



NATIVE SPECIES RESEARCH
PROGRAM WORKSHOP:
LOOKING TO THE FUTURE OF
NATIVE PLANTS IN ALBERTA
Summary Report

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EXECUTIVE SUMMARY

InnoTech Alberta and its predecessors have been involved in researching the use of native species to improve reclamation and remediation since the inception of the Native Species Research Program in the late 1970s.

The InnoTech Alberta Reclamation Team sponsored two workshops in Edmonton (November 1, 2016) and Calgary (November 9, 2016) to gather stakeholder input for the Business Case to redesign the Native Species Research Program. Eighteen people from government, resource industry, native plants industry, consultants and research agencies attended the Edmonton session and 17 attended the Calgary session. In addition, two people provided input through a workbook designed to gather the same information as was obtained in the workshops.

The objectives of the workshops were to:

1. To bring together government, industry, and research centres to discuss the role InnoTech Alberta should play to enhance the successful development and deployment of native species for reclamation and remediation.
2. To facilitate refocusing of the InnoTech Alberta Native Species Research Program to better serve the native plants industry in a collaborative capacity.

Workshop participants were encouraged to see the broad range of interest in use of native plants and noted there was ongoing need for discussion and information sharing. Significant research opportunities were identified with participants recommending InnoTech Alberta build on its capacity for long-term projects and capitalize on its existing facilities.

One of InnoTech Alberta's key strengths is the ability to undertake long-term projects (e.g., 30+ years at Smoky River coal) – this capacity should be leveraged. Another is the range of facilities and services available to support the industry.

InnoTech Alberta's native plant variety development work has helped create the potential for increased use of native plants in reclamation and restoration but the actual supply of seeds is currently limited. Workshop participants noted that *plant variety development* work is important but there is a broader suite of work required to support the industry, thus they recommended a focus on *plant development*. The oil sands mining industry is projecting significant increases in areas to be reclaimed in the near future and there will be many kilometres of seismic lines revegetated to support caribou habitat protection – there will drive native species demand.

Research continues to be required to support improvement in the successful use of native plants in remediation, reclamation and restoration work. Participants noted that in addition to the traditional oil and gas, mining and pipeline sectors there are significant opportunities in urban naturalization.

Participants agreed that there is a wealth of knowledge and experience in the province but that we have collectively failed to share it effectively resulting in a lot of reinventing the wheel. It

was suggested that InnoTech Alberta could play an important role as a knowledge hub or broker. A number of ideas were provided for tools to share knowledge with the community.

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ACRONYMS USED IN THIS REPORT

AER	Alberta Energy Regulator
ANPC	Alberta Native Plant Council
BC	British Columbia
CEMA	Cumulative Environmental Management Association
CCEMC	Climate Change and Emissions Management Corporation (now Emissions Reduction Alberta)
CFIA	Canadian Food Inspection Agency ¹
CONRAD	Canadian Oilsands Network for Research and Development
COSIA	Canada's Oil Sands Innovation Alliance
CSGA	Canadian Seed Growers' Association ²
FRF	Foothills Restoration Forum
FGRMS	Forest Genetic Resource Management and Conservation Standards
GoA	Government of Alberta
LUKN	Land-use Knowledge Network
NAIT	Northern Alberta Institute of Technology
NGO	Non-governmental Organization
NSERC	Natural Sciences and Engineering Research Council
QA/QC	Quality Assurance / Quality Control
R&D	Research and Development
RRTAC	Reclamation Research Technical Advisory Committee
SME	Small-Medium Enterprises
SRM	Society for Range Management
UofA	University of Alberta
US	United States

¹ See <http://www.inspection.gc.ca/industry-guidance/plant-guidance/eng/1374176314492/1374509816709>

² See <http://seedgrowers.ca/>

NATIVE SPECIES RESEARCH PROGRAM WORKSHOP: LOOKING TO THE FUTURE OF NATIVE PLANTS IN ALBERTA: SUMMARY REPORT

CHRISTINA SMALL, QUINN BARBER, MARSHALL MCKENZIE AND CHRIS POWTER

1.0 INTRODUCTION

InnoTech Alberta and its predecessors³ have been involved in researching the use of native species to improve reclamation and remediation since the inception of the Native Species Research Program in the late 1970s.

The InnoTech Alberta Reclamation Team sponsored two workshops in Edmonton (November 1, 2016) and Calgary (November 9, 2016) to gather stakeholder input for the Business Case to redesign the Native Species Research Program. Eighteen people from government, resource industry, native plants industry, consultants and research agencies attended the Edmonton session and 17 attended the Calgary session ([Appendix A](#)). In addition, one person provided post-workshop feedback and two people provided input through a workbook designed to gather the same information as was obtained in the workshops – this information has been incorporated into this summary.

1.1 WORKSHOP OBJECTIVES

The objectives of the workshops were to:

1. To bring together government, industry, and research centres to discuss the role InnoTech Alberta should play to enhance the successful development and deployment of native species for reclamation and remediation.
2. To facilitate refocusing of the InnoTech Alberta Native Species Research Program to better serve the native plants industry in a collaborative capacity.

1.2 WORKSHOP STRUCTURE

The workshop consisted of two discussion sessions in which participants were given an opportunity to identify R&D priority areas and where they felt that InnoTech Alberta could add the most value, with additional discussions on: the strengths of InnoTech Alberta; research opportunities; and, the value of a community of practice (workshop agenda provided in [Appendix B](#)).

³ Alberta Innovates – Technology Futures, Alberta Research Council, Alberta Environmental Centre.

A *sticky-dot voting system* was used to gather participant views on seven key questions. For each question participants were allocated three sticky dots to indicate their priorities – they were able to allocate one dot to each of three responses, or three dots to one response, or a combination of one and two dots. There were a total of 111 dots eligible to be counted for each question (37 participants x 3; InnoTech Alberta staff attending the workshops did not vote). Figure 1 shows that participants did not use all of their votes for each question – the question on which Focus Areas InnoTech Alberta could add the most value to received the most votes while the fewest number of votes was received for where InnoTech Alberta could add the most value for the sector types.

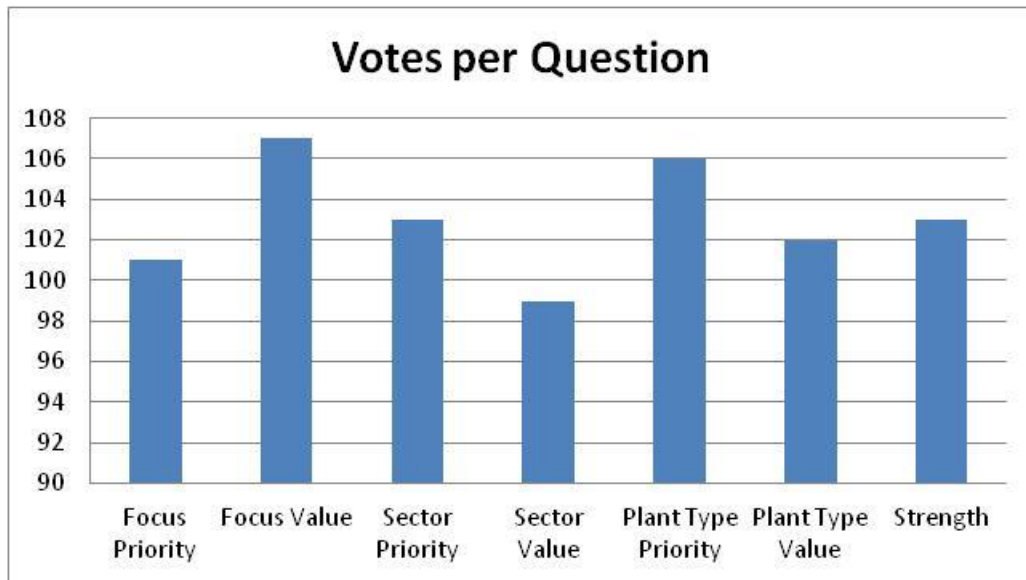


Figure 1. Vote Tallies for each Question. Questions are listed in the Workshop Agenda ([Appendix B](#)).

1.3 REPORT STRUCTURE

The report sections follow the workshop Agenda (Appendix A) with each of the sessions a separate chapter (Session 2 has been split into two chapters). In each chapter the key issues raised in the discussions are noted, and where applicable, the results of the sticky dot voting are provided.

The discussions in each session were far-ranging, often addressing issues in other sessions. To make the report easier to read we have placed the relevant materials (key issues in the text and discussion comments in the Appendices) into the most appropriate section rather than in the session the comments were actually made.

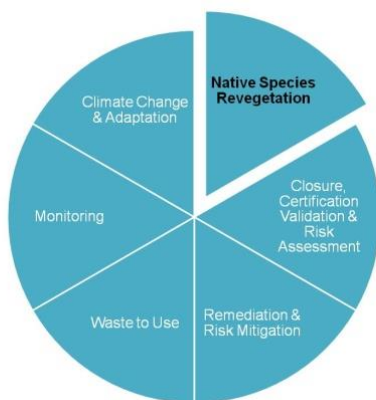
1.4 BACKGROUND TO THE NATIVE SPECIES RESEARCH PROGRAM

The workshop began with a presentation by Christina Small, Interim Reclamation Team Lead, on the recent change from Alberta Innovates – Technology Futures to InnoTech Alberta and the history and focus areas of the Native Species Research Program (presentation provided in

Appendix C) to provide context for participants. Key messages from the presentation are provided below.

As of November 1, 2016 Alberta Innovates – Technology Futures became InnoTech Alberta, a wholly-owned subsidiary of the newly merged Alberta Innovates corporations. The intent of the change is to:

- Create a more streamlined, efficient and transparent innovation system
- Fund and drive innovation
- Make it easier for researchers, companies and partners to access and navigate the opportunities and support available to them



The Native Species Research Program is part of the larger suite of programs managed by the Reclamation Team. The vision for the Native Species Research Program is to facilitate the return of disturbed land to former and/or productive use through development and deployment of native species in reclamation and remediation. Research is directed towards the improvement of ecological function across a variety of settings:

- Reclamation of disturbed specified lands (i.e., oil sands and coal mine sites, in-situ oil production sites, wellsites, pits and quarries, pipelines, highway rights-of-way, etc.) across the Grassland, Parkland, Boreal, Canadian Shield, Foothills and Rocky Mountain Natural Regions;
- Reconstruction of wildlife habitat and restoration of ecological function of disturbed habitat;
- Rangeland rehabilitation;
- Development of fire smart landscapes;
- Development of sustainable urban environments; and,
- Remediation of contaminated sites.



Program goals are to:

- Increase public awareness on the need to protect the natural environment.
- Conserve biodiversity.
- Prevent further landscape fragmentation.
- Increase the productivity of marginal lands.
- Advance research and development.
- Create new industries (i.e., crop diversification).

The Breeder Seed Program has released 22 commercial native species varieties (Table 1) and continues to contribute to the improvement of disturbed, degraded and/or impacted soils throughout Western Canada.

Table 1. InnoTech Alberta Native Grass Varieties Currently Available as Certified Seed.

Species	Variety	Collection Site
Awed or Bearded Wheatgrass	Hillcrest	Eastern Slopes, AB
Slender Wheatgrass	Adanac	Mixed Grass, SK
Slender Wheatgrass	Highlander	Eastern Slopes, AB
Slender Wheatgrass	Revenue	Mixed-Grass, SK
Northern Wheatgrass	Elbee	Canadian Prairies, AB&SK
Western Wheatgrass	Walsh	Canadian Prairies, AB&SK
Violet or Broad- Glumed Wheatgrass	Mountaineer	Eastern Slopes, AB
Alpine Bluegrass	Blueridge	Eastern Slopes, AB
Alpine Bluegrass	Glacier	Eastern Slopes, AB
Green needle grass	Grouse	Alberta prairies
Alpine Fescue	Vista	Eastern slopes
June grass	Mountain View	Crowsnest Pass
Rocky Mountain Fescue	Plateau	Eastern slopes, AB
Spike Trisetum	Sentinel	Eastern slopes, AB
Canada milkvetch	Aspen	Central Parkland
June grass	Prairie	Alberta prairies
Indian ricegrass	Porter	Ribstone, AB
Rocky Mountain fescue	Butte	Butte, Waterton Lakes
Awed wheatgrass	Metisko	Central Parkland
Nodding bromegrass	Hillbilly	Central Parkland
Blue grama	Badlands	Special Areas, Central Parkland
Plains rough fescue	Bison	Northern fescue region
Canada wildrye	Centennial	Ribstone, Wainwright area, Hardisty

Discussion points raised following the presentation included:

- What is meant by “breeding” of seeds - how far do they diverge from Native Species?
 - Marshall clarified that selective breeding is not conducted - the Canadian Food Inspection Agency (CFIA) certification is primarily for QA/QC. The goal is to maintain the breadth of diversity in the harvested collections. However it is possible to unintentionally select for faster germinators / growers that set seed at same time to make harvest easier and more predictable.
- What is the purpose of your breeder stock? Is it to support local producers in Alberta?
 - We do hold seed stocks into perpetuity. We don’t really know how our business model will change into the future. We have worked with smaller producers in the past, but we believe they have been purchased by Brett Young. We would like to see the formation of a seed coop. We can provide this seed to growers, but we can’t force them to sell it.

- How many of these varieties are available and where are they used currently?
 - Marshall indicated that there are about three being used on an annual basis. Concern was raised that many of the species are not currently available. InnoTech Alberta will be reviewing the current breeder seed allocation system to increase availability.
 - One of our big projects right now is developing recovery strategies for each of the Natural Regions. We have identified the seed InnoTech Alberta has developed as a good resource, but no one will be able to purchase it.
 - The Achilles' Heel is that we need multiple growers to drive down the price of native seed. If multiple companies owned the species, it would prevent the restrictive monopoly by one.
- Are all types of plants included in your program? Grasses, Forbs, wetland species?
 - Yes.
- Can you tell us what is going on in the mesocosms right now?
 - Christina: The initial pilot terrestrial mesocosms were built in 2013 as an oil sands joint industry project. They were interested in some specific research questions, and the mesocosms allowed for a more realistic, larger setting. InnoTech Alberta and the University of Alberta/Helmholtz Alberta Initiative collaborated together to build the terrestrial mesocosm facility in 2016 as unique research infrastructure, despite industry pulling out from the initial 2013 project.
 - The aquatic mesocosm infrastructure was funded by InnoTech Alberta with the intention of supporting a joint-industry project.
- If you want to focus on the future of the program make sure you are inviting collaborators. You're inviting with this, keep being that way. Make an effort to identify the skills that each collaborator provides to a joint venture.

2.0 SESSION 1: FOCUS AREAS

In this session participants were asked to identify the priority research and development needs based on the three focus areas of the current Native Species Research Program – Native Species Plant Development; Reclamation Research or Remediation Research. Participants were then asked to identify where InnoTech Alberta could add the most value. Figure 2 shows the combined results from the two workshops and the workbook submissions (Figure 6 in [Appendix D](#) shows the results for each question broken down by source). The Native Plant development focus area received the majority of votes both for R&D and where InnoTech Alberta could add the most value. There were very different views between the Edmonton and Calgary audiences (Figure 6, Appendix D), with Edmonton emphasizing the value InnoTech Alberta could add for Remediation Research while Calgary emphasized value added opportunities in Native plant development – likely a reflection of the strong interest in grasslands in the Calgary audience.

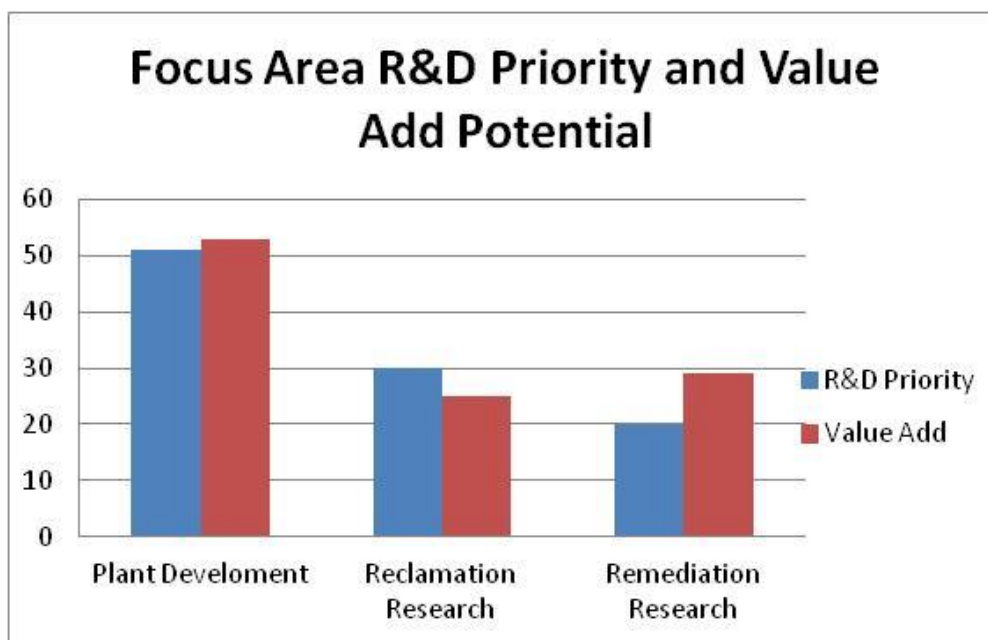


Figure 2. Summary of the Voting Results on the Native Species Research Program Focus Area Priorities.

2.1 DISCUSSION

The primary themes emerging from the discussions are listed below; detailed notes from each of the workshops and the workbook submissions are provided in [Appendix D](#)). The themes do not necessarily reflect a consensus view of participants – rather they are provided as key considerations for developing the Native Species Research Program business case.

- There are a number of drivers setting the stage for greater native plant usage.
- There is frustration at the lack of availability of the native species varieties that have been developed by InnoTech Alberta. Multiple companies should have access to the

breeder seed, instead of just one, to ensure the market functions properly. It may be time to redo the Market Assessment as conditions have changed considerably since the original Assessment.

- Plant producers / distributors can add significant value to clients by providing information in addition to the *commodity* (seeds or plants); the problem is they often don't get asked, or there are intermediaries between the supplier and user.
- Municipalities are increasingly interested in native species for a variety of naturalization projects.
- There are significant opportunities for Aboriginal communities to get involved in native species work, from wild harvest collection to monitoring to growing stock.
- InnoTech should focus on remediation research and reclamation of harsh environments. InnoTech has a strong soils capacity and appropriate facilities so InnoTech can add the most value in soil remediation.

3.0 SESSION 2A: SECTORS

In this session participants were asked to identify the priority research and development needs based on the industrial development sectors. Participants were then asked to identify where InnoTech Alberta could add the most value. Figure 3 shows the combined results from the two workshops and the workbook submissions (Figure 7 in [Appendix E](#) shows the results for each question broken down by source). The oil and gas sector and highways and infrastructure received the most votes; the R&D scores were strongly influenced by the Calgary votes - in Edmonton the R&D emphasis was on oil sands (Figure 7, Appendix E).

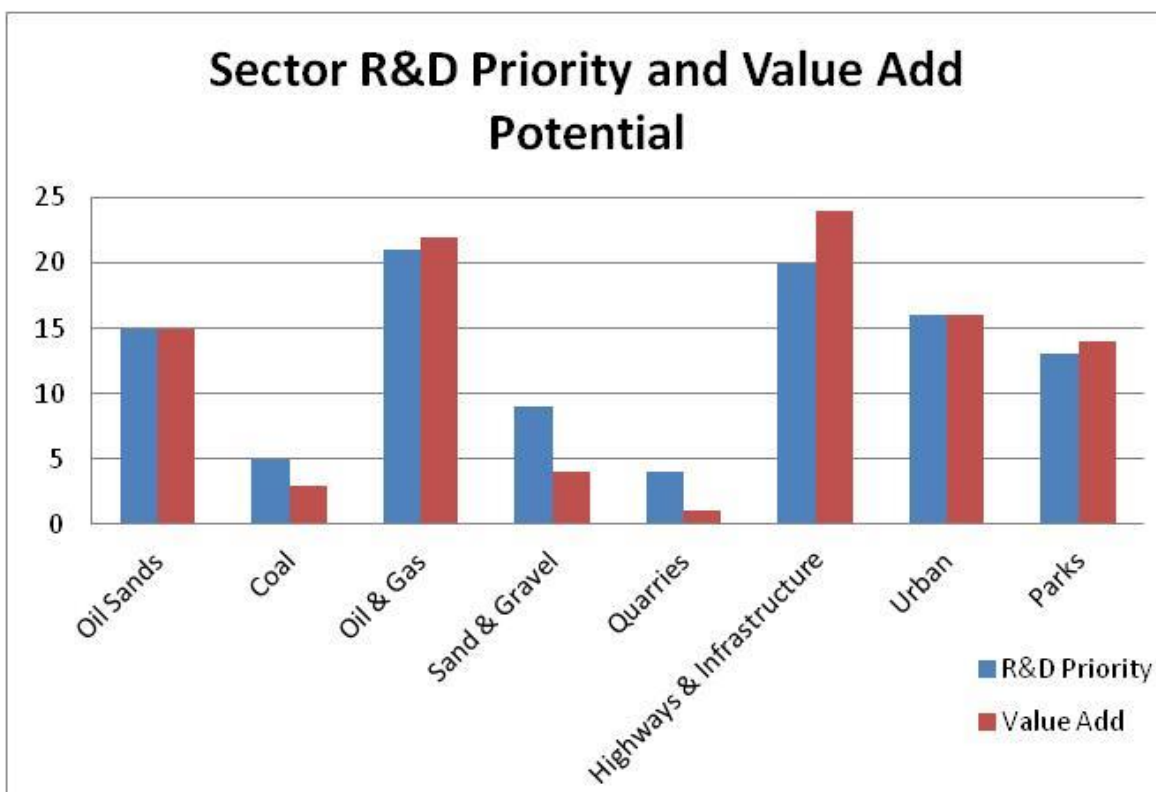


Figure 3. Summary of the Voting Results on the Sector Priorities for Research and Development.

3.1 DISCUSSION

The primary themes emerging from the discussions are listed below; detailed notes from each of the workshops and the workbook submissions are provided in [Appendix E](#)). The themes do not necessarily reflect a consensus view of participants - rather they are provided as key considerations for developing the Native Species Research Program business case.

- To plants most disturbed areas are similar - i.e., it isn't a question of sector it is a question of the nature of the disturbance and the reclamation/restoration goal. Rather than think of industrial sectors it would make more sense to think *ecological sectors*

(e.g., grasslands, mountains, boreal). Coincidentally many of these also split along Green Area / White Area boundaries.

- A number of other sectors were identified (e.g., ranching (native prairie), renewable energy sites, medicinal plants, health products, green roofs).
- It would be useful to consider the potential for multiple uses of native plants as a driver for development and deployment (e.g., food, medicinal, cosmetic, traditional use, etc.).

4.0 SESSION 2B: PLANT GROUPS

In this session participants were asked to identify the priority research and development needs based on selected plant groups. Participants were then asked to identify where InnoTech Alberta could add the most value. Figure 4 shows the combined results from the two workshops and the workbook submissions (Figure 8 in [Appendix F](#) shows the results for each question broken down by source). Wetland plants were clearly seen as the focus area for both R&D and where InnoTech Alberta could add the most value. R&D priorities were similar in the Edmonton and Calgary workshops, but the Edmonton participants felt InnoTech Alberta could add more value to Wetlands while the Calgary participants focused on Cryptogams (Figure 8, Appendix F).

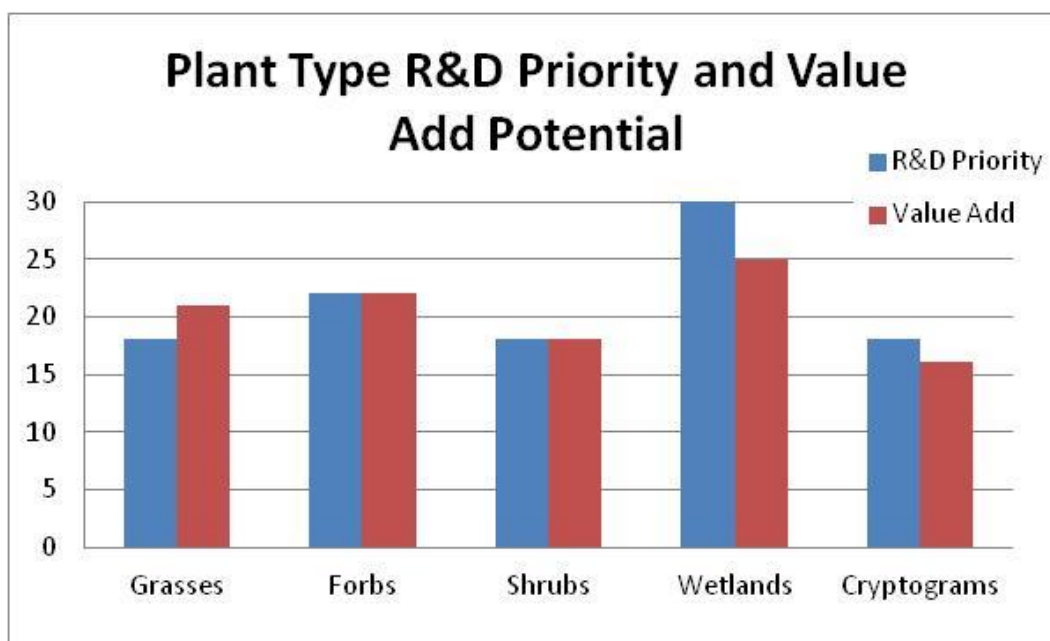


Figure 4. Summary of the Voting Results on the Plant Type Priorities for Research and Development.

4.1 DISCUSSION

The primary themes emerging from the discussions are listed below; detailed notes from each of the workshops and the workbook submissions are provided in [Appendix F](#)). The themes do not necessarily reflect a consensus view of participants – rather they are provided as key considerations for developing the Native Species Research Program business case.

- There is a need for greater understanding of how wetland ecosystems function.
- Rare species production and deployment (especially for grasslands) requires work. They have different needs than common plants.
- Revisions to the Alberta Forest Genetic Resource Management and Conservation Standards (FGRMS) for the Boreal have led to discontent among users of shrubs; work is

required to confirm the Standards, including progeny trials for shrubs to adjust seed zones.

- Forbs and cryptograms are important for developing biodiversity and both have a high degree of R&D need.
- Growers need protocols that help provide scientific background on what to grow and how to manage invasive species.
- Clients need more information as well to develop proper order specs.
- We need more *how to* information to de-risk the use of native plants by increasing likelihood of success.
- There is value in looking at fit-for-purpose plants (e.g., tailings dewatering, traditional use, carbon sequestration, wildlife habitat, biomaterials, beautification).
- Plant migration and assisted migration relative to climate change are both areas that we need to consider, possibly using provenance testing.

5.0 SESSION 3A: STRENGTHS AND RESEARCH OPPORTUNITIES

In this session participants were asked to identify what they thought InnoTech Alberta's main strengths are and where they saw research opportunities to pursue. The primary themes emerging from the discussions are listed below; detailed notes on InnoTech Alberta strengths from each of the workshops and the workbook submissions are provided in [Appendix G](#) while the detailed notes on research opportunities are provided in [Appendix H](#).

5.1 STRENGTHS

Figure 5 shows the combined voting results on InnoTech Alberta's perceived strengths from the two workshops and the workbook submissions (Figure 9 in [Appendix G](#) shows the results broken down by source). Clearly InnoTech Alberta's Facilities and Services are highly valued, followed closely by their Research strengths (the majority of Edmonton participants voted for the Facilities and Services while the Calgary participants focused more on Plant Development and Research - Figure 9, Appendix G). Greater awareness of the potential of the 3rd Party Validation program to support the native species industry is needed.

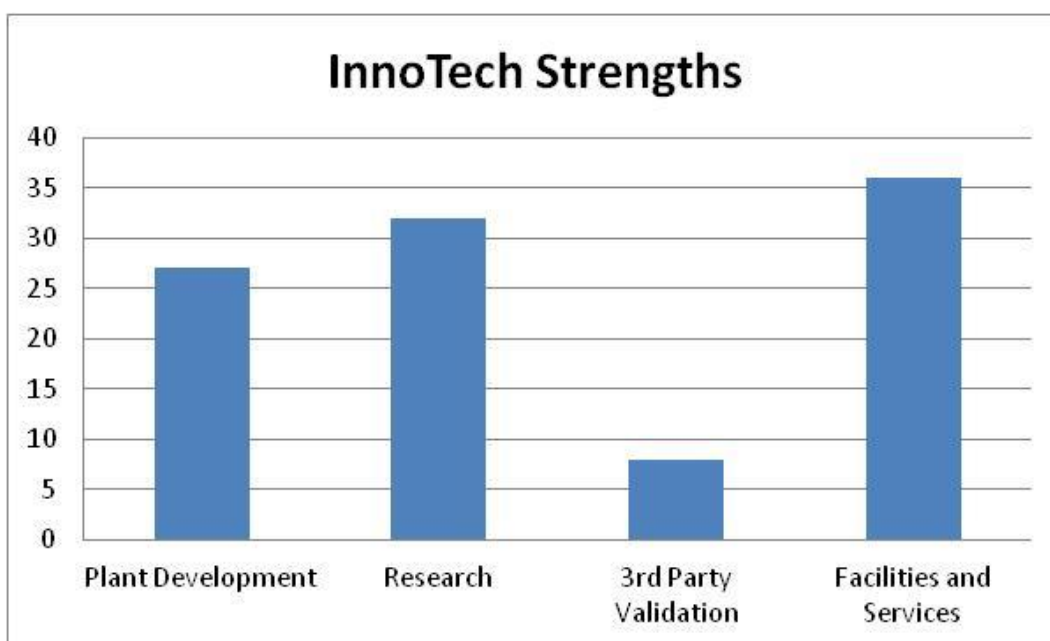


Figure 5. Summary of the Voting Results on the Perceived Strengths of InnoTech Alberta.

The primary themes emerging from the discussions are listed below. The themes do not necessarily reflect a consensus view of participants - rather they are provided as key considerations for developing the Native Species Research Program business case.

- It is obvious that facilities and services are your advantage here, and you have a reputation for them. They are a strong asset to attract collaborators; BUT need to catalogue and promote the capabilities and facilities.

- Long-term studies are within the mandate of InnoTech Alberta and are not well-captured by industry or even post-secondary institutions. They provide an opportunity to track change over time and do multi-disciplinary, integrated studies.
- There are some specialized services that InnoTech Alberta already provides (e.g., genotyping) and some that could be developed (e.g., cryogenic storage).
- InnoTech Alberta hiring for the program should focus on: native plant specialist; plant breeder; horticulturalist specializing in growing; business specialist who ensures that any work you disseminate does not decrease market competitiveness, especially for small companies.

5.2 RESEARCH OPPORTUNITIES

The primary themes emerging from the research opportunities discussions are listed below:

- Research efforts should be aimed at practical, cost-effective solutions that can be implemented by the private sector.
- There is a lot of work to do around prioritizing plants to work on; narrow the list to key species.
- The Oil Sands Vegetation Cooperative has identified priority species and priority research areas. Industry doesn't want to be the coordinator but rather the recipient – maybe a role for InnoTech Alberta. We should communicate to coordinate on what we should be working on.
- Need to develop and maintain a catalogue of *standard* native species mixes used by government agencies (and others if possible).
- Explore the notion of a provincial InnoTech Vegetation Cooperative, along the lines of the Oil Sands Vegetation Cooperative.
- There is a sense that the focus on environmental outcomes, rather than prescriptive rules, will help generate increasing interest in, and use of, native species.
- The focus needs to shift from individual species work to communities.
- More information is required on native plant succession and how to adapt seeding/ planting programs to maximize success.
- Trajectory research is needed so we can predict success potential early on.
- Training of wild harvest collectors is required. This is highly specialized work.
- Climate change-related provenance trials to determine resiliency of plant communities in the face of change are required.

6.0 SESSION 4: COMMUNITY OF PRACTICE

In this session participants were asked about the value of establishing a Community of Practice as a vehicle for sharing information about native species research and development work.

6.1 DISCUSSION

The primary themes emerging from the discussions are listed below; detailed notes from each of the workshops and the workbook submissions are provided in [Appendix I](#)). The themes do not necessarily reflect a consensus view of participants – rather they are provided as key considerations for developing the Native Species Research Program business case.

- There is a need for a *facilitator* organization who can connect native plants practitioners. There isn't a listing for who works on Native Plants in Alberta. That would be a really good first step!
- There is a need to integrate the knowledge between sectors (especially between government and industry). InnoTech Alberta would be a good place to go, acting as a neutral knowledge broker, as a disseminator.
- There are a number of communication vehicles that should be explored as a means of maximizing the number of people who have access to native plant knowledge.

7.0 SUMMARY

Workshop participants were encouraged to see the broad range of interest in use of native plants and noted there was ongoing need for discussion and information sharing. Significant research opportunities were identified with participants recommending InnoTech Alberta build on its capacity for long-term projects and capitalize on its existing facilities.

7.1 GENERAL OBSERVATIONS

There was considerable debate about the extent of demand for native species but general agreement that there is not enough locally-available stock.

There is no such thing as a formalized native plant industry in Alberta – there is a collection of individuals who may or may not know about each other. This makes coordination and collaboration difficult.

There was little awareness of InnoTech Alberta’s 3rd Party Validation role and how the Voucher Program might apply to the native species sector to benefit small to medium sized enterprises.

7.2 INNO TECH ALBERTA STRENGTHS

One of InnoTech Alberta’s key strengths is the ability to undertake long-term projects (e.g., 30+ years at Smoky River coal) – this capacity should be leveraged. Another is the range of facilities and services available to support the industry.

7.3 PLANT DEVELOPMENT OPPORTUNITIES

InnoTech Alberta’s native plant variety development work has helped create the potential for increased use of native plants in reclamation and restoration but the actual supply of seeds is currently limited. Workshop participants noted that *plant variety development* work is important but there is a broader suite of work required to support the industry, thus they recommended a focus on *plant development*. The oil sands mining industry is projecting significant increases in areas to be reclaimed in the near future and there will be many kilometres of seismic lines revegetated to support caribou habitat protection – these will drive native species demand.

7.4 RESEARCH OPPORTUNITIES

Research continues to be required to support improvement in the successful use of native plants in remediation, reclamation and restoration work. Participants noted that in addition to the traditional oil and gas, mining and pipeline sectors there are significant opportunities in urban naturalization.

7.5 KNOWLEDGE BROKER OPPORTUNITIES

Participants agreed that there is a wealth of knowledge and experience in the province but that we have collectively failed to share it effectively resulting in a lot of reinventing the wheel. It was suggested that InnoTech Alberta could play an important role as a knowledge hub or broker. A number of ideas were provided for tools to share knowledge with the community.

8.0 RECOMMENDATIONS

InnoTech Alberta should proceed to develop the Native Species Research and Development Program Business Case incorporating, where appropriate, the following project components identified by workshop participants and in workbook submissions.

8.1 QUICK WIN PROJECTS

Within the next 12 to 18 months InnoTech Alberta should work towards completing the following:

1. Publicize the infrastructure and services available at InnoTech Alberta to generate more interest in partnerships, particularly among the smaller players who commonly inhabit the native plants business.
2. Produce a detailed description of the process InnoTech Alberta uses to develop and release a native plant variety.
3. Produce a detailed description of the characteristics and potential uses of each of the 22 native species varieties produced to date.
4. Undertake a new native plant market assessment to determine needs, economics and barriers – much has changed since the original assessment.
5. Revisit the current breeder seed allocation system to enhance availability through multiple providers.
6. Inventory historical InnoTech Alberta reports and data to see what can be made available online.
7. Survey the reclamation, restoration and remediation communities to identify priority species for further plant development work.
8. Approach Canada's Oil Sands Innovation Alliance about opportunities to collaborate with the Oil Sands Vegetation Cooperative.
9. Develop and maintain a list of existing prescribed native plant seed mixes to help growers identify opportunities and to drive work to provide improved mixes.
10. Determine priority remediation research needs.
11. Explore implementation of a Native Plant Information Hub on the InnoTech Alberta website or an alternative site.
12. Develop a periodic Newsletter that will disseminate native plant R&D information – promote this through existing organizations.

8.2 MEDIUM-TERM PROJECTS

Within the next 18 months to 3 years InnoTech Alberta should work towards completing the following:

1. Evaluate the opportunities and viability of a provincial seed bank / seed exchange at Vegreville. May require additional infrastructure (e.g., cryogenic storage).

2. Expand the existing shrub provenance testing project to more species and more sites to assist in supporting/revising the Forest Genetic Resource Management and Conservation Standards and in supporting climate change adaptation options.
3. Develop *how to* extension materials for the use of native plants.
4. Develop a catalogue of demonstration sites that people can view to promote successes (and help understand failures) – list what was done, when and why.
5. Host at least one native plant reclamation tour and workshop.

8.3 LONGER-TERM PROJECTS

Within the next 3 to 10 years InnoTech Alberta should work towards completing the following:

1. Determine basic plant propagation characteristics for priority plant species (e.g., collection, storage, germination) to support commercialization by the private sector.
2. Develop methods to effectively and economically deploy cryptogams on disturbed sites – e.g., sandy soil/tailings for erosion control, near-vertical quarry faces.
3. Develop enhanced wetland reclamation methods for urban stormwater ponds.
4. Develop revegetation success monitoring protocols.
5. Compile trajectory monitoring data, and develop models where appropriate.

9.0 APPENDICES

Appendix A: [List of Workshop Attendees](#)

Appendix B: [Workshop Agenda](#)

Appendix C: [History and Focus of Native Species Research Program](#)

Appendix D: Session 1 - [Focus Areas Notes](#)

Appendix E: Session 2A - [Sector Notes](#)

Appendix F: Session 2B - [Plant Group Notes](#)

Appendix G: Session 3A - [Strengths Notes](#)

Appendix H: Session 3B - [Research Opportunities Notes](#)

Appendix I: Session 4 - [Community of Practice Notes](#)

APPENDIX A: LIST OF WORKSHOP ATTENDEES

The following people attended the November 2 workshop in Edmonton and November 9 workshop in Calgary. The Workshops were facilitated by Chris Powter, Enviro Q&A Services.

Edmonton Attendees

Mike Ardiel	TreeTime Services Inc.
Sasha Bachmann	Clark Ecoscience and Sustainability
Michael R. Clark	Clark Ecoscience and Sustainability
Brittany Davey	City of Edmonton
Dave Ealey	Wagner Natural Area Society
Kim Gould	Wild Rose Consulting
Dallas Johnson	Alberta Innovates
Greg Kelley	Clark Ecoscience and Sustainability
Agnieszka Kotowska	City of Edmonton
Jodie Krakowski	Alberta Agriculture and Forestry
Michelle Pahl	Wild Rose Consulting
Jennifer Porter	Alberta Environment and Parks
Catherine Shier	City of Edmonton
Ann Smreciu	Wild Rose Consulting
Alia Snively	Nature Conservancy of Canada
Jean-Marie Sobze	NAIT Boreal Research Institute
Robert Vassov	Shell Albian
Caitlin Willier	University of Alberta

InnoTech Alberta Attendees

Quinn Barber
Shauna-Lee Chai
Marshall McKenzie
Christina Small

Calgary Attendees

Al Fedkenheuer
Donna Fleury
Lori-Jo Graham
Jane Lancaster
Lee Moltzahn
Lori Neufeld
Christine Nicholls
Tanner Petersen
Ray Shaw
Heather Sinton
Dayle Soppet

Dylan Spetz
Steven Tannas
Matthew Wass
Lelaynia Wells
Rachel Whitehouse
Ken Wright

ALCLA Native Plant Restoration
Alberta Agriculture and Forestry
Alberta Agriculture and Forestry
Kestrel Research Inc.
Alberta Conservation Association
Imperial
TransCanada Corporation
TMD SEEDS INC.
Knutson and Shaw Growers
Alberta Environment and Parks
Alberta Native Plant Council / Lacuna
Ecological
TMD SEEDS INC.
Tannas Conservation Services
TMD SEEDS INC.
Suncor
Alberta Conservation Association
Wright Nursery

InnoTech Alberta Attendees

Quinn Barber
Shauna-Lee Chai
Marshall McKenzie
Christina Small

APPENDIX B: WORKSHOP AGENDA

Alberta Innovates – Technology Futures Native Species Research Program Workshop: Looking to the Future of Native Plants in Alberta

This workshop will bring together government, industry, and research centres to discuss *the role InnoTech Alberta should play to enhance the successful development and deployment of native species for reclamation and remediation*. The results will facilitate redevelopment of the InnoTech Alberta Native Species Research Program to better serve the native plants industry in a collaborative capacity.

Workshop Agenda

8:45 – 9:00 – Coffee and light breakfast

9:00 – 9:30 – Introductions and welcome

9:30 – 10:00 – History of the InnoTech Alberta Native Species Research Program and workshop context

10:00 – 10:50 – **Session 1: Roles and Functions.**

Where are the R&D priorities – native plant development, reclamation or remediation?

Where can InnoTech Alberta add the most value?

10:50 – 11:10 – Break

11:10 – 12:00 – **Session 2: Sectors and Plant Groups.**

Which sectors require the most R&D?

Where can InnoTech Alberta add the most value?

Which plant groups (e.g., grasses, forbs, shrubs, wetland species, and cryptograms) require the most R&D?

Where can InnoTech Alberta add the most value?

12:00 – 1:00 – Catered lunch

1:00 – 1:30 – **Session 2: Discussion Continued**

1:30 – 2:15 – **Session 3: Strengths and Research Opportunities.**

What do you see as InnoTech Alberta's primary strength: cultivar development; third party technology validation; research; facilities and services

In what instances should InnoTech Alberta lead, partner with collaborators, or take no part in the various aspects of native plants work?

2:15 – 2:45 – Break

2:45 – 3:15 – **Session 4: Community of Practice.**

Is there a need for a Native Plant R&D Community of Practice, and what would you want it to accomplish? Would you participate?

3:15 – 3:30 – Wrap up and next steps.

APPENDIX C: History and Focus of Native Species Research Program

The following summary of the history and focus of the Native Species Research Program was provided by Christina Small, Interim Reclamation Team Lead.



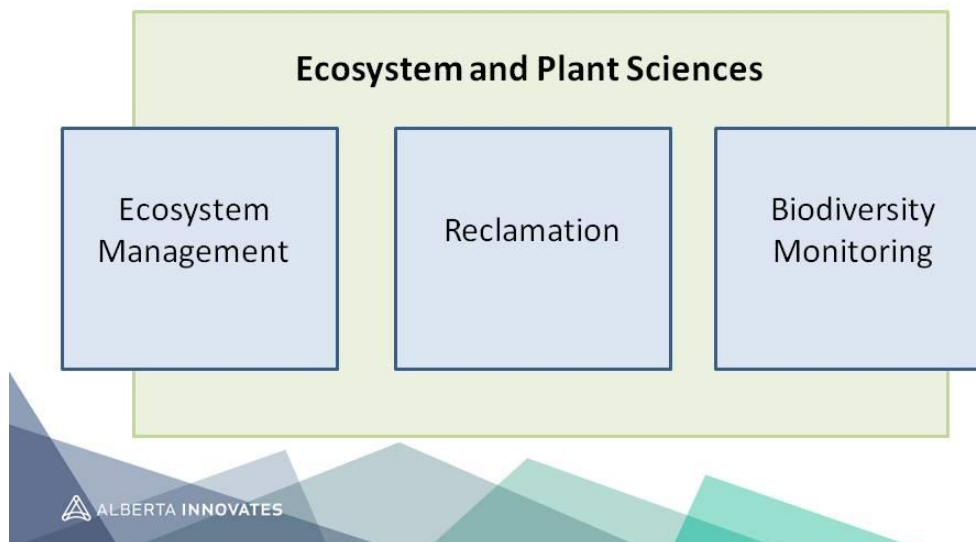
As of November 1, 2016

- Consolidation of the four Alberta Innovates corporations
- Applied research now a separate subsidiary, called **InnoTech Alberta**
 - *Same people, expertise, quality of work!*
- Intent is to:
 - Create a more streamlined, efficient and transparent innovation system
 - Fund and drive innovation
 - Make it easier for researchers, companies and partners to access and navigate the opportunities and support available to them

www.albertainnovates.ca

CURRENT ORGANIZATIONAL STRUCTURE

- Functional groups support Environment, Oil & Gas, Pipelines, Food & Fiber, and Health Sectors



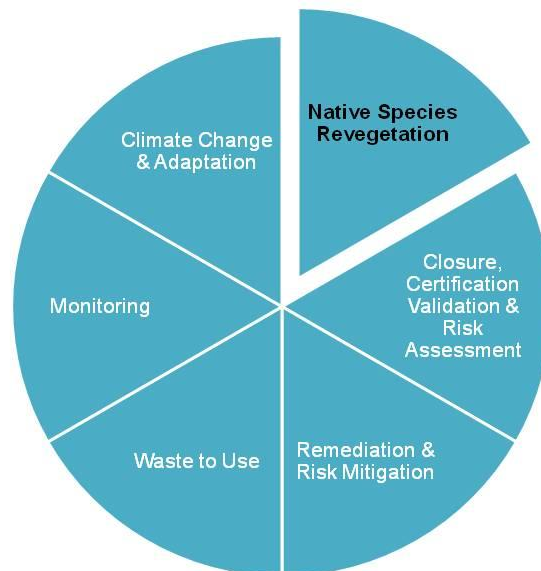
RECLAMATION TEAM MANDATE

- To develop applied, innovative, practical and holistic land reclamation and remediation procedures and technologies for landscapes disturbed by industrial activities for the benefit of Albertans, our partners and clients.
- To work across sectors, applying and transferring knowledge from various fields of study
- To remain a touchpoint for industry and regulators



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RECLAMATION CURRENT FOCUS AREAS



ALBERTA INNOVATES

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KEY PEOPLE AND SKILLS



Bonnie Drozdowski; MSc., PAg.

- Soil science and applied reclamation research
- 10 years of experience working in the reclamation industry in Canada
- Site characterization, soil classification and morphology, soil chemistry, waste utilization for soil amendments, and biometric carbon assessments



Dani Degenhardt; PhD., PAg.

- Soil chemistry, fate and transport of contaminants in soils and wetlands
- >5 years of experience working in applied reclamation research with a strong technical background in environmental chemistry, contaminant fate in wetlands, soil genesis and land reclamation using soil amendments.
- Soil science instructor at the University of Alberta



Christina Small; MSc., PAg., EPT.

- Long-term monitoring, sensor validation and development, phytoremediation, plant growth enhancement, soil reconstruction, and climate adaptation research
- 7 years of combined research (basic and applied) and field experience in environmental monitoring, reclamation, remediation and air/soil/water characterization, management and assessment



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KEY PEOPLE AND SKILLS (CONT'D.)



Simone Levy; M.Sc., PAg.

- 12 years of experience in contaminated site assessment, remediation and reclamation
- Assessment and management of contaminated sites; risk assessment; spill response; soil, groundwater and surface water monitoring; reclamation in agricultural, forested and wetland ecosystems



Quinn Barber; M.Sc.

- 5 years experience in environmental data analysis, remediation and reclamation
- Climate data analysis; species conservation monitoring/mapping; contaminated site assessment; geographic information systems and remote sensing; soil, groundwater and surface water monitoring.



Marshall McKenzie

- 8 years experience in native species identification, seeding, germination, and propagation research (field, laboratory, greenhouse), wild seed collection, invasive plant identification and management, field monitoring and protocol developments



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KEY PEOPLE AND SKILLS (CONT'D.)



Tania McDonald

- 15 years experience in agricultural and environmental research (field, greenhouse and laboratory)
- Research specializes in bioherbicide development, crop/plant disease control, molecular development of canola breeds and native species across Alberta



Andrew Underwood; B.Sc.

- 8 years experience in land reclamation research
- Specializes in climate monitoring/micrometeorology, sensor design/fabrication, instrument prototype development, proximal sensors, GIS, and data analysis



Victor Bachmann; B.Sc.

- 3 years experience in land reclamation research
- Specializes in laboratory soils assessment, native plant identification, experimental design and execution, long-term field monitoring (soils, vegetation)



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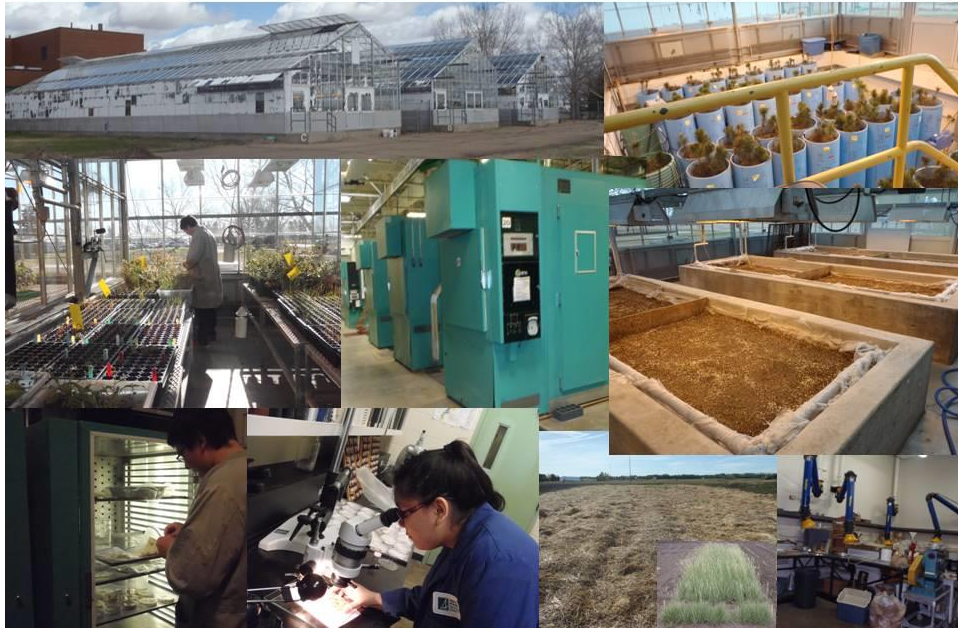
ADDITIONAL InnoTech Alberta Expertise

The Ecosystem Management Team



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FACILITIES AND RESOURCES



NATIVE PLANTS PROGRAM

- Started in the late 1970's (Alberta Environmental Centre)
- Vision:
 - To facilitate the return of disturbed land to former and/or productive uses through the development and deployment of native species
 - Included the improvement of ecological function across disturbed specified lands; rangeland rehabilitation; reconstruction of wildlife habitat; developing fire smart landscapes and sustainable urban environments

NATIVE PLANTS GOALS

- Increase public awareness on the need to protect the natural environment
- Conserve biodiversity
- Prevent further landscape fragmentation
- Increase the productivity of marginal lands
- Advance research and development
- Create new industries (i.e., crop diversification)



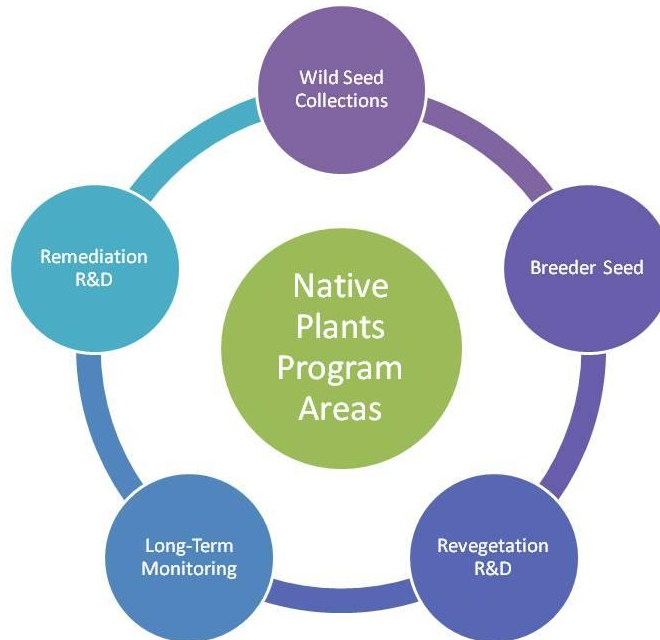
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DESIRED OUTCOMES

- Availability of native seed is increased
- A proven production base is established
- Production technologies are improved
- Costs and risks associated with producing native seed are reduced
- Reclamation and revegetation have higher success rates
- Lost marginal lands are regained
- Rangelands are improved
- New industries are developed within Alberta



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NATIVE SPECIES WILD SEED COLLECTIONS

- Goal
 - To collect varieties of native plant species that perform well and have optimum genetic diversity
- Targets species that:
 - Stabilize soil/prevent erosion
 - Show good growth and vigor
 - Are non-invasive
 - Grow on bare soil, acidic soil, sandy soils, etc.
 - Are active colonizers
 - Allow invasion by other indigenous species



BREEDER SEED PROGRAM



- Foundation seed provided to commercial growers to help meet various sector-specific needs
- **InnoTech Alberta** maintains breeder seed plots to CFIA standards, registered with the CSGA
 - Inspected and certified annually
- 22 commercial varieties currently available



Spike Trisetum



Junegrass



Plains Rough
Fescue



Rocky Mountain
Fescue



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Varietal Release	Soils Adaptation	Origin	Marketing Company
"AEC Highlander" slender wheatgrass	Black chernozem, Brown, Dark brown	Rocky Mountains of Alberta	Brett-Young Seeds
"AEC Hillcrest" awned wheatgrass	Black chernozem, Brown, Dark brown	Crownest Pass	Brett-Young Seeds
"AEC Mountaineer" broad-glumed wheatgrass	Mountain soils, nutrient poor soils	Rocky Mountains of Alberta	Brett-Young Seeds
"AEC Glacier" alpine bluegrass	Black chernozem, Brown, Dark brown	Lower elevation in the Rocky Mountains of Alberta	Brett-Young Seeds
"AEC Blueridge" alpine bluegrass	Black chernozem, Brown, Dark brown	Rocky Mountains of Alberta	Brett-Young Seeds
"ARC Sentinel" spike trisetum	Black chernozem, Brown, Dark Brown	Rocky Mountains of Alberta	Brett-Young Seeds
"ARC Plateau" Rocky Mountain fescue	Black chernozem, Brown	Rocky Mountains of Alberta	Brett-Young Seeds
"ARC Mountain View" June grass	Black chernozem, Brown	Crownest Pass	Brett-Young Seeds
"ARC Vista" alpine fescue	Black chernozem, Brown	Rocky Mountains of Alberta	Brett-Young Seeds
"ARC Grouse" green needle grass	Black chernozem, Brown	Wainwright area	Brett-Young Seeds
"ARC Metisko" awned wheatgrass	Sandy, Brown, Dark brown	Metiskow	No supplier, breeder seeds available at AITF
"ARC" Porter" Indian rice grass	Sandy, Dark brown	Wainwright – Ribstone Creek	No supplier, breeder seeds available at AITF
"ARC Prairie" June grass	Black chernozem, brown, sandy	Crownest Pass	Brett-Young Seeds
"ARC Centennial" Canada wild rye	Sandy	Wainwright area	Brett-Young Seeds
"ARC Hillbilly" nodding brome grass	Sandy Parkland	Wainwright area	Brett-Young Seeds
"ARC Butte" Rocky Mountain fescue	Sandy	Near Waterton Lake National Park	Brett-Young Seeds
"ARC Aspen" Canada milk vetch (legume)	Sandy/Parkland	Vegreville	Brett-Young Seeds
"AITF Bison" Plains rough fescue	Black Chernozem, Brown	Northern fescue region	Brett-Young Seeds
"AITF Badlands" blue grama grass	Brown soil	Hand Hills, Hanna	Brett-Young Seeds
"AITF Battle bend" tufted hair grass	Sandy/Parkland, stabilisation of tailings sand	Wainwright area	Negotiation
"AITF Painted Skies" Rocky Mountain fescue	Sandy/Parkland	Wainwright area	Negotiation
"AITF Cascade" Hairy wild rye	Mountains/Upper Foothills	Jasper/Hinton	Brett-Young Seeds



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REVEGETATION RESEARCH AND DEVELOPMENT

- Provenance trials
- Germination improvement trials
 - Seed priming, stratification, etc.
- Promotion of shrub and tree growth
- Soil reconstruction techniques for plant growth promotion
- Methods for control/eradication of non-native species/invasive species
- Mitigation methods that promote restoration of ecological value



 ALBERTA INNOVATES

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NATIVE SPECIES LONG-TERM MONITORING

- Objectives
 - Measure the progress of native re-vegetation and natural succession in disturbed areas
 - Track ecological recovery and evaluate reclamation success
 - Track and model non-native/invasive species migration



 ALBERTA INNOVATES

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NATIVE PLANTS REMEDIATION RESEARCH

- Plant tolerance studies
 - Evaluation of native species tolerance
 - Techniques to improve tolerance
- Phytoremediation trials
 - Whole plants
 - Rhizobacteria
- Native species for Tier 1 guideline validation
 - PAHs, salinity, metals
- Ecotoxicity studies

LOOKING TO THE FUTURE OF NATIVE PLANTS IN ALBERTA

- Refining the strategic direction
- Seeking how we can work collaboratively with existing research institutions, government agencies, seed providers, consultants and industry

THANK YOU

Christina Small, M.Sc., P.Ag.
Reclamation Researcher; Interim Reclamation Team Lead
Christina.Small@InnoTechAlberta.ca
T. 780-450-5474



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APPENDIX D: SESSION 1 - FOCUS AREAS NOTES

Participants were asked to explain the reasons for their choice(s) on the Program Focus Area research and development priorities (Figure 6 shows the detailed breakdown of the voting results) and provide any other comments.

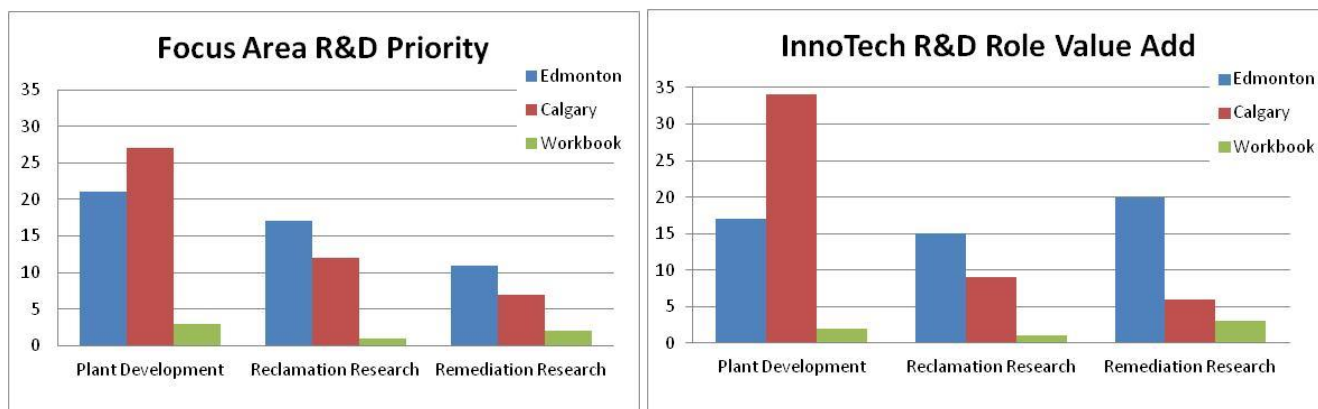


Figure 6. Detailed Breakdown of Voting Results on the Focus Area R&D Priorities from the Edmonton and Calgary Workshops and the Workbook Submissions.
Left Panel - R&D Priorities; Right Panel - Value Added Opportunities for InnoTech Alberta.

Some questions were provided to help promote discussion:

- What other roles and functions should be explored by InnoTech Alberta (e.g., seed or propagule bank, similar to the Oil Sands Vegetation Cooperative)?
- Is it time to re-evaluate the native plants market?
- Should InnoTech Alberta certify our seed cleaning facility to increase capacity and resources available?
- Is there a need to continue wild seed collection efforts across Alberta, to increase the availability of native species currently not available on the commercial market?
- How can InnoTech Alberta best operate in the space between consultants and university researchers to enhance collaboration and avoid competition?
- Are there needs and opportunities for phytoremediation in remediation?
- Would your answers change if you were considering InnoTech Alberta's existing expertise, or only InnoTech Alberta's existing resources (equipment, facilities, etc.)?

NOTE: At the Edmonton session participants agreed to change the original Focus Area label from the narrow *Native Species Variety Development* to the broader *Native Plants Development* to account for important development work required outside the variety development work; it was also felt that the other two Focus Areas (reclamation research and remediation research)

were very broad and variety development was very narrow. This change was carried through to the Calgary Workshop and reflected in the Workbook.

The following notes are a compilation of the workshop discussions and workbook submissions and have been organized into common themes.

- I like to go out and help businesses to install plants, to help make sure they are successful. That is the difference between a seed supplier and a native plant professional.
 - I think a lot of businesses treat you as a supplier, but many of us (growers) have other knowledge than just a supplier.
 - The producer has to give good advice, but there are often many parties between the ultimate client (user) and the producer so it's complicated.
 - The producer doesn't get into the process early enough to do good. We haven't received the order until too late, and we have no method of communicating with the reclamation team prior to this order.
 - And with scaling up to commercial production the producers don't actually know the plants. In one case, they want to ban wheatgrass use because they are too fecund. If you are using a species for reclamation you have to be careful in development, because you are naturally weeding out the slow growing plants, unintentional selection. This invalidates the seeds, because they outcompete the other species. I will have to take out some species from a mix because they will take over.
- Maybe we should expand the existing plant development to add more species.
 - Presently the interest in native material is high but often access to propagules is limited or even non-existent depending on species. Variety development provides a marketable product with the potential to decrease cost (another roadblock to use). This in turn would aid more rapid development of the native seed industry which struggles in comparison to large development south of the border. There are a lot of guidelines around using local varieties and a sense that the demand is there.
 - Native plant market: we are in a chicken and egg situation of trying to promote plants that are hit and miss in their availability, which means things we intend to demonstrate don't get demonstrated, which means demand isn't increased, which means the plants aren't available, which makes us wary to market them as solutions. How to overcome?
 - We need more R&D in species development.
 - Growing seed collected from around Alberta to commercial levels and making it available to industry/stakeholders. Collaborate with other groups to enhance efficiency and reduce duplication.
 - The development of 22 native plant varieties to date is a remarkable achievement by InnoTech Alberta and I personally feel that more work in this area is warranted. This is especially valid as it pertains to native grasses, an obvious core strength of the Native Plant Development's past work. However, the commercialization of InnoTech Alberta native grasses varieties (and one legume) to date has not been completely successful. Seed availability is still remarkably limited. Perhaps the time

- has come to entertained an alternative approach in contracting out distribution rights, which need not be awarded to a single seed company in an exclusive long-term contract.
- Native plant varieties provide a better option than the use of tame forages and provides yet one more vital tool in the collective toolbox that assist in achieving more desirable outcomes in reclamation. Many of the Workshop attendees expressed a desire for greater product availability and a more off-the-shelf approach for their revegetation needs. Therefore, in response, InnoTech Alberta should endeavor to increase both awareness and seed availability of these varieties in order to facilitate their ultimate and intended end-use in land reclamation. Further, native plant varieties and wild harvest need not be an either/or situation. Named varieties, wild-harvested seed and orchard-grown material will all have place in reclamation in Alberta's future.
 - On the flip side ...
 - Native varieties are a shrinking industry, so development of varieties is not important. I think that's still a bit of an albatross, it's the market. Yes, seed remains a little viable over time, but the quality decreases over time.
 - We've seen a number of others who have gotten into native plant seed production, and they're gone when the reclamation industry is down.
 - Caution around domestication of native species through breeding programs.
 - The forestry industry collects their own because it doesn't make sense to breed seed with the seed zone restrictions.
 - A number of the species are not Alberta centric thus the potential exists to bring other jurisdictions on side for improved collaboration, cost sharing.
 - Our expectations are flawed. Instead of getting high quality, we are growing seed in large quantities. You only need 10 acres to flood the market. One to two companies can do it.
 - I'd rather sell aspen seedlings than seed, from a business standpoint.
 - In one of the states, they're doing native seed planting. That state has become a native seed supplier for much of the surrounding state. However, it's hard to sustain the native plant industry with the fluctuations in the oil and gas market.
 - First Nations opportunities
 - The oil sands provides an opportunity for a First Nations nursery. If there is a sustainable niche in the oil sands region, I wouldn't discourage a First Nations business because they might put someone else out of business.
 - I've tried to get growers to start privately on reserves, but it's not economically viable without government support.
 - We've looked at greenhouses in reserves, but the market is so up and down that they may only be in business for a few years.
 - To my knowledge a BC First Nation had success because it was anchored to reclamation of a local mine.
 - In northeastern BC, we are seeing challenges around natural regeneration, primarily from indigenous communities. They do not make seed requests with full awareness

- of where the seed will be sourced. We get the response of “we can grow it”. Is there some initiative off knowledge sharing/partnering with indigenous communities?
- We have three reserves we work with right now. Stoney, Sitsitka, and one into BC right now. However, their overgrazed lands do not have any seed to harvest.
 - Is it time to redo the Market Assessment?
 - Conditions have changed considerably since the original Assessment.
 - Maybe the market has changed with the oil price.
 - The rate of grassland decline has not changed, despite improved practices.
 - The total area to be reclaimed hasn't gone down.
 - It would also be useful to consider the potential for multiple uses of native plants as a driver for development and deployment (e.g., food, medicinal, cosmetic, traditional use, etc.). Plants have multiple purposes; maybe a species has other values.
 - InnoTech should focus on Remediation because Reclamation should be the focus of the Reclamation Industry.
 - InnoTech has a strong soils capacity and appropriate facilities so InnoTech can add the most value in soil remediation, since reclamation is largely covered by NAIT, industry, etc.
 - Remediation is a huge knowledge gap with potential economic benefits.
 - Phytoremediation is a very useful process that needs more R&D, as well as promotion and extension to the energy industry (including renewable energy groups).
 - Bioretention research: We have a theoretical list of plants for this phytoremediation practice (typically designed for parking lot and road runoff as part of green infrastructure). Engineers require a high infiltration rate of the media and nutrient leaching is a concern. Soil and phytoremediation of nutrients, metals, hydrocarbons, bacteria with tolerance to salt, sediment, and high/widely fluctuating hydraulic loadings are the goals. Currently a mesocosm-scale experiment is being devised at the new Town of Okotoks Wastewater Treatment Plant, but it is not going to come close to answering all the questions that we have. I read that you have a mesocosm facility. I would like to know more about this.
 - Remediation would be a good place for InnoTech to do 3rd party validation.
 - The City would like see contaminated sites and ecosystem restoration funded by industry. Reclamation research is more suitably funded by Government of Alberta.
 - Harsh environments are another challenge, such as environments high in methane, contaminated sites, etc.
 - We should talk about very specific things, look at it in a different way than we look at reclamation, with the goal of moving away from the non-native plants we've used in the past.
 - Salinization on oil and gas sites will be a challenge.
 - Drivers for future work
 - Natural areas require Native Species Development and InnoTech adds value there.
 - The government wants to restore 10,000 acres of seismic lines over the next 5 years, so there is a real need for knowledge here.

- Millions of trees will be planted on old seismic lines.
- Oil sands mines are going to need to do exponentially more reclamation, which will require greater seed stocks. This may require better seed longevity, better supply, orchard development, progeny trials. Specifically, it's the research required for development of seed orchards, especially the genetics of the understory plants.
- In the recent south Saskatchewan regional plan, there is an assumption that old footprint will disappear off the landscape, but that doesn't necessarily happen without the right tools and reclamation practices.
- New guidelines for peatlands (wellsites and peat extraction) will drive needs.
- The Oil and Gas sector may have slowed down but the reclamation and remediation requirements and work have not.
- On the flip side there is emphasis on minimal disturbance meaning there may be less reclamation work.
- Urban/municipal needs
 - I am happy to see a focus in your mandate on 'development of sustainable urban environments'. We are working squarely in this area. A good part of sustainable stormwater management involves the use of plants and soil to restore natural functions which are lost in the land development process.
 - We have been working for about 6 years now on exploring and promoting the virtues of native plants in urban areas and have been on the sharp end of lack of supply for our purposes, including general landscaping demonstrations of water-sensitive designs, solutions to small urban lot challenges and crime prevention through environmental design constraints, streetscape habitat and habitat connectivity strategies, and phyto/bio remediation of runoff in roadways at all scales, to name a few.
 - We would like to use more native plants in stormwater management, etc. However, all that is available to us is the "naturalization mix", but that's not native. Right now the City has NO experts on Native Plants. We try to do the right thing, but this isn't really the mix we're looking for.
 - We talked about municipalities needing assistance.
 - Calgary is working hard to use native plants in their native areas. They have seed contracts in place, lots of urban municipality work in place. This is a bigger business than reclamation right now.
 - You almost need to mandate the production ahead of time. That's what City of Calgary is doing, they're developing their own varieties. This gives a grower a stable base. That's not necessarily something you guys can do, but that's how you develop stability.
 - The City of Lethbridge is developing a native seed mix for stormwater drainage ponds.
 - We hear that in Edmonton too, including in infrastructure reclamation need.
 - Talking with Winnipeg, they have a 90% failure rate, because there is demand but there isn't a strong supply, the product we get is infested with non-native weeds and it is high-maintenance.

- We need a low-maintenance, weed-resistant product. Once a company becomes good at this, it becomes proprietary information and it isn't available.
- This needs to be driven by the province or non-profit so that it becomes public information and it remains available.
- What about a consortium of municipalities that might facilitate coordination of research needs and communication to research institutions?
- Alberta Low Impact Development Partnership⁴ is a good connecting agency for urban projects. City of Edmonton and City of Calgary are both members. They support sustainable development, sustainable soil rebuilding.
- Not a lot of plant people are on that Partnership.
- Smaller municipalities are keen to do naturalization but don't have the resources - opportunity to support them.

⁴ See <https://alidp.org/>

APPENDIX E: SESSION 2A - SECTOR NOTES

Participants were asked to explain the reasons for their choice(s) on the Sector research and development priorities (Figure 7 shows the detailed breakdown of the voting results) and provide any other comments.

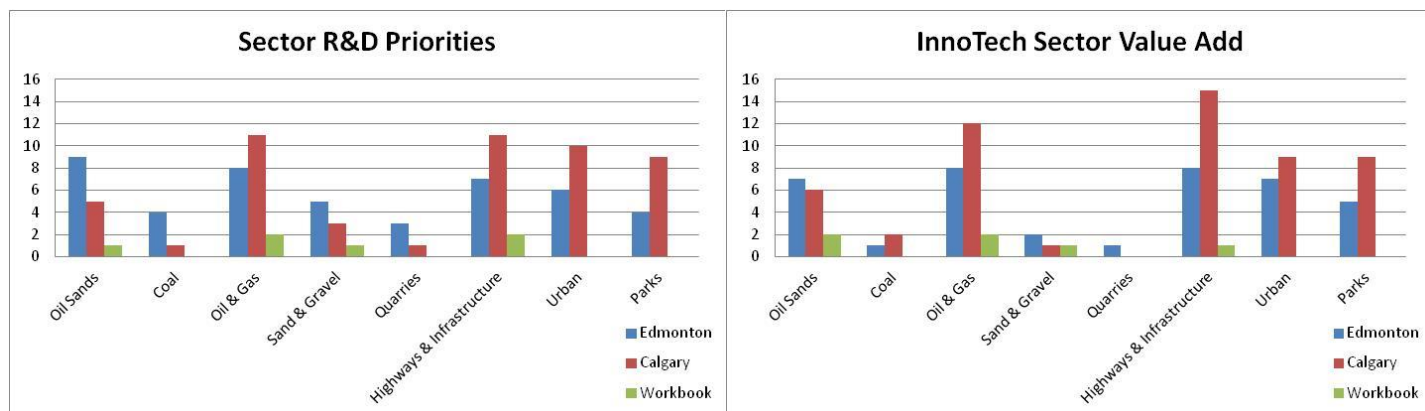


Figure 7. Detailed Breakdown of Voting Results on the Sector R&D Priorities from the Edmonton and Calgary Workshops and the Workbook Submissions.
Left Panel - R&D Priorities; Right Panel - Value Added Opportunities for InnoTech Alberta

Some questions were provided to help promote discussion:

- Where do you see the public pressure now and in the future for native species use?
- Are there other sector focus areas, not currently explored, where InnoTech Alberta should pursue further research (e.g., traditional use, medicine/food, carbon sequestration, beautification,)?
- Should InnoTech Alberta focus on areas where there are currently a large number of researchers or a limited number of researchers? Which research areas are currently lacking research and development effort?

The following notes are a compilation of the workshop discussions and workbook submissions and have been organized into common themes.

- To plants most disturbed areas are similar - i.e., it isn't a question of sector it is a question of the nature of the disturbance and the reclamation/restoration goal.
 - BUT, disturbance size does matter if there is any intent to rely on natural colonization.
 - Also there are differences in the length of time between disturbance and reclamation in different sectors which can affect success.

- Rather than think of industrial sectors it would make more sense to think ecological *sectors*.
 - For example, the “oil sands” sector would be considered the Boreal.
 - There are also the mountains with a lot of infrastructure work, that is a sector that may be represented by “highways and infrastructure”. Mountain areas have special needs.
 - One of the biggest challenges on Native Prairie restoration is finding local seed source that will maintain the ecological integrity of the various eco-regions. The challenge is to find enough seed of each species.
 - Most of these sectors can be divided into north and south Alberta, or Green Area and White Area.
- I think with the economic recession, what we see is that now is the time to start leveraging dollars and working together to solve issues. Why just focus on one sector? It is best to target broader impact.
 - The only way we exist is because of multiple industries. Pipelines and conventional oil are too up and down, that reclamation industry is not enough to support a small reserve industry.
- Pipelines are a diverse community. Trees are planted on pipelines to limit the linear disturbance.
 - I struggled with the dot placement with some of the pipelines work in oil and gas. We’ve had interveners challenge us on our pipeline reclamation activities. Interveners rely on oil sands reclamation information and apply it to linear disturbances. Oil sands developments are more than just a “big square box”. Linear footprints make up the bulk of our in-situ reclamation.
 - Pipelines and seismic lines both suffer from failure to regenerate, especially trees.
- Missing sectors.
 - Ranching (native prairie) is a missing sector.
 - Renewable energy sites.
 - It would have been helpful to have a choice for *diversification* and *economic opportunities* (e.g., bio-industrial).
 - There is a variety of interests around native plants for medicinal purposes and health products.
- Don’t narrow focus so much that you pass up work on important areas.
- Urban landscapes are a major driving business force.
 - Just from a grower point of view, most of the industry is urban. Maybe 90%, including highways ... and they’re predictable.
 - There is a lot of interest around using native plants in green roofs/green constructions.
 - Some of the only growers left in Alberta are those involved in urban landscapes.

- I struggle with “native seed” because we’re sourcing it from outside of the province. In the oil sands we have to use locally-common species from the seed zones. Seed zones may provide challenges, but they also mandate using actual native seed.
 - Perception that the reclamation industry mostly imports seed for grassland reclamation.
 - We grow plants from larger seed providers in our greenhouse, and often it isn’t what we ordered.
- I truly believe that conventional oil and gas is not up to the level of oil sands reclamation. Oil sands reclamation is highly advanced.
- We see municipality and traditional oil and gas landscape problems, such as continued hydroseeding of grass instead of native seed shrubs. I’ve seen a huge natural slope sprayed to kill Canada thistle.
 - I agree that municipalities are struggling with native ecosystem restoration and seed mixes, pesticide application techniques, etc.
 - Are there best practices for municipalities? There are new guidelines out for northern fescue, etc. There is evidence so far that municipalities are not really engaged.
- There are a lot of possibilities for partnership with smaller municipalities, many of those lack resources.

APPENDIX F: SESSION 2B - PLANT GROUP NOTES

Participants were asked to explain the reasons for their choice(s) on the Plant Group research and development priorities (Figure 8 shows the detailed breakdown of the voting results) and provide any other comments.

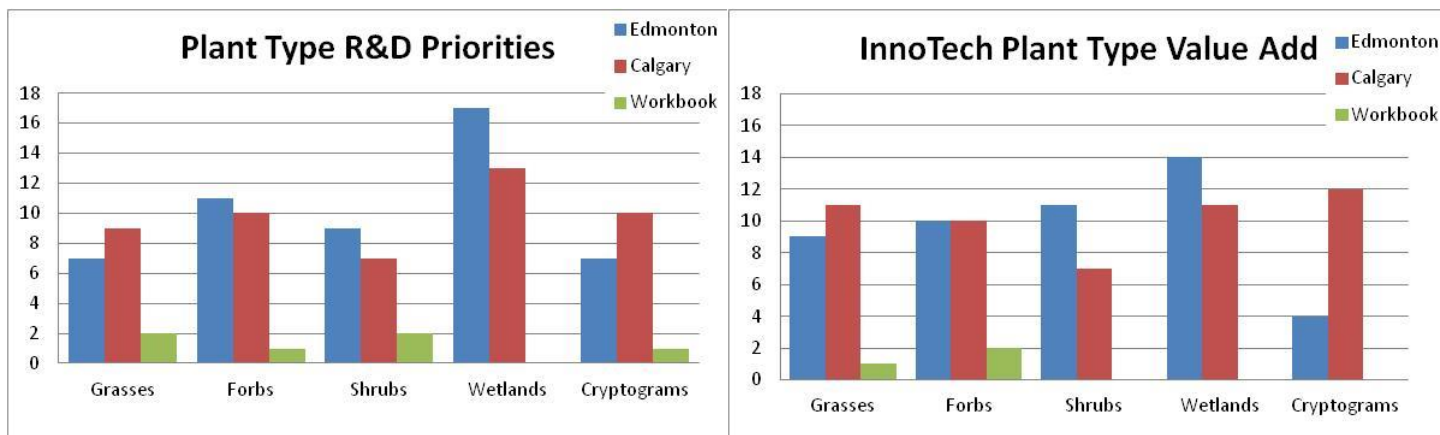


Figure 8. Detailed Breakdown of Voting Results on the Plant Group R&D Priorities from the Edmonton and Calgary Workshops and the Workbook Submissions.
Left Panel - R&D Priorities; Right Panel - Value Added Opportunities for InnoTech Alberta

Some questions were provided to help promote discussion:

- Where do you see the public pressure now and in the future for native species use?
- Should InnoTech Alberta focus on areas where there are currently a large number of researchers or a limited number of researchers? Which research areas are currently lacking research and development effort?
- How can InnoTech Alberta get more species volume and varieties into use in industry more effectively (e.g., seed growers co-op, multi breeder supply contracts, recognition and demand for Alberta local seeds)?

The following notes are a compilation of the workshop discussions and workbook submissions and have been organized into common themes.

- Wetlands and forbs identified as leading need and InnoTech Alberta has capacity.
- Rare species (especially in grasslands) production and deployment require work.
 - They have different needs than common plants.
 - Also rare plants, are a knowledge gap. Most of the research has been around translocation, but propagation would be valuable.

- I feel that grasses were chosen as a cultivated species because it is easier to do large areas with seed instead of planting. It shows where the technology is that we only have grasses working currently. Grasses were the easiest ones that fell into our traditional cultivation techniques, rather than the other species.
 - I think also it's that we have a more limited number of grasses, compared to forbs or shrubs or wetlands. It's hard to develop a market for a hundred species.
 - There are some grasses with very little commercial production. Western Porcupine Grass, etc. These are keystone species with no real source other than wild collections.
 - ARC did a lot of research into fescue seed mixes. That's really valuable information, not the kind of information that you can expect to get out of industry.
 - Rating the Grass as the highest priority to focus on is related to these comments. The supply of "native grasses" that industry has access to usually comes from the US; this does not necessarily lend to maintaining the ecological integrity of Alberta's native prairie ecosystem. InnoTech can assist with this matter by making local seed genetics more readily available.
 - We have a multitude of old energy sites [in the south] that are being abandoned and reclaimed, without a good local seed source.
- Develop some legumes.
- Plants with heavy seeds that are not wind-disseminated require more work.
- Interest in milkweed and reed canary grass.
- Shrubs are very important at this stage because industry is asked to plant shrubs on their sites under the new Alberta Forest Genetic Resource Management and Conservation Standards⁵ (FGRMS) guidelines.
 - FGRMS for the Boreal has led to discontent among users of shrubs; work is required to confirm the Standards, including progeny trials for shrubs to adjust seed zones.
 - The Oil Sands Vegetation Cooperative has done preliminary work to identify priority species and priority research areas. Industry doesn't want to be the coordinator but rather the recipient - maybe a role for InnoTech Alberta. We should communicate to coordinate on what we should be working on.
 - We need seed orchards for shrubs.
 - Should the regulators require more native species? With the National Energy Board, we are getting approval conditions seeking to restore caribou habitat and offset cumulative impacts on caribou habitat. There we are looking at managing an ecosystem to skip over that early seral stage that attracts wolves. Managing through that risky period, trying to accelerate a mature ecosystem to limit impacts to caribou. Our environmental consultants were great for forbs or grasses, but they did not help us with the woody shrubs. Foresters were fabulous collaborators, but they also struggled with shrubs. We want to put shrubs in place that are not palatable for those caribou, but also seed handling, growing...
 - In the world of shrubs, the processes of germinating and starting those plants, could use a lot more research. Some of these shrubs can't germinate past 50%.

⁵ See <https://open.alberta.ca/publications/9780778584674>

- One grower said that 99% of their native species requests are for shrubs – minimal requests for grasses or forbs.
- We lack expertise around how wetland ecosystems function.
 - Wetlands is a community issue not an individual plant issue.
 - We lack knowledge around wetland species, specifically increasing longevity of wetland seed storage. Wetland species can only be stored for so long and not in large quantities.
 - Need certificate of provenance for government but it doesn't exist for many species.
 - We've been working on floating islands with native plants in case they escape into the surrounding areas. Many people don't think it's important to incorporate native plants, but there are really big research questions there, including around water quality.
 - Speaking for wetland plants, the nature of my business is that if you have a bunch of wetland seed and you distribute over a large area, you are lucky to get 2% germination. With grass species, you have it a little easier. There are a lot of challenges around getting wetland plants to germinate. It would have to be a habitat development thing, rather than a seed development thing.
 - On the wetland side, it is very important to work on seed production. Climate change is a big thing also. This year I relied on wetland seeds, and I had perhaps 20% of the expected seeds, the plants didn't set seed or they were underwater, or there were insects. Another barrier is the provenance restrictions.
 - Research into how plants interact is where research is needed.
 - I grow cattails because there is demand, but it's silly to grow them because they often come in naturally.
 - Wetland compensation and mitigation will also drive needs.
- From the forb reclamation point of view, the emphasis is always on using grasses.
 - Forbs only get in sometimes through biodiversity. We talk about biodiversity, but most people only consider grasses (as an addition to trees).
 - There is only one driver for forb use, and that is the wellsite reclamation guidelines.
 - Perhaps for the southern regions, but in the Boreal we truly do consider biodiversity through the ecosite criteria. We target diversity of collections. We have planted one site with 23 species.
 - One important forb is fireweed⁶. Fireweed is also important for cosmetic and personal care.
- Surprised to see the votes for Cryptogams – any comments?
 - Some ecosystems are dominated by them.
 - I think there is an enormous knowledge gap around Cryptogams. There are a lot of questions around succession, and other things. Maybe NAIT is looking at this under their fen work?
 - For clarity we should include bacteria, fungi and mycorrhizae in this group.
 - I think the main thing is understanding the cryptogams better.

⁶ See http://acrr.ualberta.ca/Portals/14/ACRREDocuments/Chamerion_angustifolium.pdf

- Cryptogams are important for biodiversity. There are some ecosystems, northern boreal, that are dominated by lichens and mosses. So to just re-establish the plants is not enough.
- It's a matter of providing the habitat and the soil type that native plants can grow back into.
- Is there room for a grower industry? Or just natural recovery. Growers are poorly suited to address site limitations.
- NAIT (Amanda Schoonmaker) is looking at *hitchhiker plants* – secondary plants placed into a plug with the primary species. Is that a place for Cryptogams? It could be worth looking at packaging seedlings with cryptogams.
- Maybe the answer is that they come in naturally over time? At what rate?
- Can we facilitate their return? Maybe that's slurries of cryptogams? You can buy commercial inoculants, but it's hard to tell if it would work. There has been very little research on establishing cryptogams.
- To our knowledge, we don't know of anyone who goes out there and collect lichens/mosses. Maybe that's an opportunity.
- Cryptogams around highways may improve moisture retention and air quality.
- Potentially useful for vertical quarry faces?
- There are very few requests for grasses, forbs, wetlands, cryptogams, etc.
- Growers need protocols that help provide scientific background on what to grow and how to manage invasive species⁷.
 - Need full life history information about target plants.
 - Reclamation for a woody plant grower is hit or miss, people don't have time to track down effective growers.
 - Seed handling procedures and guidelines often produce very different results, for example, germinating saskatoons has as massive difference in success rates.
 - Best practices doesn't always work well in this industry, sometimes there's cheap stuff coming from elsewhere. For example, mountain brome from New Zealand.
 - We lose money from growing Native Plants. Why do you lose money from growing Native Plants? These are the conversations we should be having here. You can grow 3M trees and deliver them to one client. For Native Species you have to track and grow many, many different species, and there are enormous rates of failure. Germination rates, success rates are a major problem.
- Clients need more information as well to develop proper specs for orders.
 - That's where the big opening is. We get nonsensical orders, or responses that our plants are not working, for reasons we have no control over (e.g., client implementation). Get orders and there is no opportunity to make changes based on experience or availability.
 - Nurseries require a lot of lead time and a lot of background research, so native species development is important to the reclamation process. If we had more of a heads up on what might be needed would be great.

⁷ See <http://acrr.ualberta.ca/Resources/OSRIN-2009-2014/Revegetation-Species-Profiles>

- A company isn't going to grow 1,000,000 plants on the expectation that they are going to be able to sell them. For example, we grew about 300,000 willows for the NE Anthony Henday extension. They have been grown and thrown out for two generations because the delivery date kept getting extended.
- Industry often doesn't know what's required for production? Lead up time, collections.
- We need more *how to* information.
 - We need to de-risk the use of native plants by increasing likelihood of success⁸.
 - There has been a lot of reclamation work to date, but there is a continued need for research into native plant best practices. This includes deployment, storage, etc.
 - I voted for Plant Development, but I would like to emphasize that I think the importance is around best practices and information, not variety development. For example, scarification, storage, etc. This information is currently scattered and it is not very accessible.
 - Is there a role for your organization in researching handling, storage? How to guarantee seed availability in a market with fluctuating availability?
 - There is a lot of knowledge around how to do it, but also how not to do it. We can't keep reinventing the wheel, and especially not the *broken wheel*.
 - It has taken 30-40 years for the forestry sector to develop plugs. There is a lot of relevant research around Native Plants: what plug size should shrubs use, for example.
 - What are the best spacing densities per hectare for reclamation? Nature doesn't use even spacing – how to plant effective clumps.
 - We also need to consider the bottom half of the plant, will it become too root bound? What about root type? This is important research.
 - We often deal with decisions around the size of trays, of plugs, etc. The company has grown enormously over the past 10 years. This is a multi-generational industry: how do we facilitate one another?
- We need to know about maintenance.
 - We have a site with sterile topsoil, largely because they had to spray it to control for noxious weeds. We don't need to be spraying for everything.
 - We need to review weed policies – for example, milkweed is being sprayed out as a weed, although it is important for expanding Monarch Butterfly habitat.
- In the oil sands in particular and the forested areas, we are not planting grasses on our reclamation areas anymore. We want native plants, native to that particular seed zone. There is a declining need for grass seed.
 - In the oil sands areas, we need to find non-grass native species for erosion control.
 - There are grasses in the Boreal, but only 2-3 species, and they are not desirable. We need available, successional species, such as Hairy Wild Rye (for the Boreal).

⁸ See <https://extranet.gov.ab.ca/env/infocentre/info/library/5927.pdf>

- Is there value in targeting fit-for-purpose plants? What about traditional use plants, carbon sequestration, wildlife habitat, beautification?
 - There is some work involved in tailings dewatering – sacrificial plants to increase the load-bearing capacity of substrates? The Alberta Environmental Centre (now InnoTech Alberta) did early work on this⁹.
 - CO₂ capture projects (using native species) are long-term projects that may fit well within this proposed framework. Carbon sequestration hasn't been a focus to date, but it will become one soon. Reclamation sites represent an ideal place to test CO₂ capture and climate adaptation options.
 - I volunteer in Waterton on a wildlife biology project where we are trying to foster plants palatable to elk. There is likely a wildlife biology project that requires multidisciplinary experts to integrate these fields. Waterton is an interesting place for reclamation because they are collaborating with those south of the border (seed zone conflicts?).
 - First Nations have many plants with importance for cultural and medicinal purposes. Incorporating those species into landscape reclamation is a good multidisciplinary project. Some species are sacred to First Nations, others are fairly common.
 - Biomaterials (e.g., absorbents, erosion control mats, fibre boards).
 - I was just in a green building materials workshop, and many companies care about their environmental footprint. Maybe architects, etc, could use these species.
 - Colonizers or nitrogen fixers would be good to develop.
 - Is there a potential for sharing plants/resources around these alternative uses.
- Plant migration and assisted migration are both areas that we need to consider, possibly using provenance testing.
- Have we looked at pollinator habitats at all?

⁹ See RRTAC 93-8: Oil Sands Sludge Dewatering by Freeze-Thaw and Evapotranspiration. R.L. Johnson, P. Bork, W.H. James and L. Koverny. 247 pp. <http://hdl.handle.net/10402/era.22675>

APPENDIX G: SESSION 3A - STRENGTHS NOTES

Participants were asked to explain the reasons for their choice(s) on the perceived strengths of InnoTech Alberta (i.e., what is it that would draw you to work with InnoTech Alberta) and what research opportunities they thought InnoTech Alberta should pursue.

Some questions were provided to help promote discussion:

- What makes InnoTech Alberta a good research and development partner? Where can InnoTech Alberta improve?
- If InnoTech Alberta had the opportunity to hire new staff, what skill sets and expertise should InnoTech Alberta look for in order to provide the most value to a native species research and development program?
- In what situations should InnoTech Alberta take the lead, be a partner/collaborator or not be involved?

Figure 9 shows the detailed breakdown of the voting results on InnoTech Alberta's perceived strengths.

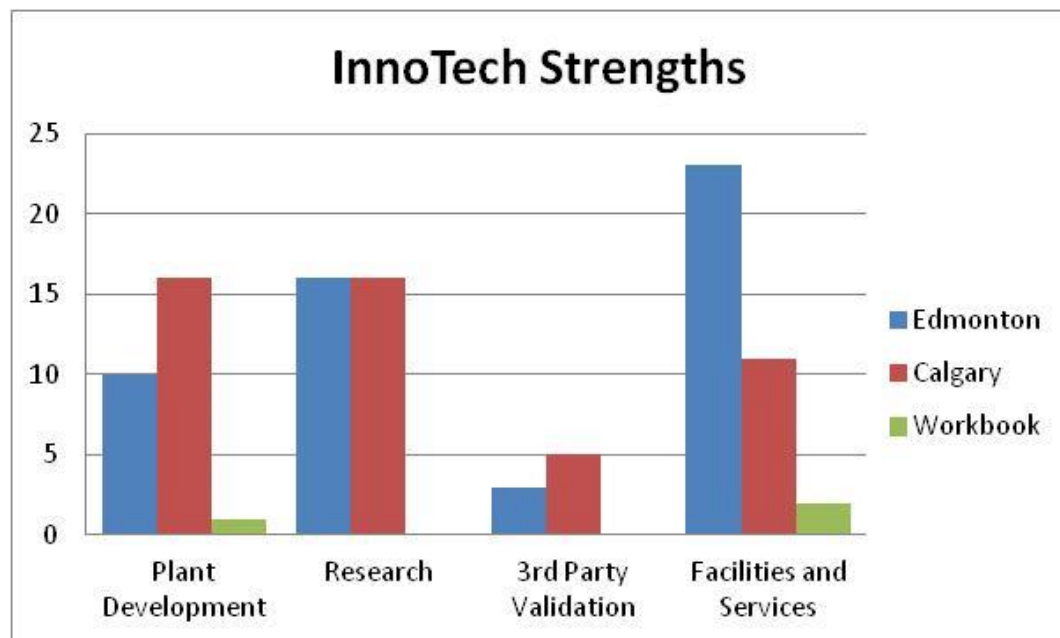


Figure 9. Detailed Breakdown of Voting Results on the Perceived Strengths of InnoTech Alberta from the Edmonton and Calgary Workshops and the Workbook Submissions.

The following notes on perceived InnoTech Alberta strengths are a compilation of the workshop discussions and workbook submissions and have been organized into common themes.

- It is obvious that facilities and services are your advantage here, and you have a reputation for them.
 - Strong asset to attract collaborators.
 - BUT need to catalogue and promote the capabilities and facilities.
 - I put facilities because they are expensive, and it is restrictive for smaller groups.
 - There are some questions around capacity, we don't know what kind of capacity you have (labs and equipment).
 - There is a lot of interest around facility use, seed testing, etc.
 - Do you have cryogenics abilities (-80)? Liquid nitrogen?
 - We have cryogenics ability in some limited capacity. No liquid nitrogen storage.
 - The facilities are already in place to allow for seed cleaning and increasing the amount of native grass seed available (and other plant forms).
 - If InnoTech were able to certify their seed cleaning plant to increase capacity, this may help to alleviate the shortage of local seed sources thus maintaining genetics.
- Until I was requested to participate I was unaware InnoTech Alberta existed therefore communication beyond Alberta would help develop working relationships.
 - I had no previous knowledge of your existence, nor, curiously, did my natural areas contact at the City.
 - Most people do not know who or what InnoTech is. There is an opportunity to promote it to various user groups (NGO, GoA, AER, industry partners).
 - Most energy industry players are not aware of InnoTech or what they do or how it could help.
- I think in the past our strengths have been the varieties. One-off projects were another thing, but secondary to the variety development.
- What's the best way to leverage the mesocosms? Awareness, example projects?
 - I think the mesocosm will provide relative mass balance input/output experiment environments.
- Long-term studies are within the mandate of InnoTech and are not well-captured by industry or even post-secondary institutions.
 - Long-term projects are certainly one of InnoTech's strengths.
 - Due to the long term nature of the research involved research facilities outside the University domain maybe better suited.
 - Grad students are the cheapest way to do short-term research. InnoTech can fill the niche for longer term projects.
 - Plus industry hates funding long-term research.
 - Long-term studies provide opportunity to track change over time and do multi-disciplinary, integrated studies.
- You are big enough to leverage interdisciplinary projects.
- What would you like to come to InnoTech Alberta for?
 - In the case of developing plant varieties, it would be good if you could provide workshops on how you develop plant varieties, demonstrations, etc.

- We've used your facilities for genotyping because of proximity, capacity, and competitive rates.
- Seed storage is a major question. We spend a lot of money collecting it and we store it without knowing how to store it properly, and the nurseries find it doesn't grow.
- Handling prior to storage is also important. A good example is aspen seed, a couple days to collect it but if any moisture hits it there are problems with viability. Viability degrades significantly every year.
- If InnoTech Alberta could hire new staff what sorts of skills would you like to see?
 - Native plant specialist.
 - You have limited plant development capacity. You need a plant development professional.
 - A breeder would be valuable.
 - A horticulturalist specializing in growing.
 - On the climate change adaptation side of things, who do you have? There are two of us in the Reclamation Team researching that, also Shauna-Lee Chai.
 - You should have a business specialist who ensures that any work you disseminate does not decrease market competitiveness, especially for small companies.
 - It sounds like you need a business communications coordinator for the native plants / reclamation community.
 - Big companies are going to suffer similarly to small companies.
 - Small companies suffer more. All these different places need help. Small companies need help connecting with InnoTech and industry.

APPENDIX H: SESSION 3B - RESEARCH OPPORTUNITIES NOTES

Participants discussed potential research opportunities.

Some questions were provided to help promote discussion:

- Should InnoTech Alberta undertake short-term or long-term projects?
- How can InnoTech Alberta leverage the new mesocosm facility?
- What would you like to be able to come to InnoTech Alberta for?
- How does the use of native species support existing regulatory requirements?
- What can be done to encourage further use of native species for reclamation and ecosystem restoration?
- What are some barriers to further native plant use (e.g., approaches failed, germination issues, misunderstandings) and what can be done to overcome these?
- In what situations should InnoTech Alberta take the lead, be a partner/collaborator or not be involved?

The following notes are a compilation of the workshop discussions and workbook submissions and have been organized into common themes.

- Research efforts should be aimed at practical, cost-effective solutions that can be implemented by the private sector.
- Work with existing regulating bodies to enhance awareness of projects underway at InnoTech as well as to gather research ideas.
- There is a lot of work to do around prioritizing plants to work on; narrow the list to key species.
- Need to develop and maintain a catalogue of *standard* native species mixes used by government agencies (and others if possible)¹⁰.
 - That's difficult because its site specific.
 - We're doing that for one specific area. Waterton has taken over storing its own seed, because construction companies always mess it up.
 - Jasper is doing that too now.
- There is an oil sands vegetation cooperative. Can there be an InnoTech Vegetation Cooperative?
 - InnoTech Alberta's current seed bank of wild accessions represents a valuable resource and exceptional starting point in developing a larger model, perhaps for use in the White Area to complement current work underway in the Green Area.

- ¹⁰ See Alberta Transportation mixes at <https://www.transportation.alberta.ca/Content/docType233/Production/DesignBulletin25.pdf>

The opportunity here is to expand the seed-bank depository of wild-harvest collections/accesion to include many native species (both woody shrubs and herbaceous species) which could then be orchard-grown on an as-needed basis (by contracting out to individual growers). Further, InnoTech Alberta native varieties could largely be reproduced in a similar manner (contracted out to individual seed growers). In certain situations, this orchard-grown material of “wild stock” could even be employed by end-users in tandem with InnoTech Alberta native grass varieties to form a more rounded revegetation application. This flexible approach would go a long way to supporting a native-plant industry in Alberta. To this end, the Native Plant Research group would need to take on the role of coordinator between industry and growers, perhaps extending as far as taking on a leadership role in the development of a corresponding industry-level cooperative.

- The five or six vegetation co-ops in the province, are great. But they cover only a few seed zones, and there are 90 seed zones in the province.
- A provincial seed bank to facilitate all of the problems we would have.
- Requires buy-in from collectors and users and a long-term, stable source of funding. Alberta Environment and Parks, Transportation, City of Edmonton, City of Calgary, etc. – they are the ones who can get funding committed.
- I think the oil sands are way ahead of some of the rest of the province. Getting a cooperative started would be valuable. The oil sands are, in my mind, a unique situation. A number of companies have a very concentrated effort, making it easier to get funding committed compared to the southern parts of the province.
- Foothills Research Forum has a seed exchange program¹¹.
- At some point we have to figure out, do all of these coops need to form a provincial coop? Is that private? Public-private? With no discussions, we’ll develop local coops, which are hard to bring together.
- Is there work required on the regulatory side to drive the native plants business? Do regulators need to stipulate reclamation targets, mandatory mixes, etc.
 - Regulation to drive local sources is the only thing that is going to help. I’d certainly be willing to participate as an Alberta Environment and Parks rep on how to start that.
 - We need guidelines around source of seed. BUT maybe it can be described as desirable to use local grade, but as a secondary option use other (close/relevant) sources.
 - There is a delicate balance between setting rules to drive enhanced use and availability of native species and the timeline to make the materials available for use – may need a transition period.
 - Sometimes industry practices are even better than regulation.
 - I think it’s worth specifying an outcome, but don’t prescribe the process. So you have a middle step of guiding people towards a desired outcome, but not prescribing the process? I think if the outcomes/expectations are clear, individuals can build what works for them. I’ll give you a clip on the good agriculture collection practices: Thou shalt etc. We ended up saying to CFIA that processes are hard to

¹¹ See <https://hardgrass.ca/>

- prescribe, and instead we have developed risk-based outcome-based guidelines. Outcomes must be fairly specific, though.
- On the other hand, narrowly focused outcomes can lead to unintended consequences. 99% of what I do these days is caribou related. I am sitting with First Nations, listening to discussions about jumping to that later successional stage, trying to get linear disturbances to recover more quickly. The caribou biologist suggests that we need to spray the seismic lines to kill native plants, to prevent these species which attract caribou. In this case we are trying to discourage ungulates (including moose) from using these seismic lines. There are almost conflicting desired outcomes.
 - There is a problem with reclaiming to “equivalent capability” in the oil sands in that it is defined as reclamation to ecosite phase targets. These are ridiculously inappropriate for reclaimed lands, and are based entirely on climax species - you can't take something that took 150 years to establish and say you have to achieve it in 5-10 years. There needs to be a Reclamation Classification System that is appropriate for the subsite, soils, and position on the landscape. Doesn't that describe ecosites? Yes, but it doesn't account for pioneer species or for climate change. It doesn't account for ecosite shift.
 - There is a big difference between setting out stretch targets that people use the best available science to steward to and setting those targets as regulatory requirements. Setting yourself up for failure in the latter case.
 - There have been many different goals, in the past it was just “get it green”. Even on the regulatory route, it's only as good as enforcement.
 - I'll get on my soapbox. Thou shalt prohibit planting of grass on Boreal Sites.
 - Provenance testing to support FGRMS validation. If you get buy-in from the major players that can really help.
 - The provenance restrictions are actually a good thing. Yes, we have always advertised location of our collections.
 - Need provincial and municipal government agencies to use native species (provide an example of effective use).
 - Infrastructure and highways is still seeding alfalfa and smooth brome in ditches through Alberta's Grasslands. These “reclamation” practices are archaic and are the main reason for loss of native prairie. As a 3rd Party to government or other policy makers, there is an opportunity for InnoTech to help these ministries acknowledge and realize the negative impact they are having on the ecological integrity of the ecosystems.
 - For the city, a lot of the street trees are not native trees. It's important to keep using native plants, even for disease resilience. Our policies say, use native species.
 - Need a better understanding of the optimal soil cover type (composition/depth) for native plants (individually and communities).
 - From the oil sands point of view I think the jury is still out in terms of what a reclamation cover sufficiency should be for a certain type of plant community. I think in many situations the government has acted on the conservative side of soil

- conservation, there is probably room for optimization there. So, optimal soil for vegetation community types.
- In light of climate change do you plant for now or future? For best, worst or middle-of-the-road scenario?
 - We need to focus on entire ecosystems, not only restoration of plants.
 - From a grasslands perspective the focus has been often on the grasses without the realization of the importance of forbs and/or shrubs have nutrient cycling, habitat and foraging value. It has been demonstrated without the complete suite of functional groups restored or lands remediated do not return to a fully functional ecosystem. If grasses alone are replaced production is lost, diversity (fauna/flora) decreases. This in turn impacts ecological goods and service such as carbon sequestration, build up of organic matter, water quality, etc. This type of work requires development of core groups of researchers having several disciplines involved.
 - It's the same with trees, forbs, etc.; it's about the community we are building and not the individuals.
 - This point is well-taken. However, to get functioning communities we have to understand individual species first.
 - Topsoil quality, spoil storage, and soil bacteria are other factors that confound reclamation.
 - Belowground functions.
 - These types of projects will depend on where the funding is from, funding from clients must address client needs.
 - We don't understand native plant succession. What's going to happen to a plot of land when you don't do anything? We need someone to tell us about natural plant succession.
 - Need to know when to plant – all at once or plant understory later (may require changes to regulatory system that assumes all at once).
 - Often there is a pre-disturbance assessment, but there isn't a very good vision of the succession requirements. We've learned that, so we're planting aspen, balsam poplar, etc., in an attempt to foster that succession.
 - What we find is that with some of the reclamation work in the boreal/wetlands regions, is that there is a huge influx of cattail seeds. So how can you establish wetland plants without cattails?
 - Need to understand natural range for seed.
 - Need to know when, what and how to monitor post-reclamation and what *success* is. Particularly important for municipal work where there is often little follow-up.
 - Trajectory research is needed so we can predict success potential early on.
 - Need trajectory monitoring and data compilation for accurate disturbed site reference goals.
 - Is that based on developing accurate controls, so you have something to aim for in a reasonable time period?

- Yes, and for each type of native plant communities. We desperately need that in order to know whether we're on the right trajectory. From a government perspective, we're going to an outcomes-based approach. For example, we're doing footprint/recreation planning that will involve restoration work. We're going to be spending a lot of money on performance metrics. What are we best off planting in the beginning? For example, in some situations we're better off to plant a non-native annual that's going to disappear.
- There is work in this field, defining alternative reclamation targets based on site longevity and seral stage shift (sometimes referred to as *trajectory*). The City has succession targets but monitors progress.
- One of my concerns is the lack of wild harvest collectors in the province. We'll find we hire someone and the quality of their training is poor. There is an opportunity to provide training.
 - Wild collection is often the only means of obtaining material and increases costs of the project, potentially to the detriment of the project, as in native material becomes too expensive to use.
 - There has to be some way to develop some best practices around seed harvest, moisture content, collection time, storage, transportation. There are some conversations around how to do a wild harvest.
 - One question is, do professionals go to InnoTech? NAIT? UofA? Growers?
 - We need to expand that knowledge across the province. In particular, for shrubs.
 - Olds College puts on a course for woody seed collection.
 - This has to be an opportunity for aboriginal community mentorship. Some of the elders have a lot of knowledge, but lack the best communication measures. We have experience in plant identification for medicinal purposes. First Nations may easily be trained to identify and collect plants. It would be wonderful to involve First Nations in our reclamation communities. We've been working a lot of First Nations. They want their youth to be involved. The elders really know a lot. They're interested in growing. We, as government, are looking at ways to provide economic diversification for First Nations. We allocate a portion of our funding to First Nations. When we have a choice between a local nursery and a remote nursery. I'd say seed collection across the province is one of those areas.
 - It's also very seasonal employment. It could be in combination with other environmental training.
 - Native seed harvest is a highly technical skill set. You need multiple years of experience. The difference between a native species and an invasive one may be very difficult to discern – e.g., the difference between two grass seeds may be 1 mm in the awn (sheep fescue vs. Rocky Mountain fescue). We have to keep in mind that this is highly difficult. The collector has to have at least 5 years experience in botany, taxonomy... often we make field work a junior project, but this is not a junior level skill set. It's not that hard with shrubs ... as soon as you get into wetlands it's very difficult. Grasses too.

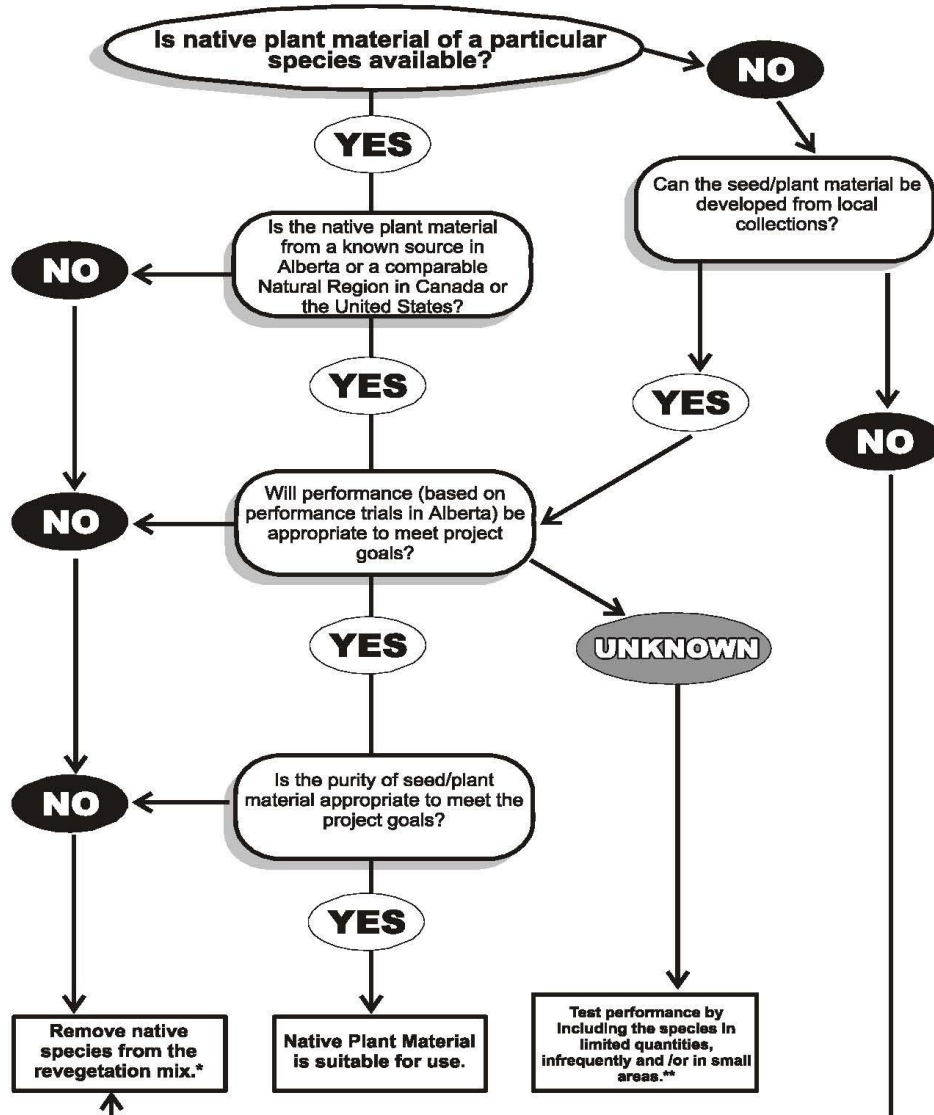
- While it is true that some end-users in the reclamation field object to the use of native plant varieties in principle over that of wild-harvested seed, in many reclamation situations wild harvest can not provide a viable solution.
- We need expertise for shrubs in particular. A good example of the need for expert knowledge and experience – shrubs came 4 weeks early this year.
- So in terms of climate change, should all our work be aimed at what community is there now or what is expected to be there in the future?
 - That’s a big question. How bad is climate change going to be? I think we need to be thinking about resiliency. There is some great work up north, restoring to how things have been. But what will it be like in 50 years?
 - This is an emergent need and the future of native species work.
 - Is climate change-related provenance trials a place for InnoTech Alberta? Yes, and I think you’ll find partners in industry.
 - Resiliency of plant communities in the face of change is required. Example of balsam poplar seed moving into Alberta on the jet stream – plants are adaptable.
- Could we, ever, put together guidelines/prescriptions? Is our goal to put together a prescription?
 - Our guidelines have gone to the lowest common denominator to “use a naturalization mix”. We need a native central parkland/grassland mix for X area. It generally may fail, etc.
 - We have a lot of expertise, we don’t have anything prescriptive. When we decided on the Native Plant Revegetation Guidelines¹², we stayed away from being prescriptive to allow people to innovate. There is a lot of innovation that is available, but there is no prescription.
 - In 2001 government put out the native plant guidelines. On page 9, there is a source identification flow chart (provided below). We need to revisit and update that guide. There was a 1996 native species book as well¹³, describing site types across Alberta and the native seed that was available at the time. Our intent was to provide recipes for each site type. There just wasn’t the research at that time to put that together, to develop a “cookbook”. I’m reluctant to say we should go in the direction of “recipes”, or “seed mix design”. Rather, guidance and directions is more desirable.
 - I was commissioned to do a seed mix design calculator over the past few years. The Foothills Restoration Forum recovery strategies documents are a good start to that.
 - In the forestry world, they come up with silvicultural matrix, here is what we need to do based on the environment.

¹² See Native Plant Working Group, 2001. Native Plant Revegetation Guidelines for Alberta. H. Sinton-Gerling (Editor). Alberta Agriculture, Food and Rural Development and Alberta Environment. Edmonton, Alberta. 58 pp. <http://open.alberta.ca/dataset/783a58b0-cc85-4e4f-a2f9-478a0516f03b/resource/c366b71a-1f3d-4436-a410-e2c8b5fd8195/download/2001-NativePlantRevegetationGuidelinesForAlberta-Feb-2001.pdf>

¹³ See [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex78](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex78)

- We need that for the Native Plants world (which species to use for which sites). We need to facilitate a conversation around what to do to encourage extensive native plant use.
- So if I came to you and said “I want to establish a 40 acre native grassland”, will you provide the seed mix, the source, the guidelines?
 - In a lot of ways we do. In terms of a wellsite, or 40 acres, we could be fairly successful.
 - Are you saying we can do prairie restoration?
 - Yes, we can do naturalized restoration. It depends on the goal – revegetation of a natural area vs. development of a functioning native grassland. We could establish and grow grasses that are common to the grasslands around Edmonton.
 - What I’m trying to get at is, do we have a recipe? How many species? What kinds of species? Because if we don’t have that recipe.
 - We don’t have that recipe.
 - When I go back to the 20 year old wellsite trial, there are statistical differences. But, as an experienced vegetated technician, I can hardly tell the difference between treatments and references.
 - There are going to be variations, sometimes weather, sometimes soil storage. But as far as having a functional ecosystem towards helping Albertans to appreciate a natural landscape, we have that.
- Need clarity around terminology
 - Reclamation, restoration, naturalization, native.
 - Remediation, phytoremediation
- Barriers to native plant use.
 - Access to material, sharing of knowledge gained, realization information should not be restricted by political boundaries, consideration of the changing environment impacts on future plant communities.
 - Another barrier is awareness and acceptance by the public. A lot of people will look at native revegetation and just see weeds.

**Figure 1. Decision-Making Chart:
Sourcing Native Plant Material**



Notes:

* prior to removing species from the revegetation mix, multiple attempts to secure alternative sources is recommended.

** records of procedures and results should be maintained and made generally available.

APPENDIX I: SESSION 4 - COMMUNITY OF PRACTICE NOTES

Participants were asked about the value of establishing a Community of Practice and whether or not they would participate in one.

Some questions were provided to help promote discussion:

- Who should be included in the community of practice?
- Is the space already occupied and well served?
- What would make you want to join a Community of Practice?
- What kinds of information would you want to be shared within the Community?
- What kinds of resources would you want available?
- What kinds of training would be valuable?
- What kinds of activities (e.g., tours, sessions, speakers, etc.) would you want to have access to?
- What related topic areas should fall outside of the Community of Practice mandate?
- What areas should it avoid?
- If not a Community of Practice, then who should InnoTech Alberta partner with to ensure wide dissemination of results?

The following notes are a compilation of the workshop discussions and workbook submissions and have been organized into common themes.

- The need exists. The number of individuals working with native species is limited to begin with and the research and development multifaceted. Therefore knowledge of what is being and by whom could result in improved utilization of resources
- The goal should be to facilitate more small companies to be a part of the whole system.
 - It sounds like technology deployment to SMEs is something that is needed, and is covered by the InnoTech Alberta voucher program.
 - Need to ensure all interested practitioners have access to the same information at the same time otherwise Small-Medium Enterprises (SME) run the risk of being left out.
- My sense is that we need some sort of a venue for communication (e.g., a Community of Practice).
 - I think today shows that there is a lack of communication in the native plants community.
 - Some sort of an Alberta Native Species forum would be valuable.
 - Community of practice should include researchers and practitioners. There are a number of organizations and committees where these individuals come together but not to deal specifically with native plant material. Such a group would allow for exchange of information such as what is known and the need. This exchange of information plus improved access to funding would be incentive to participate.

- I know there are a lot of venues where you can hear about ongoing research, but would a workshop or similar where practitioners can come, where they can discuss opportunities, problems, etc, be of interest? NAIT has their seminar, which is excellent.
- One of the other comments I'd like to make, I think information is failing to disseminate because people are starting to work on the same things. We used to have a CONRAD conference (COSIA precursor for oil sands research) where we would share work, but now I see a lot of people starting from scratch again.
- I would be strongly interested in participating in a Community of Practice. Yes, of course. The Community of Practice is of interest. I would hope that the Alberta Energy Regulator would be included in the information sharing circle with respect to reclamation and remediation practices and techniques.
- If this working group results in only Alberta centric research and support the interest in participating is greatly decreased and could result in Alberta having to work in isolation. Jurisdictional policy would disrupt the exchange of information.
- Also look to expand interest beyond traditional practitioners to others (e.g., strong interest in homeowners, landowners, etc.); this will serve to increase the community (and perhaps bring in different ideas).
- Consensus: knowledge exchange is very important.
- Outreach is something that the agriculture community has been good at for years. Canadian Forest Service has some experience.
 - Extension is a huge need for this sector.
 - It's tricky because everything you're describing has an opportunity to inhibit other things.
 - I don't think increasing communication is a problem.
- Communication vehicles.
 - It sounds like a Community of Practice may be a good end goal, but for now it may start with a mailing list. My experience is that you have to push information to people rather than expect them to come to you. Is a newsletter about native plant R&D something that might get us started? Driving us towards an annual conference, towards a scientific community? Would a quarterly newsletter be the best? There are existing newsletters that may be a good target. Alberta Native Plant Council runs a quarterly newsletters.
 - In the state of low oil, webinars and online information is far more valuable than anything that requires travel.
 - The scientific community has been communicating through journals for years. Is that not something we could be doing as well. I love peer reviewed, but it can't cover off everything. Peer review often publishes only successes, not failures (which is also a good learning tool). Peer review may be too slow, communication avenues such as webinars might be more useful.
 - Some kind of portal or social media format that allows for questions to be posted and answered (crowd sourcing) - just-in-time information is important.
 - Field tours, demonstrations, workshops would all be valuable services.

- There is not a good spot where you can find grey literature.
 - Grey literature, and reports, are not the best way to spread knowledge because we don't know what questions we need to answer.
 - You can build corporate knowledge without scientific rigour. A window into the grey literature world would be very very valuable.
 - Grey literature does have a risk with validation. However, a wrong answer is better than no answer.
 - The Alberta Invasive Species Council has a little document on each invasive species; a similar version for the native species cultivars would be nice.
 - Having this information online would be really helpful.
 - Ann Smreciu's book is older, but an excellent document including growth instructions.
- It seems that the sector has fallen short on its educational element, showing why it would be good to use Native Plants.
 - There is a need to continue to promote the use of native seed and inform groups of where to source it, and even how to seed it.
 - Our audience / stakeholders are professionals in municipalities, industry, and other non-profits across a broad range of disciplines. We communicate best practices and fill gaps wherever we can in research, training, demonstration, and building social license.
 - A lot of people are not even aware of the Native Plant Guidelines – extension efforts are needed.
 - Education and outreach should be a part of InnoTech Alberta's mandate.
- It is highly recommend that InnoTech consider collaborating with groups that are already trying to pool native seed growers, seed propagation, seeding techniques, harvesting techniques and so on.
 - For example, the Foothills Restoration Forum has created a website for seed producers and people seeking native plant materials on their website, to assist with procurement.
 - Alberta Native Plant Council¹⁴ has extensive resources, as well as extension and education programs.
 - There are organizations with lots of information that we could provide links to (e.g., ANPC, LUKN¹⁵, CEMA, etc.).
 - Collaborate with Alberta Institute of Agrologists, Foothills Restoration Forum (FRF), colleges/universities, Society for Range Management (SRM), Alberta Agriculture and Forestry.
- You have an opportunity to integrate the knowledge between sectors (especially between government and industry).
 - InnoTech would be a good place to go, acting as a neutral knowledge broker, as a disseminator.

¹⁴ See <http://anpc.ab.ca/>

¹⁵ See <https://landusekn.ca/>

- There is a lot of information but it is hard to navigate and access – a database would be useful.
- As a knowledge disseminator you have to be able to forgo doing research yourself.
- There is a lot of opportunity for integration with policy development.
- There is some very innovative work being done in non-university linked groups that have been useful and applicable in field situations.
- There isn't a problem with sharing how to grow things. The problem is, if you give things away for free, does that help competitors? If there are positive relationships between clients, collaborators, then sharing is positive. We get a lot of information from shared resources. I don't think we're sensitive, we share the information among growers. I think sometimes I have information I don't want to share, but I want to move the industry forwards. No one's going to kick us out of business because I release a little propagation information. A lot of it is available if you dig enough. Consider a grower-only part of the portal.
- InnoTech Alberta may have information on the constructed wetland project.
- There is a need to make older Alberta-specific research reports, documents and data available and accessible¹⁶.
- There are also older documents that could be updated (e.g., the RRTAC Plant Species Manual¹⁷).
- Also, many documents being used/cited are not relevant for Alberta
- How do we find out about research that has been done by InnoTech?
 - Cumulatively InnoTech has amassed a lot of data. Those data would be valuable to share, despite proprietary limits.
 - Does InnoTech have any sort of an information portal? Not really; website is undergoing updates with new structure.
 - Do you have any kind of information around what cultivars? You need website dissemination.
 - Foothills restoration forum has an information portal.
 - Alberta Native Plant Council is another good location to get information.
 - All of us should be striving to do some of that transfer before we leave.
 - What about telephone? If we network we can share knowledge the good old-fashioned way.
- There is a need for a *facilitator* organization who can connect native plants practitioners.
 - It would be great to develop a network of native plant professionals that can access other's knowledge using webinars, online resources. I think it's great to communicate, and I'm happy to answer questions.
 - There isn't a listing for who works on Native Plants in Alberta. That would be a really good first step! A database might be a start.

¹⁶ See, for example, [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/ipc5963](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/ipc5963)

¹⁷ See RRTAC 89-4: Manual of Plant Species Suitability for Reclamation in Alberta: 2nd Edition. Hardy BBT Limited. 436 pp. <http://hdl.handle.net/10402/era.22605>

- A catalogue of the players and businesses would be valuable for identifying who has capacity for specific work.
- We need guidance on who is an effective consultant.
- Create a list of practitioners (researchers, consultants, growers, etc.) and what they work on and then identify gaps.
- Identification of individuals working in the field, better understanding of work being done, improved utilization of resources, improved collaboration.
- InnoTech Alberta could do this - in everything I've been involved in, we need a lead.
- There is a lot of power in showing people what's possible.
 - Tours are really valuable.
 - Clover Bar replanting by the city was successful. The data are available.
 - Larch Sanctuary in Edmonton is also successful example¹⁸.
 - Develop a catalogue of sites that can be visited and what was done on them.
 - Canadian Land Reclamation Association went on a tour and the City people talked about use of native plants being used, but shrubs such as wild rose or dogwood weren't mentioned.
 - People have a conception of what is right, but we need a better image of what is possible, and what is desired.

¹⁸ See <http://www.larchpark.ca/sanctuary.html>