Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

Integrated Weed Management

Holistic Approach in Forested & Grazing Systems

Why are we so passionate about weeds?

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Outline

- Integrated Weed Management: IWM

What is the concept?

Why is it an important tool across all provincial jurisdictions?

- Strategies:

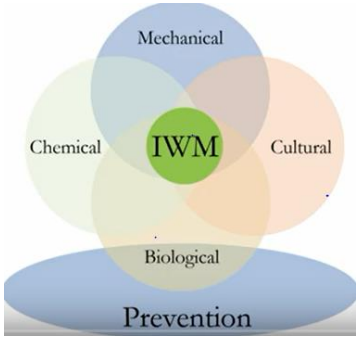
5 specific strategies to integrate as part of IWM

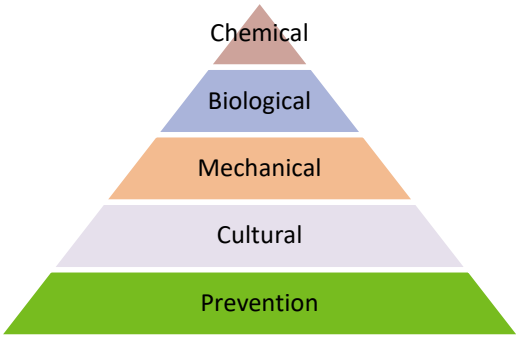
- Case Studies:

7 examples of lessons learned in grazing and forested situations

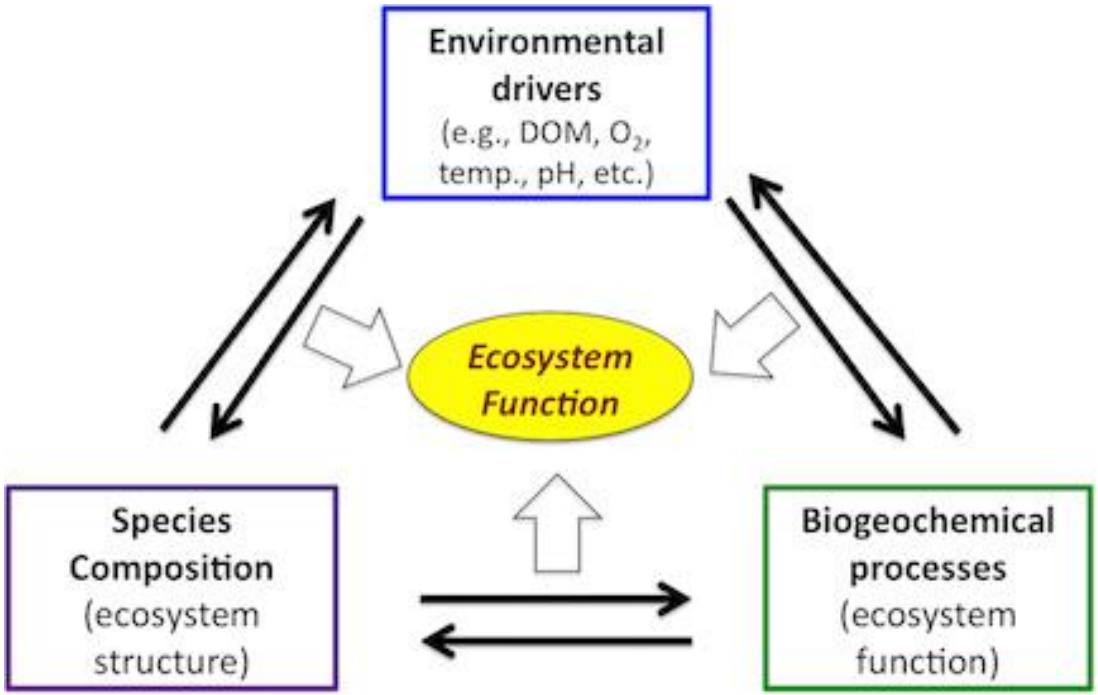
Integrated Weed Management

"using different weed management tools in an integrated way, to manage weeds or undesirable species from a holistic approach"





Back to the basics……ecology of a site



Why is the management of weeds important?

Social & Environmental Values

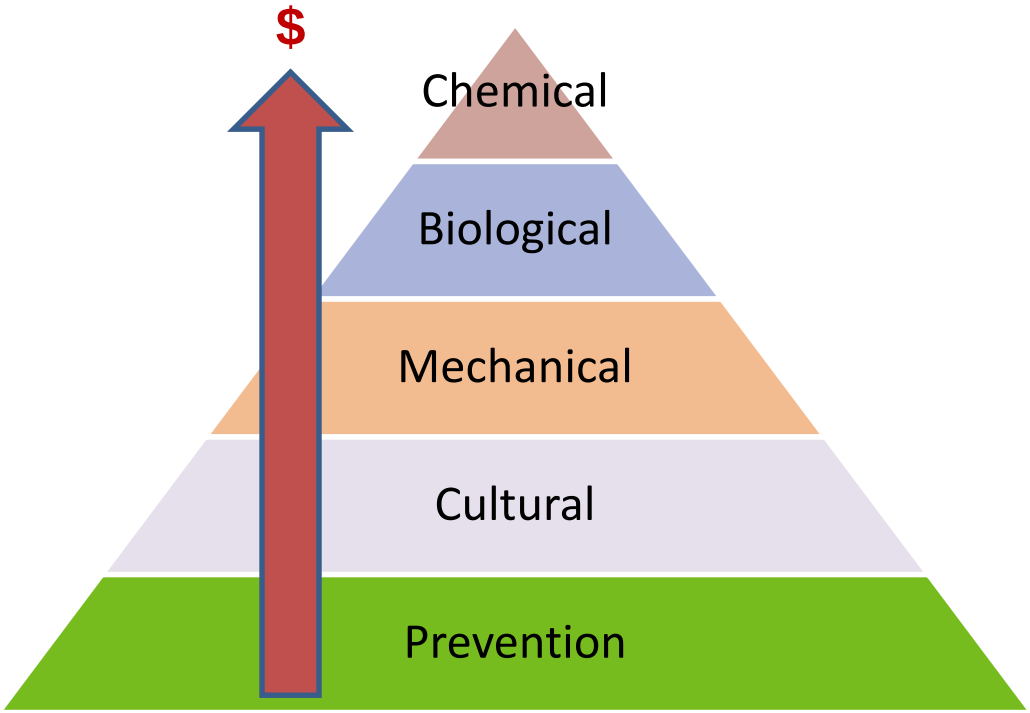
- Reduce ability to harvest plants for traditional use and sustenance
- Shift in access to public land for recreation
- Shift land use objectives & land value
- Invasive species reduce native species and natural succession rate
- Shift ecosystems in waterbodies and land

Why is the management of weeds so important?

Economic Values

- Extend the full project cost and time to closure extensively
- Public cost when entering by roadways, waterways, wind dispersal

What are the key practices?



Focus on…..

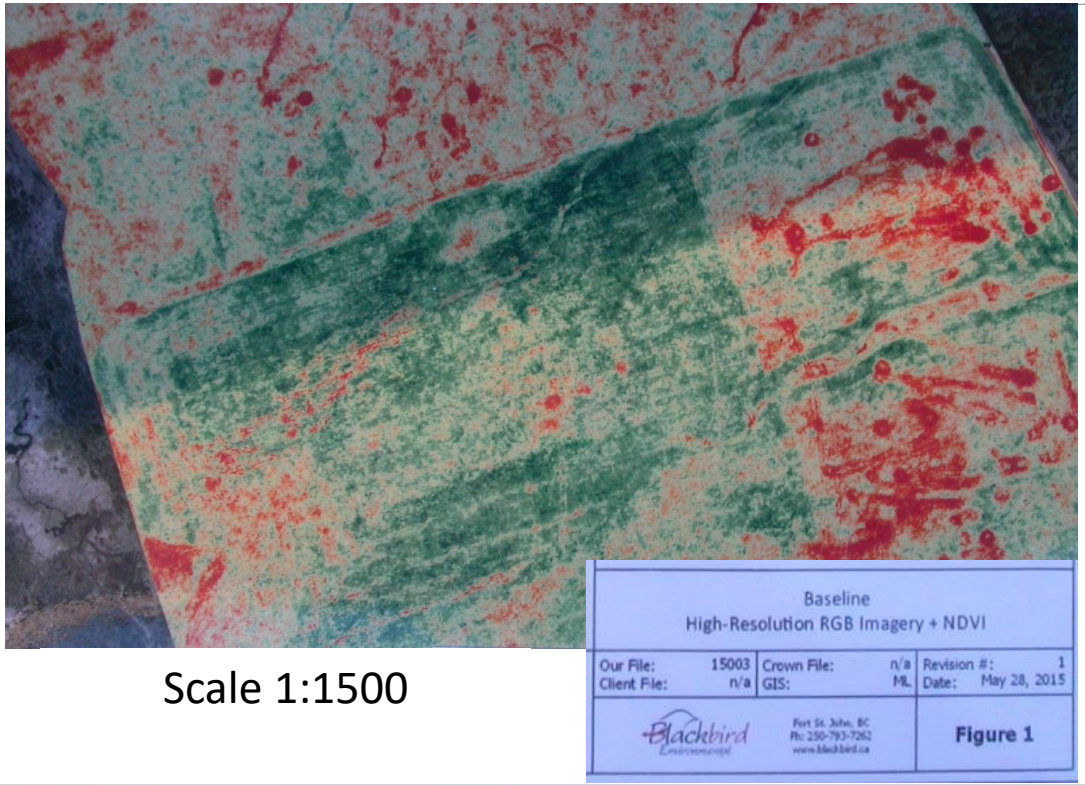
……lets talk case studies & specifics

Case Study #1: Improving Soil Quality

When a pasture or disturbed site has fragile erodible soils are there alternatives to tillage for rejuvenating? Can winter bale feeding, grazing, and nutrient management be effective alternatives?

Fall fertilizing in 2014
Winter feeding in April, 2015
Summer 2015 rest from harvesting
Winter feeding again in 2015/ 2016
Surprise hay crop in summer 2016

What are the differences in soils & forage response where winter feeding is done? 9 bench mark pairs monitored



Scale 1:1500

- Collaborated with Blackbird Environmental to conduct & process drone flight images
- High resolution RGB + NDVI images best for locating exactly where the bales were spread for feeding to locate benchmarks & monitor soil quality
- Drone images were also a valuable tool in monitoring invasive weed infestations

Case Study #1: Improving & Monitoring Soil Quality

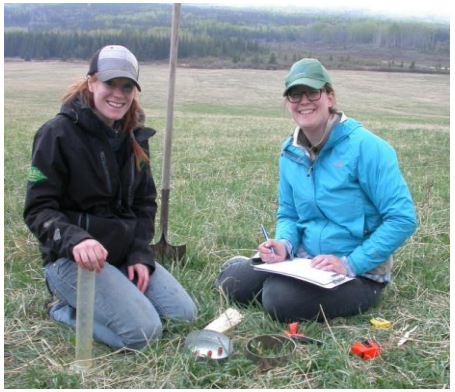
Collaboration PRFA & Dr. Bill McGill, UNBC

Ideal field test kit Include tests for:

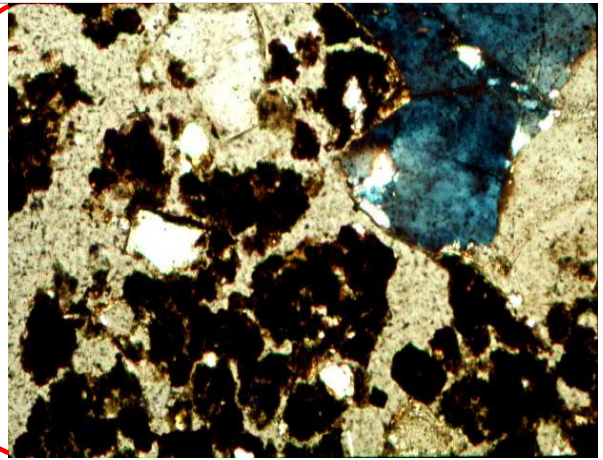
Physical: Structure, Texture, Infiltration, Bulk density, Soil moisture, Water holding capacity, Aggregate stability, Slaking

Chemical: Organic matter, pH. Salinity, Nitrate, Water quality

Biological: Soil respiration, Topsoil depth, Rooting depth, Earthworms



Case Study #1: Improving & Monitoring Soil Quality



6 similar case studies over 5 yr indicate winter feeding practices can quickly & cost effectively improve: pH, organic matter, topsoil depth, infiltration & soil respiration

Applied to restoring pipeline with Lazinchuks & well site pad with Collins

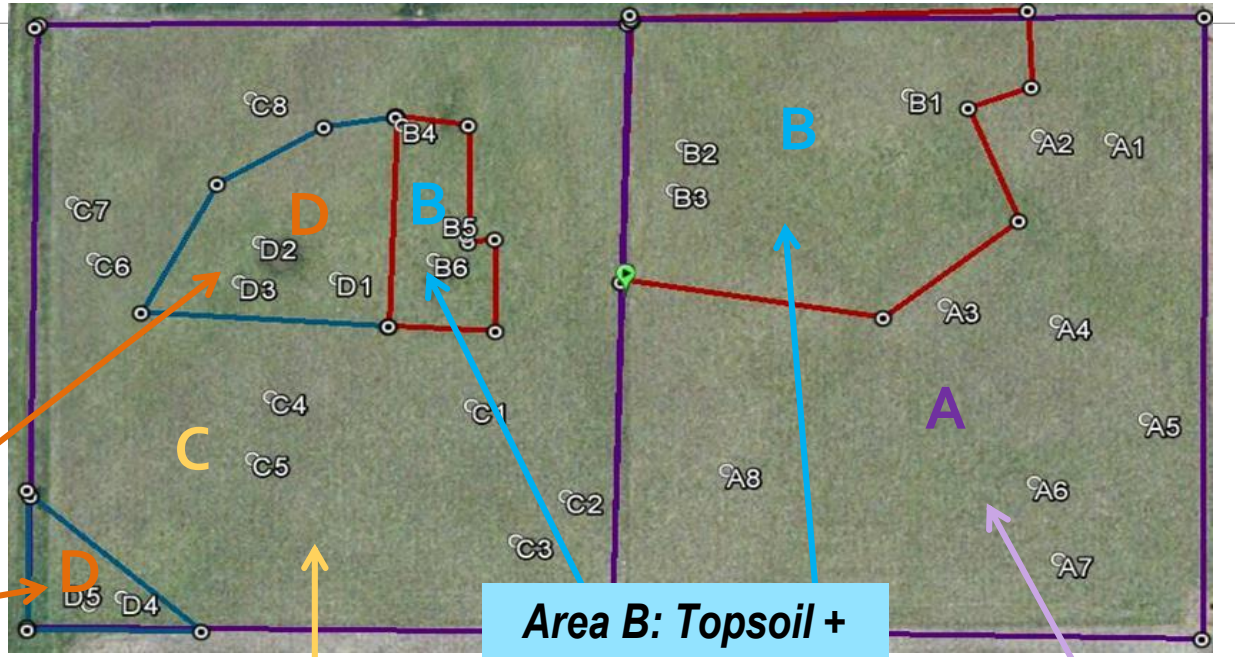
What strategies from the Integrated Weed Management Pyramid were used?

Case Study #2: Scentless Chamomile

	Field 1 History & Control Strategies
2009	Established 20 acre forage field.
2010	No reseeding.
2011	Topsoil applied & grader spread into low areas in the field. added to some low areas. Direct seeded with meadow bromegrass, hybrid bromegrass, tall fescue, orchardgrass, creeping red fescue, timothy, cicer milkvetch & alfalfa.
2012	Recognized scentless chamomile infestation. **Sprayed with Grazon & hand rouged (hand picked).**
2013	**Broadcast seeded bare upland areas with a dryland mix & waterlogged areas with a wetland mix. Hand rouged.**
2014	Little to no scentless chamomile found. **Hand rouged.**

Case Study #2 Scentless Chamomile

Field 1 Control Strategies



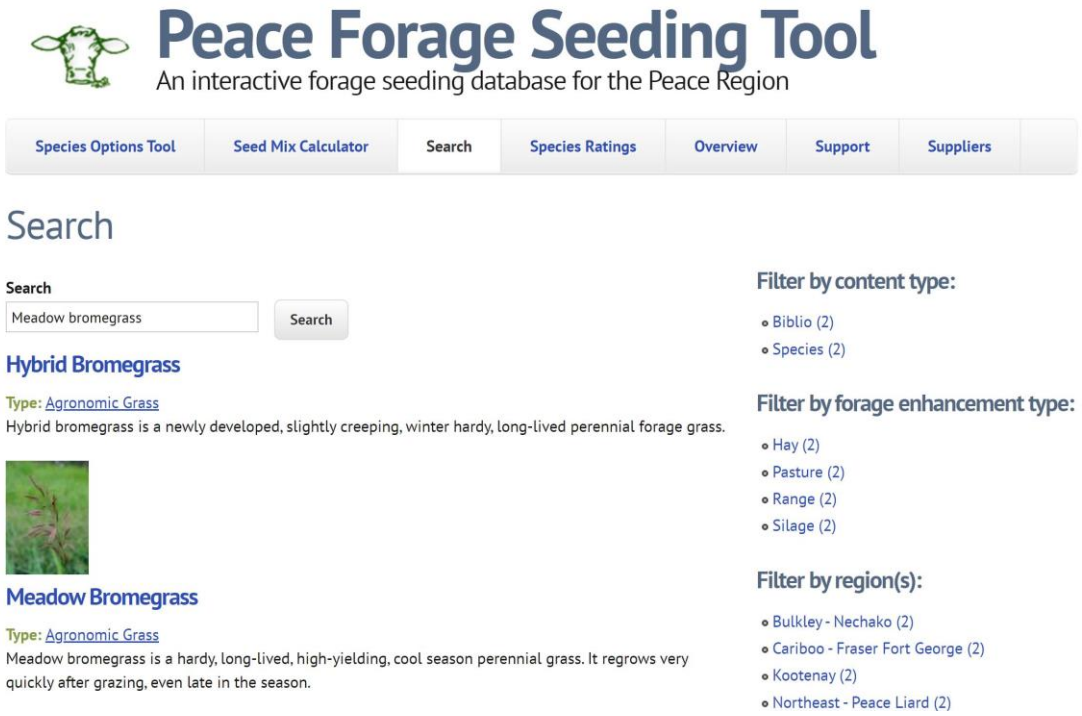
Area D: Topsoil + Dryland Seed Mix:
Meadow bromegrass
Hybrid bromegrass
Tall fescue
Orchardgrass
Creeping red fescue
Timothy
Red clover
Alfalfa

Area C: Pasture + Dryland Mix

Area B: Topsoil + Wetland Seed Mix:
Reed canarygrass
Timothy
Red clover

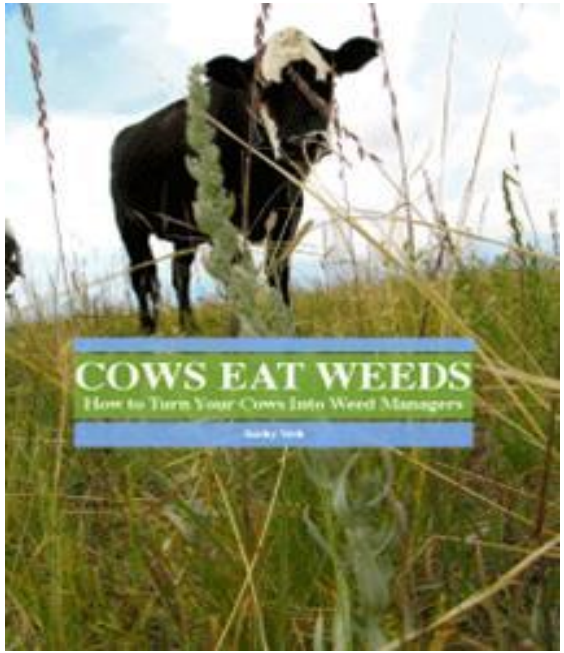
Area A: Control

Case Study #2: Learnings

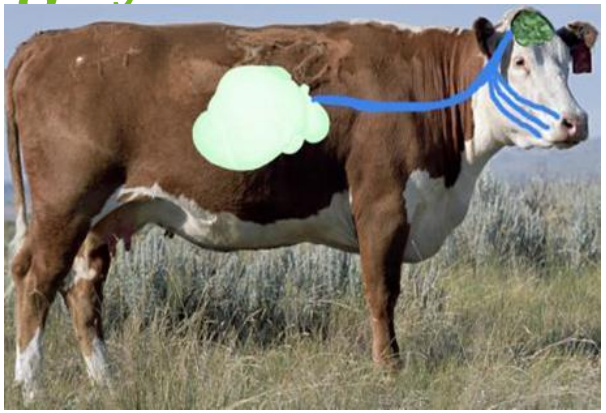


- Select appropriate seed species for site conditions e.g. wet vs dry areas
- Select species to outcompete the invasive weed
- Use high seed quality & asking for Certificates of Seed Analysis
- Source Certified seed rather than common seed
- Know the source of all materials being added to site

Case Study #3:
Using Livestock as Weed Managers



Case Study #3: Using Livestock as Weed Managers in Grazing Systems



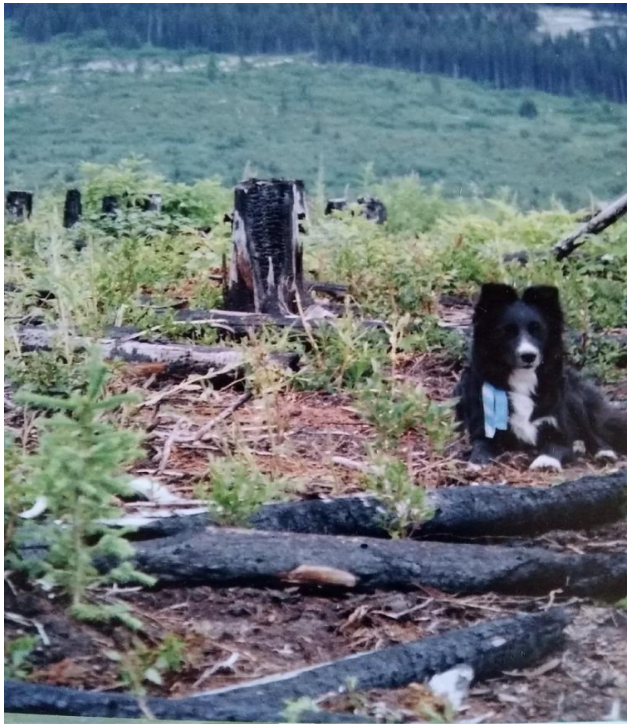
	Mature Thistle	Cow Needs
Crude Protein	8 %	7 – 8 %
Total Digestible Nutrients	64 %	55 %

Case Study #3: Using Livestock as Weed Managers in Grazing Systems

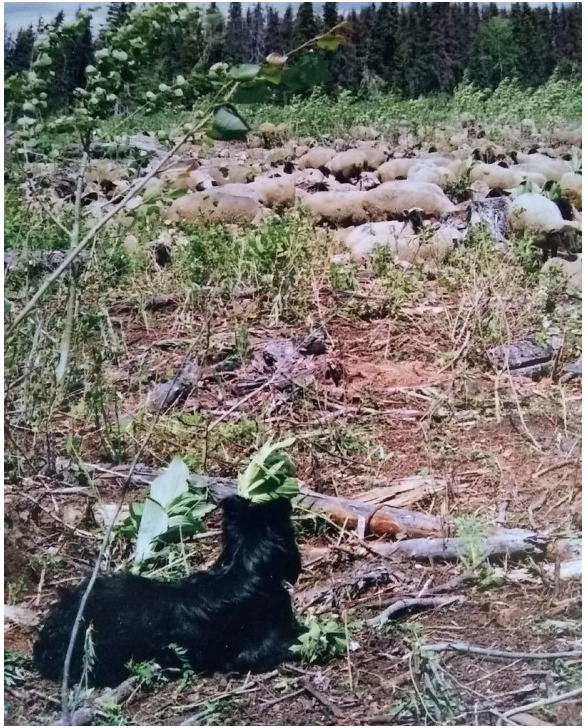
- Applicable to managing weeds on disturbed sites
- Managed livestock can be part of the solution
- Useful when land owners want to use organic practices

- **Cultural** & **prevention** strategies used

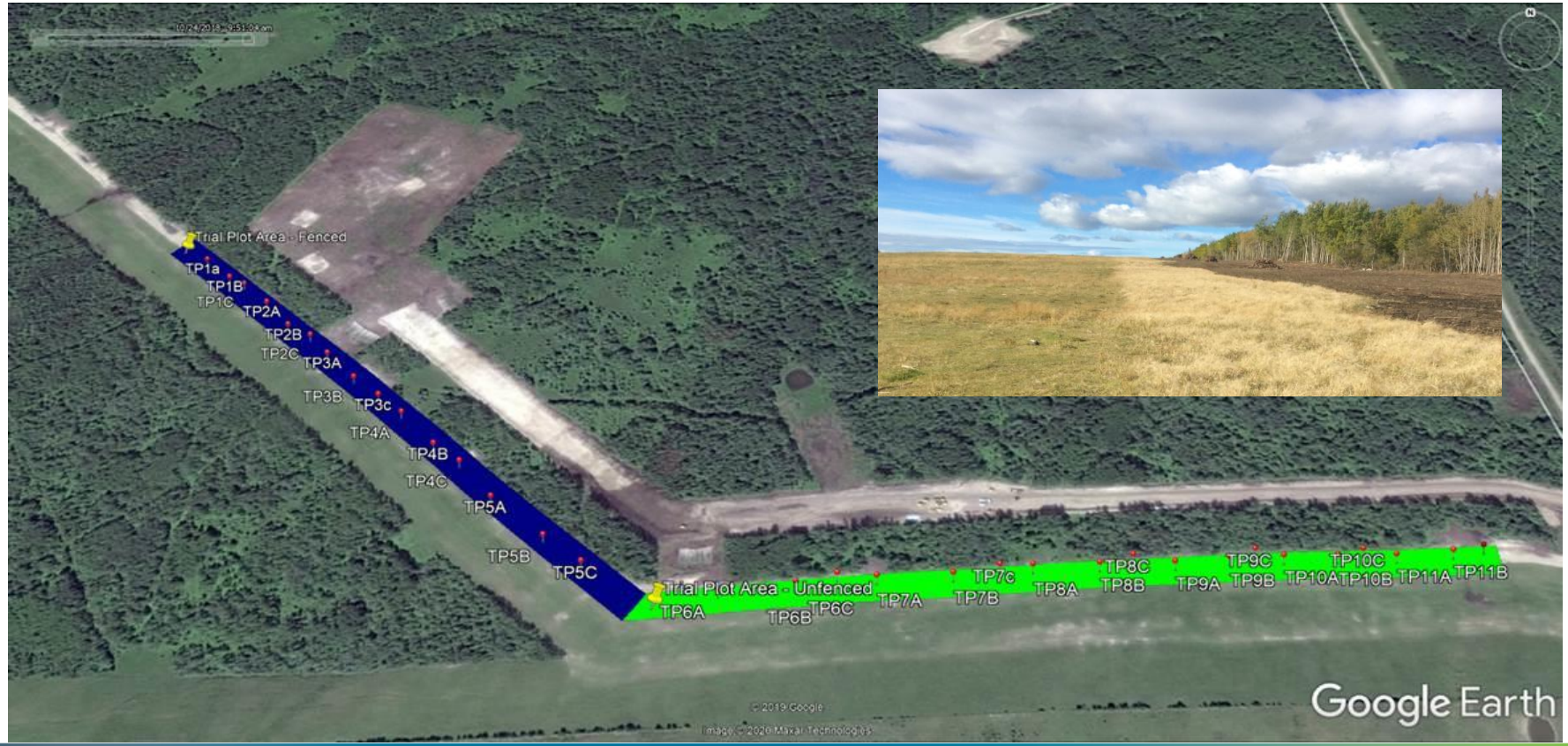
Case Study #4: Using Livestock as Weed Managers in Forested Systems



- Effective way to give desirable plants or tree seedlings the competitive advantage
- Timing of moving flocks was critical
- Has potential in remote areas where chemical control is not an option
- Requested in this case by stakeholders



Case Study #5: Foxtail Barley on Pipelines



Case Study #5: Foxtail Barley on Pipelines

YEAR	TREATMENT OR ACTION
2018	**Fall direct seeding** with **multiple seed mixtures** by composition in old and bare ground
2018	**Fall spraying on designated plots with three herbicide mixes** (Kerb SC, Kerb Granular Packets, Assure II)
2018	**Fall fencing** of the old and new pipeline in specified plots
2019	Early summer monitoring and foxtail barley plant counts
2019	**Herbicide application** and **mowing treatments**
2019	Cursory foxtail barley counts & observations
2020	Evaluate what went well and how we can improve 2020 season

Learnings to date: Foxtail barley control

- **Mowing** treatments alone **did not** yet show a significant difference in reduction of FB plants by themselves.

  Benefits : stressing the FB species while desirable direct seeded seedlings establish

  Negatives: Timing window is challenging and sensitive for plant cycle and ground conditions w potential to make problem worse.

- **Appropriate seed mix & grazing restriction is the most effective in contrast to mowing alone and chemical strategies.**

Case Study #6: Planting in an Forested Area

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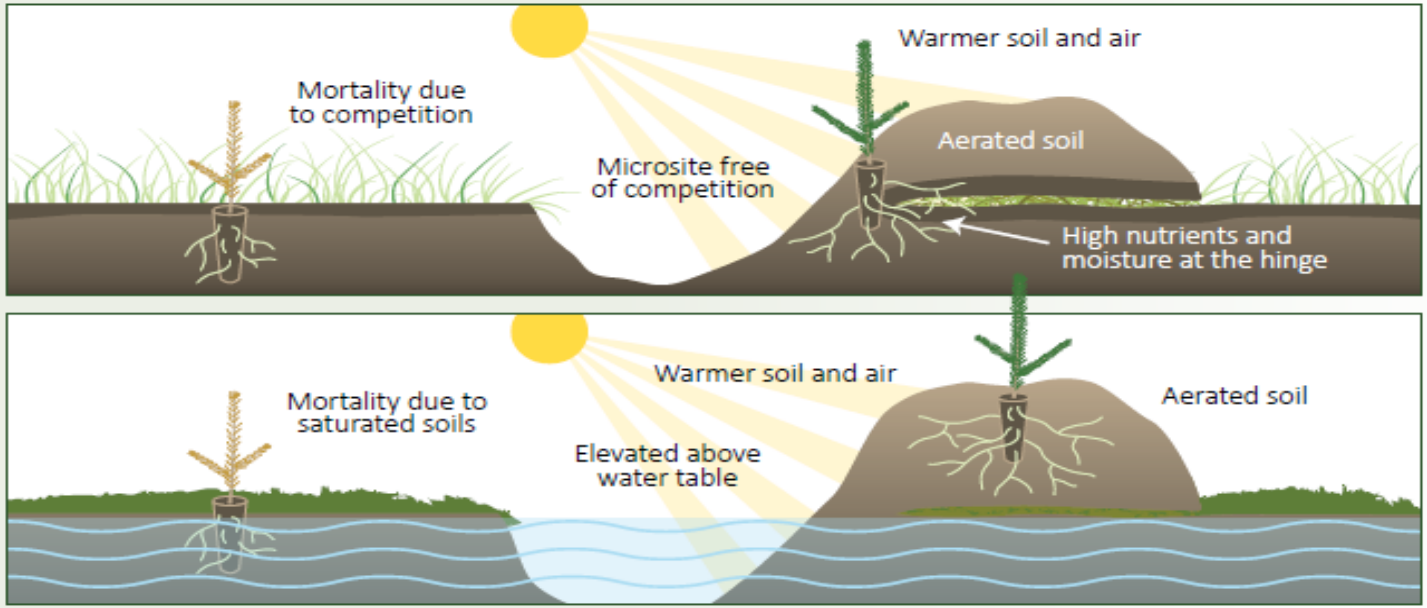
Figure 2. Advantages of mounding on mesic and wet sites.



Seek site prep resources e.g. factsheets & videos from Boreal Research Center & COSIA site

Case Study #6: Learnings

- Understand both your desired & undesired species, especially their life cycles
- Site prep to favor stronger seedlings
- Selecting healthy & vigorous seedlings
- Timing of planting & transplanting
- Can use chemical if in combination with cultural & mechanical

Case Study #7: Regeneration
To seed or not to seed?

Full disturbance not seeded, 2nd season

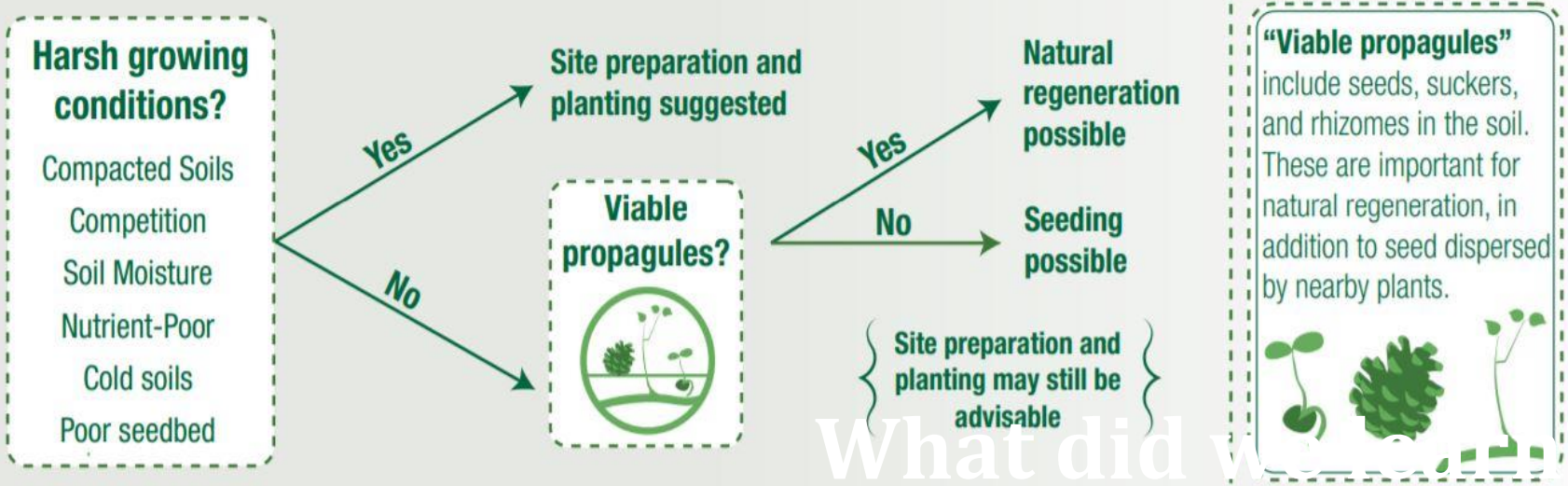
Minimum disturbance site, 13 growing seasons

- What is the feasibility of natural regeneration?
- What is the soil quality & appropriate site prep?
- Are you doing anything to mitigate the risks here?

(Risks = historical seed banks & site access & erosion)

Case Study #7: Regeneration
To seed or not to seed?

Figure 1. Generalized decision-making framework for regeneration methods.



What did we seed?

Case Study #7: Regeneration
To seed or not to seed?

Working and learning from each other is a key Integrated Weed Management Strategy

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PRRD PEACE RIVER REGIONAL DISTRICT

CENTRE FOR BOREAL RESEARCH

Blackbird Environmental

Northern Lights College

Peace River Forage Association of British Columbia

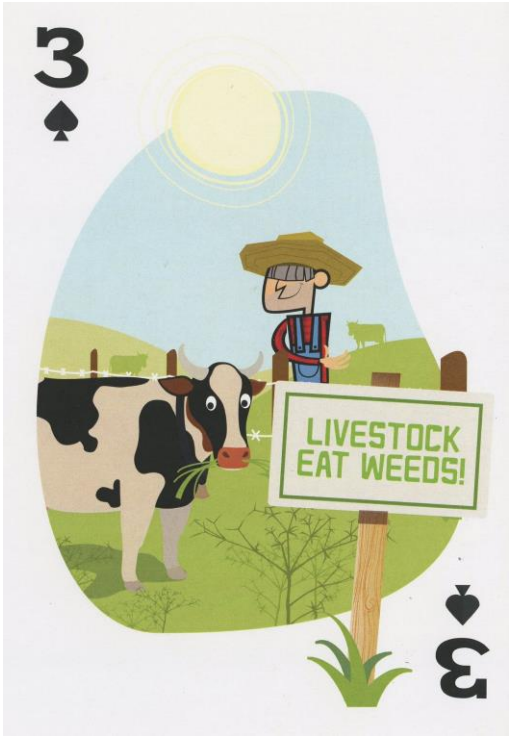
UNBC UNIVERSITY OF NORTHERN BRITISH COLUMBIA

References and Resources

- Peace River Forage Association: http://www.peaceforage.bc.ca/
- NAIT Boreal Research Centre: https://www.nait.ca/industry/applied-research/centre-for-boreal-research
- COSIA Silviculture Toolkit: https://www.360tours.cosia.ca/toolkit/
- Peace Forage Seeding Tool: http://www.peaceforagetool.ca/
- BC Rangeland Seeding Manual: by Dobb & Burton, BC Ministry of Agriculture
- Alberta Environment, Managing Weeds on Industrial Sites: file:///C:/Users/Shellie%20English/AppData/Local/Microsoft/Windows/INetCache/Content.Outlook/96LEC975/RR_03-04%20Weeds%20on%20Industrial%20Development%20Sites-%20Regulations%20and%20Guidelines.pdf
- AER: Reclamation Regulations: https://www.aer.ca/regulating-development/project-closure/reclamation
- BC OGC: https://www.bcogc.ca/site-remediation-and-reclamation-manual

……any questions?

Industry Kelsey & Agriculture Kyle



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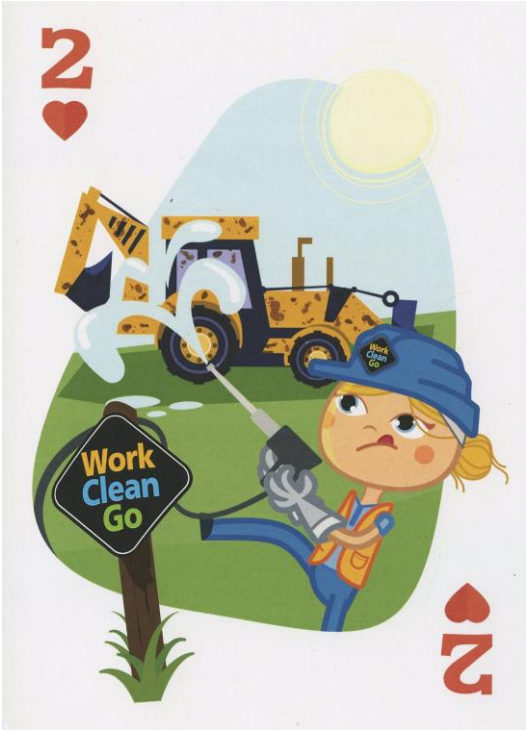

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