A Step-By-Step of Planning a Native Prairie Restoration Project

Designing for the Future
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• Project Goals and Timeline
• Resources and Information Collection
• Pre-site Survey
• Plan Development
• Implementation
• Monitoring
Project Goals and Timeline

- Project Goals
  - Reclamation
    - Process of returning disturbed land to its former or other productive uses. It can include processes such as, decontamination, surface reconstruction, soil placement and revegetation
  - Revegetation
    - Establishment of plants to a specified density (cover) across a site. Species requirements are only a small consideration during most re-vegetation programs.
  - Restoration
    - Restoration can take any number of forms, but in general the goal is to restore an ecosystem to its previous function, or to a similar function of another natural ecosystem chosen by the designer.
Project Goals and Timeline

- Timeline
  - The timeline cannot be forced. It will depend on a number of variables that are completely out of your control.
  - Once your plan is completed an estimated timeline is possible.
  - Depends on project goals
    - Plant species required, complexity, and establishment rate
    - Regulatory requirements
  - Depends on budget available
    - Shorter timelines require higher budgets
  - Depends on site conditions
    - Weeds, soil salinity, moisture regime, soil texture,
Location, Location, Location

- Identify the greater context of your location
  - Identify your natural sub-region / Ecoregion
  - Identify surrounding sub-regions / Ecodistricts
  - Depending on jurisdiction names vary
Ecodistricts in the Mixedgrass Natural Subregion

- In Alberta, Plant Community Guides provide this information
Identify Resources Available

• Required Resources and Information
  • Plant Community Guide (In Alberta) Guide by Natural Sub-region
  • Restoration Strategies Guide (In Alberta) Guide by Natural Sub-region or a basic guide for the Province
  • Guides for neighboring Ecosystems
  • Soils Information (Alberta – AGRISID)
  • Vegetation Information (Grassland Vegetation Inventory)
  • Site Specific Plant Community
  • Site Specific Topography
  • Site Specific Soil Conditions
  • Climatic Conditions
Identify Resources Available

- Plant Community Guide (In Alberta) Guide by Natural Sub-region
  - Strong resource when you do not have a surrounding community to match
  - If you are matching a surrounding ecosystem use these guides to identify suitable substitute species and determine information on the site history, land use, and what species will most appropriately replicate the required ecosystem functions on the site
- **If No Plant Community Guide is Available**
  - Use field assessments in target communities surrounding the disturbed site. This information is always more accurate for your specific location
Identify Resources Available

• Restoration Strategies Guide (In Alberta) Guide by Natural Sub-region or a basic guide for the Province
  • This guide will show you step by step what does and does not work for the environment you are in.
  • If No Guide Is Available
    • Use neighboring regions guides. Alberta’s guides apply to more than just within the province boundary.
    • Find more general guides
Identify Resources Available

- Online Information
  - Soils Information (Alberta – AGRISID)
  - Vegetation Information (GVI, AVI…)
  - This information is an important planning resource, it can speed up your planning process in the office and reduce the field data collection required.
  - This information will identify similar sites to compare to your site to determine appropriate vegetation and link you to the guides.
  - When this data is not available field data collection of the site in question and target communities is more critical.
Identify Resources Available

• Site Specific Survey Data
  • It is critical to have site specific survey information for all restoration projects no matter the size.
  • The more complex the restoration the more information that will be required.
  • If no information surrounding your site is available identify neighboring land that can be assessed as a target. You will Require:
    • Site Specific Plant Communities
    • Site Specific Topography
    • Site Specific Soil Conditions
    • Climatic Conditions
Climate and Soils

- Determine Microclimatic impacts within the Natural Sub-region
  - North face vs south face
  - Soil type and variation on the site
  - Pull information from available sources (GVI, Soil surveys, other existing sources of information),
  - understand that most map layers existing are not ground truthed at all or only superficially.
Determine Dominant Ecological Range Site

Soil Surveys maps

Field Soil Survey

Determine Reference Plant Community

GVI, AVI, Other Sources

Field Vegetation Survey

Risk Assessment

Erosion

Wind

Water

Soil Nutrients

Absence

Surplus

Soil Moisture

Lack

Abundance

Invasive Species

Regulated

Non-Regulated

Native Species

Access

Propagation Issues

Community Health and Classification

Health

Successional Level
Vegetation Assessment

• Assess your plant community
  • Range Health Assessments

**Strengths**
- Quick to run
- Takes only moderate training
- Tells you about the community health
- Tells you the successional stage
- Associates with benchmark data

**Weakness**
- Only gives top species
- Cover estimates inaccurate
- Seasonality of community has impact on cover values
- Cover values rely heavily on experienced assessment specialist
- Assess your plant community
  - (Foothills Fescue Natural Subregion)
- **Range Health Assessments**
  - 56% Healthy with Problems
  - Significant invasion
  - No Foothills Rough Fescue
  - Significant reduction in western Porcupine grass
Vegetation Assessment

- Assess your plant community
  - **Detailed Vegetation Transects**
    - **Strengths**
      - More accurate and detailed info
      - Complete community
      - Tells you about the community health
      - Tells you the successional stage
      - Associates with benchmark data
      - Gives you all info for health assessment

- **Weakness**
  - Slower to complete
  - Requires more training
  - Data only as good as assessment specialist
• Assess your plant community
• Detailed Vegetation Transects
- Assess your plant community
- Detailed Vegetation Transects
Data Layers Available

- Ecoregion, Ecodistrict
  - Consult Maps

Determine Dominant Ecological Range Site

- Soil Surveys maps
- Field Soil Survey

Determine Reference Plant Community

- GVI, AVI, Other Sources
- Field Vegetation Survey

Risk Assessment

- Erosion
- Soil Nutrients
- Soil Moisture
- Invasive Species
- Native Species
- Community Health and Classification

- Wind
- Absence
- Lack
- Regulated
- Access
- Health

- Water
- Surplus
- Abundance
- Non-Regulated
- Propagation Issues
- Successional Level
Ecological Site Restoration Risk Analysis (ESRRA)

PDF is available online at www.foothillsrestorationforum.ca
Reclamation Risk Assessment

- Project Constraints
  - Timing, Scale, Aesthetics, Timeline, Budgets...
- Ecodistrict
  - Each natural subregions, and ecodistrict contains unique risks associated with its climate, soils, disturbance regimes, and plant communities. Location will feed information to each other risk assessment.
  - Is the community present adapted to disturbance
Reclamation Risk Assessment

• Soil Stability
  • Soil texture, Topography, Climate (precipitation, wind), geology
  • Where site stability is at risk a stabilization program must be employed
    • Cover Crops
    • Bio-engineering
    • Hydro-mulch
    • Erosion control blankets
    • Turf reinforcement matting
    • Erosion control structures
Risk Assessment

• Soil Nutrients
  • Low nutrient conditions and poor rooting mediums
    • Establishment Failures May Occur
      • Species Selection
      • Fertilization
      • Organic Matter Enhancement

• Rich Nutrient Conditions
  • Invasive Species Issues, competition issues (i.e. *Bromus tectorum*)
    • Weed management program
    • Nutrient suppression
    • Seed mix balance and species selection
Risk Assessment

• Soil Moisture
  • Dry locations, droughts
    • Risk of establishment failure,
      • Species selection, irrigation, timing of seeding, seeding rates
  • Wet locations
    • Risk of competition, erosion, invasive species, (i.e. Poa pratensis, Bromus inermis...)
      • Species selection, weed control, timing of reclamation, seeding rates
Risk Assessment

• Invasive Species
  • Regulated weeds, Agronomic Species, Nuisance weeds
    • Invasive Species Control Program, Herbicide, Tillage, Cover Crops, Competitive native species, timing of seeding, nutrient suppression

• Native Species
  • Propagation Issues, Establishment Issues, Access to Material
    • Live plants, Seeding Rates, Substitute Species, Wild Harvest, Contract Growing
  • Reliability of Sources, Contamination of Weeds
    • Get Source Information, Weed Certificates, Use Reliable Labs, Adaptive Management Programs
Reclamation Risk Assessment

• Range Health and Successional Level
  • When surrounding vegetation is healthy infill and natural recovery techniques may enhance recovery,
  • climax species may be extremely difficult to restore and timelines may be increased
  • When surrounding vegetation is unhealthy the infill may all be invasive species and weed management may become critical
  • Early successional species may be easy to restore and reclamation may progress quickly
Determine Dominant Ecological Range Site

Soil Surveys maps

Determine Reference Plant Community

GVI, AVI, Other Sources

Risk Assessment

Erosion

Wind

Water

Soil Nutrients

Absence

Surplus

Soil Moisture

Lack

Abundance

Invasive Species

Regulated

Non-Regulated

Native Species

Access

Propagation Issues

Community Health and Classification

Health

Successional Level

Data Layers Available

No Data Layers Available

Ecoregion, Ecodistrict

Consult Maps

Field Soil Survey

Field Vegetation Survey
Recovery Strategies Options

Natural Recovery

Assisted Natural Recovery

Native Seed Mix
Select the Recovery Strategy

Significant Soil Disturbance (>25%)

Healthy (75% - 100%)

Healthy with Problems (50% - 74%)

Unhealthy (< 50%)

Erosion Risk

Assisted Natural Recovery

Ecologically Based Invasive Plant Management

Ecologically Based Invasive Plant Management

Assisted Natural Recovery

Native Seed Mix

Assisted Natural Recovery

Native Seed Mix
Seed Mix Design

• Compare your desired species list to what is available
  • **Determine the successional level of each species**
    • Colonizers vs climax species

• **Determine the grazing response of each species**
  • Decreasers (Critical species to replace)
  • Increaser 1 (these are fairly critical)
  • Increaser 2 (These may be site stabilizers that if used appropriately will set up your trajectory.)
  • Invader (These species may destabilize your trajectory)
Target Recovering Plant Community
Cypress Upland: Loamy, Shallow to Gravel, Gravel and Thin Breaks Range Sites

<table>
<thead>
<tr>
<th>Species</th>
<th>Proportion of Seed Mix</th>
<th>% PLS by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plains rough fescue</td>
<td><em>Festuca hallii</em></td>
<td>50%</td>
</tr>
<tr>
<td>Western porcupine grass</td>
<td><em>Stipa curtiseta</em></td>
<td>30%</td>
</tr>
<tr>
<td>Awned wheat grass</td>
<td><em>Agropyron trachycaulm var. unilateral</em></td>
<td>05%</td>
</tr>
<tr>
<td>Northern wheat grass</td>
<td><em>Agropyron dasystachyum</em></td>
<td>05%</td>
</tr>
<tr>
<td>June Grass</td>
<td><em>Koeleria macrantha</em></td>
<td>10%</td>
</tr>
</tbody>
</table>
### Target Recovering Plant Community

- Detailed Vegetation Transects

<table>
<thead>
<tr>
<th>Name</th>
<th>Average Cover (%)</th>
<th>% Prom. Value</th>
<th>Grazing Response</th>
<th>Structural Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>POAPRAT</td>
<td>14.30</td>
<td>26.97</td>
<td>Invader</td>
<td>not applicable</td>
</tr>
<tr>
<td>BOUTGRA</td>
<td>9.50</td>
<td>14.61</td>
<td>Increaser - Type 2</td>
<td>Ground cover (prostrate shrubs, graminoids, forbs, moss/lichen)</td>
</tr>
<tr>
<td>STIPCOM</td>
<td>9.00</td>
<td>13.47</td>
<td>Increaser - Type 1</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>STIPCUR</td>
<td>7.50</td>
<td>10.25</td>
<td>Increaser - Type 1</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>AGROPEC</td>
<td>6.20</td>
<td>7.70</td>
<td>Invader</td>
<td>not applicable</td>
</tr>
<tr>
<td>LIATPUN</td>
<td>5.00</td>
<td>5.58</td>
<td>Increaser - Type 1</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>SOLISPA</td>
<td>4.60</td>
<td>4.92</td>
<td>Increaser - Type 1</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>CAREPEN</td>
<td>3.60</td>
<td>3.41</td>
<td>Increaser - Type 1</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>HELIHOE</td>
<td>3.40</td>
<td>3.13</td>
<td>Decreasor</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>PHLOHOO</td>
<td>2.30</td>
<td>1.74</td>
<td>Increaser - Type 1</td>
<td>Ground cover (prostrate shrubs, graminoids, forbs, moss/lichen)</td>
</tr>
<tr>
<td>ASTEFAL</td>
<td>2.10</td>
<td>1.52</td>
<td>Increaser - Type 1</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>HETEVIL</td>
<td>1.50</td>
<td>0.92</td>
<td>Increaser - Type 1</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>TERRHO</td>
<td>1.50</td>
<td>0.92</td>
<td>Increaser - Type 2</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>GUTISAR</td>
<td>1.30</td>
<td>0.74</td>
<td>Increaser - Type 1</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>MUHLCUS</td>
<td>1.00</td>
<td>0.50</td>
<td>Increaser - Type 1</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>ARTEFRI</td>
<td>1.00</td>
<td>0.50</td>
<td>Increaser - Type 2</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>ARTECAM</td>
<td>1.00</td>
<td>0.50</td>
<td>Increaser - Type 2</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>GALIBOR</td>
<td>1.00</td>
<td>0.50</td>
<td>Increaser - Type 1</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>CIRSFLO</td>
<td>0.80</td>
<td>0.36</td>
<td>Increaser - Type 1</td>
<td>Tall Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>ACHIMIL</td>
<td>0.80</td>
<td>0.36</td>
<td>Increaser - Type 2</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
<tr>
<td>KOELMAC</td>
<td>0.50</td>
<td>0.18</td>
<td>Increaser - Type 1</td>
<td>Medium Graminoids &amp; Forbs</td>
</tr>
</tbody>
</table>
Seed Mix Design

• Compare your desired species list to what is available
  • Assess the varieties available
    • Local Wild Harvest Seed (contaminants may be desirable infill species)
    • Non-local Wild Harvest Seed (contaminants if native may not be a benefit but will rarely cause any negative impacts)
    • Ecovars and similarly selected species – genetically robust and may be developed for your local site, if not may still be suitable depending on how different the source location is
    • Source Selected – Species that can be located in a specific source location may be ideal if the source location matches your site characteristics
Seed Mix Design

• Compare your desired species list to what is available
  • **Proximity to Source** – the appropriate distance from source to site varies by species and by location.
    • Species sourced from a drier environment that is a long distance away may be more appropriate than one closer from a much wetter location
    • Each species has a different natural distribution. Distance matters for some species more than others
Seed Mix Design

• Impact of Goals on Seed Mix & Seeding Rate
  • Bunch grass vs Creeping (competition issues)
  • Fast vs slow establishment requirements
  • Erosion issues
  • Possible disturbance regimes
  • Aesthetics
On Site Management

- Experience and attention to detail is critical
On Site Management

- Experience and attention to detail is critical
Adaptive Management

1. Identify Problem
2. Design Solution
3. Monitor Site
4. Corrective Action
Adaptive Management

• Monitoring Program
  • What To Monitor:
    • Vegetation Density
    • Invasive Species
    • Soil Erosion
  • When To Monitor:
    • First Season: Monthly
    • Second Season: Spring, Late Summer
    • Third Season and Onward: Mid Summer
Establish a Monitoring and Adaptive Management Program
Adaptive Management

Fences Are Often Left Too Long

Fenced Remote Sump Site in Majorville Area: seeded native cultivars have become lodged, extensive litter buildup has altered surface moisture, and native encroachment is not occurring.
Invasive Species Management

• Species that Cause Removal Concerns
  • Baby’s Breath (Root System)
  • Centless Cammomile (Seed Production)
  • Downy Brome (Sets seed monthly)
  • Japanese Brome (Sets seed monthly)
  • Most Grasses
Invasive Species Management

- Species that Cause Competitive Problems
  - Crested Wheatgrass
  - Quack Grass
  - Creeping Red Fescue
  - Sheep’s Fescue
  - Hard Fescue
  - Smooth Brome
  - Timothy
  - Sweet Clover
  - Baby’s Breath
  - Meadow Brome
Smooth Brome Control

- Wick Application with or without Mowing was the only method to significantly reduce smooth brome.
- Sooth brome was reduced to levels found in off RoW Controls

P<0.0001
Timothy Control

- While wick application was the most efficient at reducing timothy, all treatments effectively reduced timothy to that seen in the control

P<0.0001
Kentucky Bluegrass

- Response of Kentucky bluegrass to treatments
- Kentucky bluegrass was opportunistic and replaced the timothy and smooth brome

![Graph showing the response of Kentucky bluegrass to treatments over the years 2009 to 2012. The graph includes data points for M, MW, W, RoW control, and control treatments. The P-value is 0.02.]

P=0.02
Kentucky Bluegrass Invasion

- The interaction of distance from the focal *F. campestris* plant and defoliation on the cover of *P. pratensis* within stands planted with *F. campestris* at high (top), medium (middle) and low (bottom) density. Means and error bars are from the mixed model analysis.
Kentucky Bluegrass Invasion

- The mean distance (±SE) of *P. pratensis* encroachment from the perimeter into the plot towards focal *F. campestris* plants at each of 3 different planting densities. Letters show significant differences *P*<0.05.

![Diagram showing the mean distance of *P. pratensis* encroachment from the perimeter into the plot towards focal *F. campestris* plants at different planting densities. Letters A, B, and C indicate significant differences at the *P*<0.05 level.](image)
Recovery Strategies Publications

- The First Approximations of both the Dry Mixedgrass and Mixedgrass Recovery Strategies Documents are available in pdf format online at: www.foothillsrestorationforum.ca
- PDF versions of the Range Plant Community Guides for the Dry Mixedgrass, Mixedgrass, Northern Fescue and Foothills Fescue NSRs are also available via the website.
- Bound Hardcopies can be purchased online, by contacting Donna Watt at corporrate@shaw.ca or by visiting us at the table outside; we will be available for the duration of this afternoon.
- Thank-You!
Contributions

- Marilyn Neville
- Eileen Tannas
- Foothills Restoration Forum Documents
  - Range Plant Community Guides
  - Recovery Strategies of the Dry Mixed Grass Natural Subregion
Questions

?