New Forest Genetic Resource Management and Conservation Standards: How they Apply to the Reclamation Business

NAIT Seminar
Utilizing Native Plants in Reclamation

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Alberta Agriculture and Forestry
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Outline

1. Background of the Alberta Forest Genetic Resource Management and Conservation Standards (FGRMS)
2. Review of selected standards
3. Using the standards in reclamation step-by-step
4. Shrub seed research at Alberta Tree Improvement and Seed Centre (ATISC)
First introduced in 2003, applied to reforestation activities

Revisions in 2005, 2009 and 2015/16

The purpose of this policy is to “ensure the adaptability, diversity and health of wild and managed plant populations, and to conserve the genetic integrity of wild plant populations”.

FGRMS
FGRMS purpose

Make sure that reforestation and reclamation activities are successful in the long term by:

- Planting material that is adapted to local conditions
- Maintaining sufficient genetic variability so the populations can continue to evolve in response to environmental changes

Preserve genetic composition of local wild populations
FGRMS review process

- Steering committee
- Technical committee
- Representatives from the academia, government, forest and reclamation industry
- Consultation
FGRMS in reclamation policy

Alberta Energy Regulator December 2013
Integrated Standards and Guidelines, Enhanced Approval Process:

200.2.9. “Revegetation with trees or shrubs within the Green Area shall be consistent with the Alberta Forest Genetic Resource Management and Conservation Standards”
FGRMS climate change

• In Alberta drought may become more important than low temperature as the limiting factor for plant growth – we need to plant diverse populations.

• Poorly adapted seed sources may still grow well in the average conditions of a site, but will suffer from the infrequent extreme climatic events - we need to be careful when moving plant material.
Dothistroma needle blight infections in 25-year old lodgepole pine provenance study near Calling Lake
1. Genetically modified organisms are not approved for use on public land in Alberta. Testing of GMO’s may be allowed if federal approval is granted.

2. Exotic species may be allowed for deployment on public land only after (extensive) testing is completed.
FGRMS applicability

- FGRMS apply to all woody plants (trees and shrubs) used in forestry and reclamation in Green Area

- Any material collected for deployment in Green Area must follow FGRMS
The standards are in two main categories

1) Stream 1 standards – standards governing acquisition and use of wild seed and vegetative materials
   a) Collected from wild trees and shrubs
   b) Deployed in appropriate location as approved by GoA (seed zones)
   c) NOTE: shrubs fall in this category

FGRMS plant material category
FGRMS plant material category

2) Stream 2 standards – standards governing development and use of seed and vegetative materials from Controlled Parentage Programs (CPP)

a) Bred, tested and selected for specific traits
b) Deployed in appropriate location as approved by GoA (CPP region)

c) NOTE: in FGRMS 2016 shrubs are not included in this category
Stream 1 deployment

- Plant materials (seed or vegetative propagules) are collected and used within the same seed zone.
Stream 2 deployment

- Plant material is tested and used within each species-specific deployment zone

- Can be used in reclamation (white and black spruce, lodgepole and jack pine seeds available from forest companies or ATISC)
FGRMS structure

The FGRMS manual has six main chapters

1) General (Section 1 – 6) – explains the rationale and history of provincial standards

2) Policy Issues and International Agreements (Section 7 – 9) – deals with material transfer agreements, intellectual property rights, international agreements, GMO’s and access to data and information

3) Material Collection, Handling, Registration and Storage (Section 10 – 17)
FGRMS structure

The FGRMS manual has six main chapters

4) Green Area Deployment (Section 18 – 23) –standards governing deployment

5) Tree Breeding, Testing and Verification (Section 24 – 31) –standards governing tree breeding

6) Production of Controlled Parentage Materials (Section 32 – 34) –standards governing establishment and management of seed orchards and stoolbeds
FGRMS format

The new 2016 FGRMS will be published in two volumes

- Volume 1 – Stream 1 standards only
- Volume 2 – Stream 1 & Stream 2 standards similar to the current manual
**FGRMS shrub standards**

- Deployment of shrubs will be regulated through the existing Alberta seed zones – literature review shows that these seed zones are appropriate for some of the frequently used shrubs or may be even too large.

- The seed zones are not species-specific. Currently there is not enough data to aid creation of such zones.

- Standards for establishment of Stream 1 seed orchards to secure a stable supply of seed have been created

A Stream 1 seed orchard is linked to a single seed zone
Using FGRMS in reclamation

Alberta Forest Genetic Resource Management and Conservation Standards

Third Revision of STIA

Volume 1A: Stream 1
1a. Identify seed zone of project

• Material is collected and deployed in the same seed zone
1b. Identify seed zone of project

- Project in a different seed zone than the collection zone but very close to the border:
  - move material between the zones up to 1 km within 100 m of elevational change

- Project in a different seed zone than the collection zone:
  - apply for variance to move material collected in one seed zone to the other (form in Appendix 8)
  - deployment variance can be used with point collections only
2. Apply to Forest Area Office for authorization to collect plant material

Form in Appendix 10A.
Include a list of all possible species for opportunistic collections
3a. Collect plant material following FGRMS Point collections

<table>
<thead>
<tr>
<th>Material category</th>
<th>Stream 1 material</th>
<th>Minimum plants per collection for unrestricted registration or establishment of serial propagation</th>
<th>Range of plants per collection eligible for restricted registration¹</th>
<th>Maximum elevation range from which plants collected</th>
<th>Maximum area from which collection is made</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>All seedlot collections except aspen and balsam poplar, and clonal shrubs⁴</td>
<td>30</td>
<td>20-29</td>
<td>100 m</td>
<td>2 km radius</td>
</tr>
<tr>
<td>B</td>
<td>Aspen and balsam poplar and clonal shrubs⁴ seedlot collections</td>
<td>10 (well-spaced clones/patches)²</td>
<td>7-9 (well-spaced clones/patches)²</td>
<td>100 m</td>
<td>5 km radius</td>
</tr>
<tr>
<td>C</td>
<td>Vegetative lots (deployed without serial propagation)</td>
<td>75³</td>
<td>N/A</td>
<td>100 m</td>
<td>5 km radius</td>
</tr>
<tr>
<td>D</td>
<td>Vegetative lots (serial propagation before deployment)</td>
<td>120³</td>
<td>75-119</td>
<td>100 m</td>
<td>5 km radius</td>
</tr>
</tbody>
</table>

Reproductive characteristics of common shrubs are in Appendix A38.4

Restricted registration: need to apply to use it, can’t move outside seed zone
3b. Collect plant material following FGRMS

Seed zone-wide collections

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<tr>
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<td>All seedlot collections <strong>except</strong> aspen and balsam poplar, and clonal shrubs⁴</td>
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</table>
3c. Collect plant material following FGRMS

- 10.14 For locally infrequent species or rare species, special registration and deployment provisions may be enabled by Alberta for conservation, restoration or reclamation purposes.

- Can mix seedlots after collections to obtain the required diversity.

- Materials collected outside Alberta may be registered and deployed in Alberta through a variance application system if:
  - The source is within a 50 km radius and 100 meter elevation of the planting site.
  - FGRMS registration requirements are met.
4a. Transport seeds to the approved seed processing facility

- Stream 1 Registration Request (form in Appendix 2) must accompany all shipments of public land collections.

Approved Commercial Seed Testing Facilities

British Columbia Tree Seed Centre
Heather Rooke
604 541-1683

Smoky Lake Forest Nursery Ltd.
Box 220
Smoky Lake, AB T0A 3C0
Stuart Howarth
780 656-4130

PRT Prince Albert Nursery
Box 2901
Prince Albert, SK S6V 6J9
Doug Gullickson
306 953-4700

Approved Commercial Seed Processing Facilities

Bonnyville Forest Nursery Inc.
5110-55 Avenue
Bonnyville, AB T9N 2M9
Dan McCurdy
780 826-6162

British Columbia Tree Seed Centre
Heather Rooke
604 541-1683

Chickadee Reclamation Services
7624-88 Avenue NW
Edmonton, AB T6C 1K8
Eckehart Marenholtz
780 722-9761

Grumpy’s Greenhouses and Gardens Ltd.
Box 2488
Pincher Creek, AB T0K 1W0
Debbie Everts
403 627-4589

PRT Prince Albert Nursery
Box 2901
Prince Albert, SK S6V 6J9
Doug Gullickson
306 953-4700

Smoky Lake Forest Nursery Ltd.
Box 220
Smoky Lake, AB T0A 3C0
Stuart Howarth
780 656-4130

Yellow Point Propagation Ltd.
13735 Quennell Road
P.O. Box 669
Ladysmith, BC, V9G 1A5
Don Pigott
250 245-4635
4b. Transport vegetative material to the approved processing and storage facility

- Stream 1 Registration Request (form in Appendix 2) must accompany all shipments of public land collections.

- Production population materials that need to be maintained in growing conditions must be stored at an approved storage facility. An approved production site is considered an approved storage facility.

- Submit the Stream 1 Registration Request (form in Appendix 2) to the Provincial Seed Officer.
5. Seed processing and transportation to the approved seed storage facility

- Seed processing/testing facility must obtain moisture measurement for each seedlot. Other seed testing results (germination %, purity, 1000 seed weight) are not required for registration.

- Stream 1 Registration Request (form in Appendix 2) must accompany all shipments from the processing to the storage facility.
6. Seed storage

- All seed must be stored in an approved seed storage facility (currently only ATISC).

- For the seed to be registered and stored, the seed processing/testing facility must indicate in the Registration Request form moisture measurement of the processed seed.
7. Deployment

• Submit to ATISC (Provincial Seed Officer) Seed and Vegetative Materials Withdrawal and Transportation Form (Appendix 17)

• Only registered seedlots can be deployed on public land except:

Std. 19 Wild transplants and propagules from within 5 km and 100 m elevation of the target planting site, or from within 20 km of the planting site and in the same seed zone, may be deployed without registration. These transplants and propagules may not be multiplied or serially propagated.
FGRMS Forms


- Contact ATISC: [ATISC@gov.ab.ca](mailto:ATISC@gov.ab.ca)
  1-780-656-5072

- Google
Shrub seed research at ATISC

Lindsay Robb
Provincial Seed Specialist
Alberta Tree Improvement & Seed Centre (ATISC)
Why valid research on germination & seed storage is important

Germination
• Amount of seed dormancy will vary both within and between populations and often on a single plant. Seed dormancies can be linked to other plant traits, e.g. ecologically, linkage disequilibrium, pleiotropy.
  → 75% germination of filled seed is the global standard goal for good conservation practice

Storage
• Many of these shrub species may be much shorter or longer lived in storage than the conifer species we’ve dealt with up until now
  → forewarned is forearmed!

• Seed death in storage is NOT RANDOM (see above re dormancy) and we don’t want to lose valuable plant traits that could be important to survival and resilience
  → no seed domestication if preventable
Beaked Hazel
*Corylus cornuta* Marshall

- Reports from nurseries regarding difficulties in propagation
- Literature states ‘undecided’ for orthodox vs recalcitrant due to conflicting papers - often due to different maturities!
- Very small test done in 2013 – not recalcitrant but most likely immature, therefore not desiccation tolerant yet
Hazel Work 2015/16
*Corylus cornuta* Marshall

- **Wet**
- **Dry (20% RH, 4% MC), frozen (-20°C, 4 months)**

Germination %

0 wk maturity

6 wk maturity
90% RH, 20°C
Now we know:
• Hazels produce very few empty nuts → too expensive
• Ex situ maturation had a positive effect on germination & longevity
• Neither drying nor freezing had negative effects
  → NOT recalcitrant
• Germination >35% of filled nuts was never achieved

Therefore:
• Harvesting to beat the squirrels is too early – no way around it
• Germination methodology is not optimal

2016/17 → Large factorial trial set up with new harvest to find a practical way to produce maximum number of seedlings with high diversity
Other woody shrub research

- Large research project summer 2016, divided into 3 sections:
  1. TZ methods
  2. Practical germination methods
  3. Longevity

- To be systematically completed for 12 species:

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Alnus incana</em></td>
<td>river alder</td>
</tr>
<tr>
<td><em>Alnus viridis</em></td>
<td>green alder</td>
</tr>
<tr>
<td><em>Arctostaphylos uva-ursi</em></td>
<td>bearberry</td>
</tr>
<tr>
<td><em>Betula pumila</em></td>
<td>bog birch</td>
</tr>
<tr>
<td><em>Dasiphora fruticosa</em></td>
<td>shrubby cinquefoil</td>
</tr>
<tr>
<td><em>Lonicera involucrata</em></td>
<td>bracted honeysuckle</td>
</tr>
<tr>
<td><em>Prunus pensylvanica</em></td>
<td>pin cherry</td>
</tr>
<tr>
<td><em>Prunus virginiana</em></td>
<td>chokecherry</td>
</tr>
<tr>
<td><em>Rosa acicularis</em></td>
<td>wild rose</td>
</tr>
<tr>
<td><em>Shepherdia canadensis</em></td>
<td>buffaloberry</td>
</tr>
<tr>
<td><em>Symphoricarpos albus</em></td>
<td>common snowberry</td>
</tr>
<tr>
<td><em>Vaccinium myrtilloides</em></td>
<td>dwarf blueberry</td>
</tr>
<tr>
<td><em>Viburnum edule</em></td>
<td>low bush cranberry</td>
</tr>
</tbody>
</table>
Other woody shrub research

- TZ protocols completed for 7 species – different from both ISTA and AOSA suggested methods
- Germination trials to begin winter 2016 on 5 species
- Full reports will be completed and published/distributed as each section is completed
Annual Seed Conservation Course at ATISC

Free 2-day course (Feb/Mar) covering:

• Seed-air moisture relations
• Harvest assessment & post-harvest handling
• Storage behavior
• Seed longevity
• Intro to tetrazolium chloride viability testing
• Germination & dormancy
• Includes a cut testing lab plus a germination problem solving tutorial

white spruce  pin cherry  saskatoon