRM Strategy elements in September.
- Design a GRM Strategy Workshop which will be held in mid-October.
- Prepare a *Workshop Workbook* which will include the draft GRM Strategy elements organized into a progression of workshop sessions.
- Conduct the GRM Strategy Workshop (location TBD but likely Richmond).
- Take the outputs from the Workshop and prepare and circulate for review and feedback a second draft GRM Strategy and Action Plan.
- Based on the feedback to prepare a final draft Strategy by December 2007.

Once again, many thanks for your interest and participation in this Dialogue!