

# CONVENTIONAL VS. PASSIVE MANAGEMENT OF NOXIOUS WEEDS FOR FINAL RECLAMATION OF INDUSTRIAL SITES IN THE BOREAL FOREST: A RISK MANAGEMENT-BASED APPROACH

## Project team

**NAIT:** Amanda Schoonmaker, Ph.D., Andres Rolhauser, Ph.D., Noel Lockyer, BSc.

**InnoTech Alberta:** Stefan Schreiber, Ph.D.

**Enviro Q&A Services:** Chris Powter, M.Sc.

**Vertex:** Dean Mackenzie, Ph.D.

**APPLIED  
RESEARCH**



# Why this project?

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# Management of noxious weeds in boreal forest reclamation

## **Need to control noxious weeds**

Alberta's wellsite certification requires controlling noxious weeds: destroy prohibited, inhibit non-prohibited.

## **Herbicide use can backfire**

Herbicide application is standard but risks harming non-target plants, potentially disrupting forest regeneration.

## **Public concerns**

Herbicides are increasingly questioned due to chemical residues, effects on biodiversity, and contamination of soil and water.

## **And weeds can even bounce back**

Our survey of 6- to 16-year-old **rec certified sites** showed that Canada thistle and perennial sow thistle were frequent (62% and 33%), with occasional high cover.



# Management of regulated weeds in boreal forest reclamation

Some questions arise:

## **How effective are our current weed management strategies?**

The balance of herbicide applications might be negative in the long term.

## **Are these species detrimental to the development of forest vegetation?**

Regulated weeds are mostly ruderal and shade-intolerant herbs absent from mature forests.



# What about other undesirable species?

## **Industrial use decreases soil quality**

Industrial activities (such as wellsites) compact the soil, reduce organic matter, and disrupt its structure.

## **Current regulations and grass seeding?**

Boreal forest reclamation criteria requires “a minimum of 25% canopy cover of herbaceous species”.

Although current policy was intended to discourage grass seeding, the 25% herbaceous cover requirement could still be met using native grasses because of their commercial availability and rapid establishment on disturbed soils.

## **Grasses seem to “arrest” forest succession**

Grasses often persist as dominant cover on reclaimed sites, but the mechanisms behind this persistence (e.g. competitive exclusion or altered soil conditions) remain poorly understood.



# What about other undesirable species?

Some more questions:

## **How negative are grasses for forest reclamation?**

High grass dominance and negative correlations with trees suggests that they are worse than noxious weeds.

## **Are current, broadleaf weed management approaches steering these sites toward grass-dominated trajectories?**

Removing broadleaf weeds may leave open spaces and resources that fast-growing grasses can exploit.



# Knowledge gaps and project objectives

## 1) Herbicide effectiveness

There is limited evidence, mostly based on chronosequences or having limited spatial scope, underscoring the need for **long-term**, representative trials.

**OBJECTIVE 1** Evaluate the long-term effects of herbicide use on noxious weeds and forest regeneration on reclaimed sites across Alberta (**standard vs passive**).

## 2) Alternative strategies

Scarce data supporting alternatives to conventional weed management, such as mechanical site preparation or **vegetation-based light competition**.

**OBJECTIVE 2** Evaluate the effects of planting density on canopy closure and natural weed suppression (**standard vs high density**).



# Project benefits

## **Science-based weed management**

Provide industry and land managers with credible data to refine or replace current broadleaf-herbicide practices.

## **Reduced herbicide reliance**

Identify practical alternatives, such as higher planting density, to control weeds.

## **Better reclamation outcomes**

Enhance the success and speed of boreal forest recovery, supporting biodiversity and soil health.

## **Policy support**

Supply long-term evidence to guide updates to Alberta's weed-management and forest-reclamation policies.



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# Methodology

# Experimental design

## Site distribution and treatments

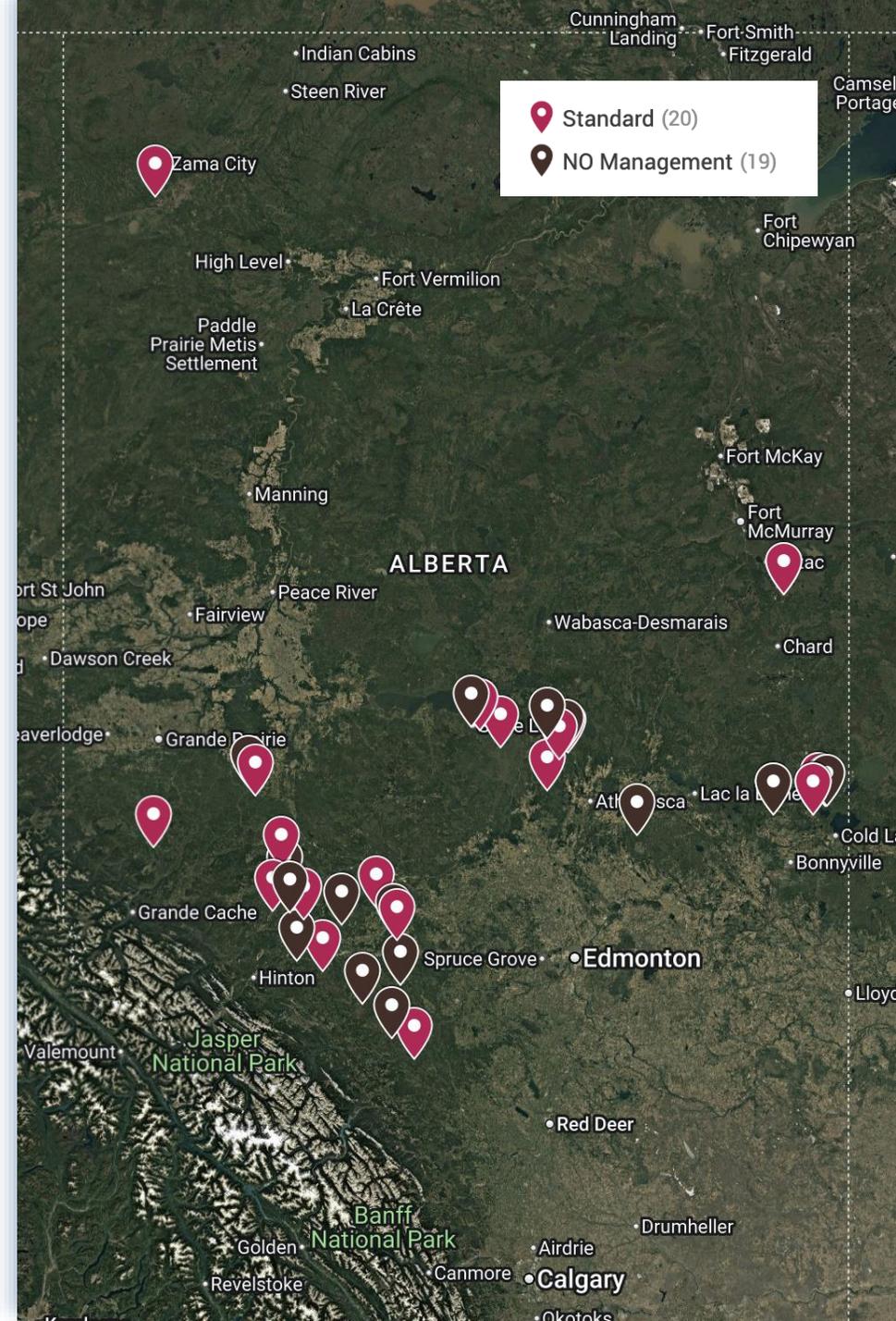
A total of **80 freshly reclaimed sites** (where final site contouring and soil placement have been completed) **across five subregions** will be randomly assigned to either standard (herbicide) or passive management treatments. Of these, **39 sites were surveyed in 2025**.

## High-density planting subset

8 standard and 8 passive management sites will be planted with a higher than-usual density (4,000 stems per ha) of deciduous trees (balsam poplar, paper birch, and gray alder).

## Long-term monitoring schedule

Sites will be monitored in years 1, 3, 5, and 10 following final soil placement and tree planting.



# Measurements

## Long term vegetation surveys

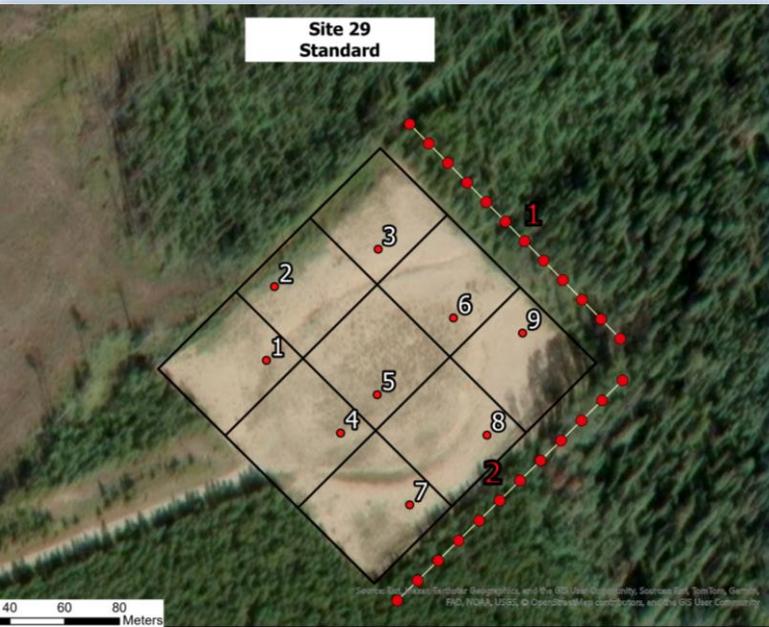
Surveys use nine on-site **permanent plots** and 2 off-site transects per site. Methodology similar reclamation certification (ESRD, 2013), plus detailed vegetation community data.

## Soil physical and chemical analysis

Soil bulk density, texture, and chemical properties are analyzed from samples collected at five plots.

## 360° Imagery

For virtual field tour to illustrate vegetation dynamics.

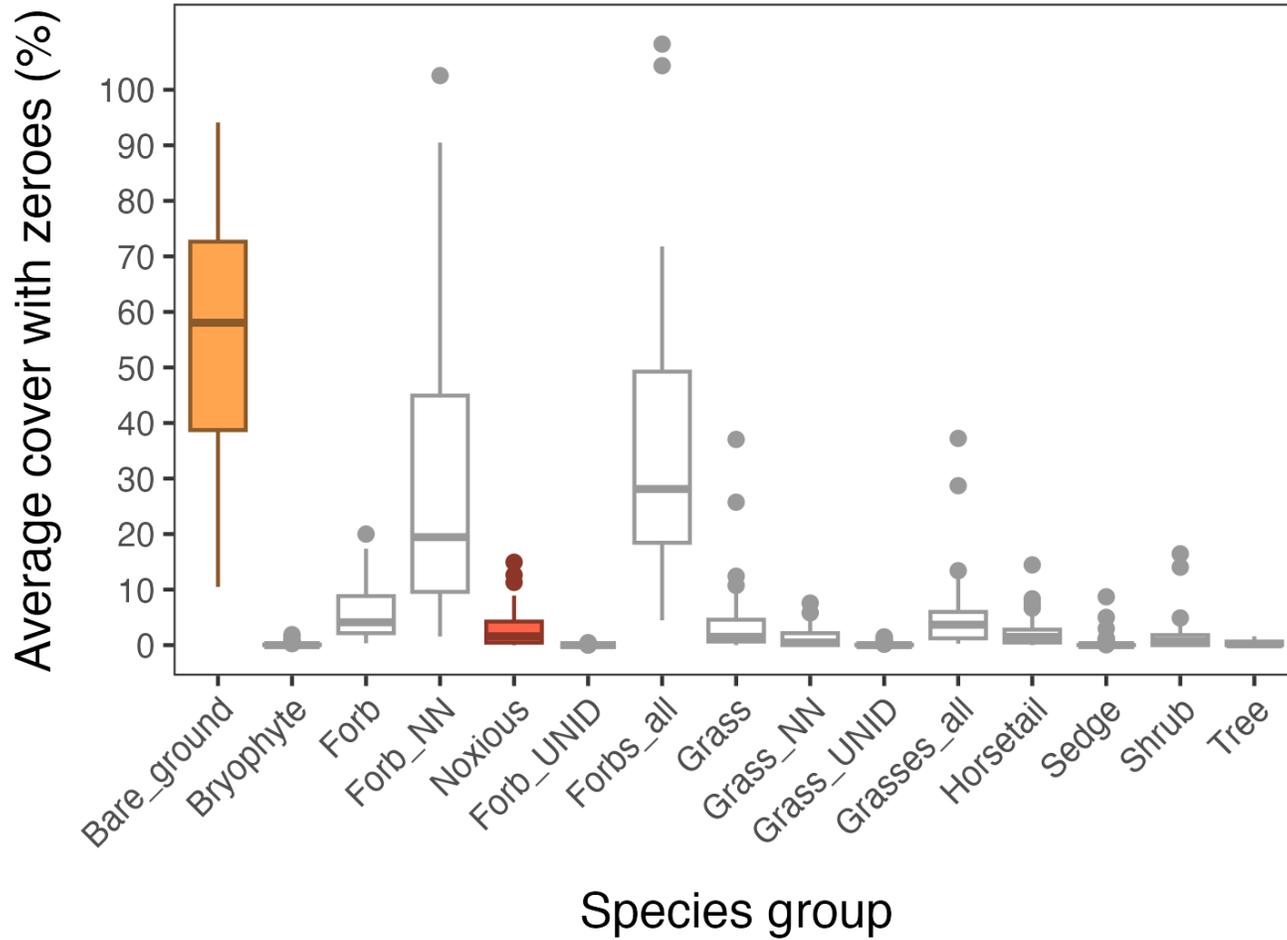


# Year 1 Results and Future Work

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# Bare ground and non-native weeds, though not the regulated kind



# Dominant non-regulated, non-native forbs

Alsike clover

(*Trifolium hybridum*)

97% of sites, 23% mean cover when present



Sweet clover

(*Melilotus* spp.)

74% of sites, 20% mean cover when present



Hemp nettle

(*Galeopsis tetrahit*)

51% of sites, 21% mean cover when present



# Some noxious weeds were frequent, and some were also locally abundant

Species	Frequency (% of sites)	Mean cover when present (%)
Canada thistle	59	9
Perennial sow thistle	54	11
Scentless chamomile	23	7
Oxeye daisy	18	3
Tall buttercup	8	2
Yellow toadflax	5	5
Field bindweed	5	4
Common tansy	5	6

Canada thistle  
(*Cirsium arvense*)



Perennial sow thistle  
(*Sonchus arvensis*)



# Native forbs can be frequent or locally abundant, but not both

Wild strawberry

(*Fragaria virginiana*)

74% of sites, 1% mean cover when present



Nodding beggarticks

(*Bidens cernua*)

3% of sites, 45% mean cover when present



Photos: Minnesota Wildflowers

Tall bluebells

(*Mertensia paniculata*)

31% of sites, 12% mean cover when present



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# Competitive grasses are already present

**35 out of 38 sites had at least one of these species**

Bluejoint - native

*(Calamagrostis canadensis)*

56% of sites, 13% mean cover when present



Timothy - nonnative

*(Phleum pratense)*

54% of sites, 4% mean cover when present



Photo: Minnesota Wildflowers

Smooth brome - nonnative

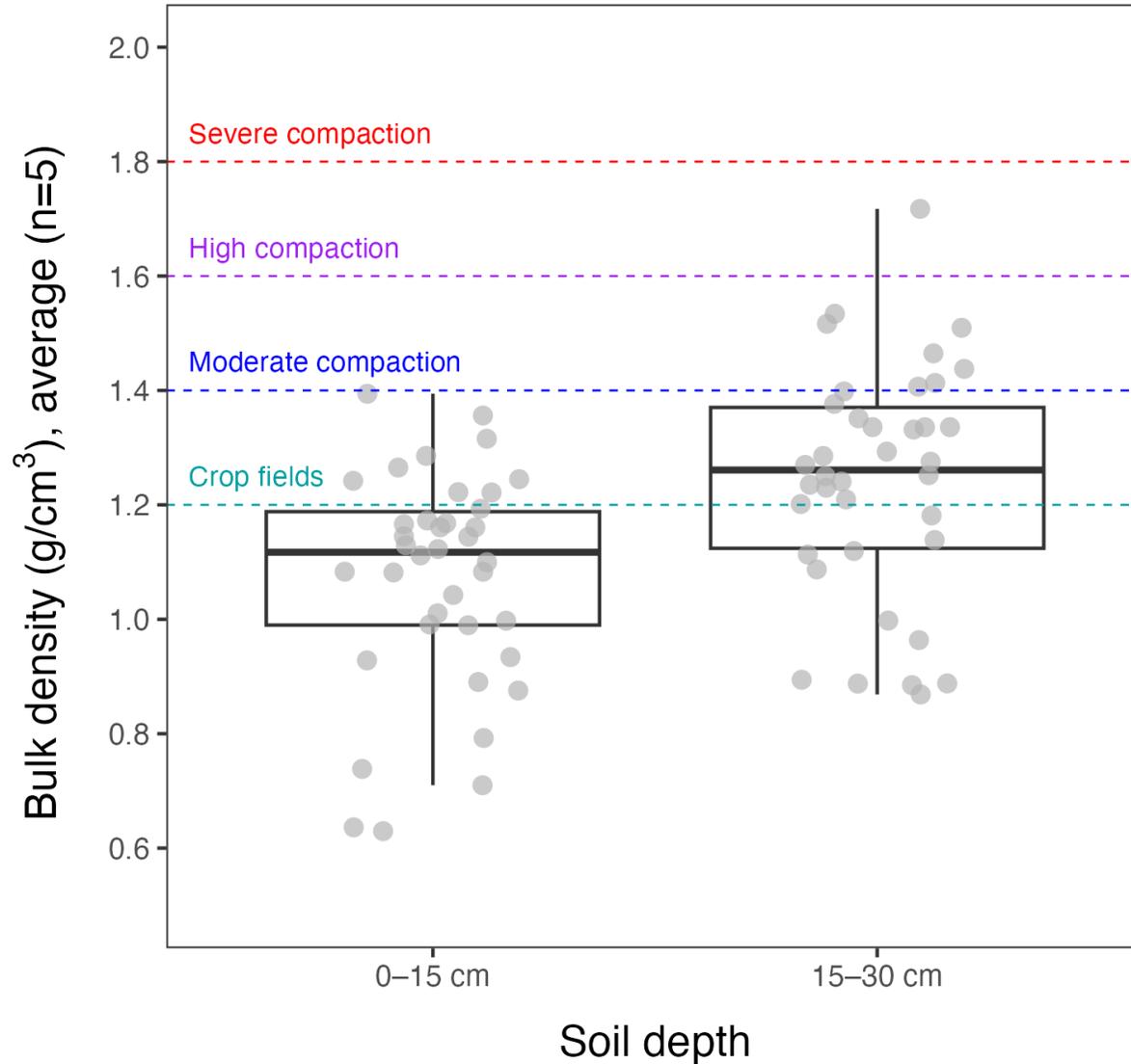
*(Bromus inermis)*

26% of sites, 4% mean cover when present



Photo: Minnesota Wildflowers

# Some soil compaction, especially below 15 cm



Values are comparable to those in cultivated land.

# Year-1 key points

- Dominant features are bare ground and non-native, though non-regulated forbs.
- We found 8 noxious weeds, all of them non-prohibited: two were relatively frequent and abundant (Canada thistle and perennial sow thistle).
- Native forbs were frequent but not abundant. It is unclear how these will develop in future.
- Grasses known to dominate older reclaimed sites are widespread, even within the first year after final soil placement.



# Future work

- Survey additional sites in 2026. This will not only increase our sample size, but also an additional year as successional starting point.
- Re-survey all sites at years 3, 5, and 10 to capture vegetation dynamics and outcomes over time.
- Install high-density experiment.
- Use long-term data to help refine herbicide use and alternative strategies.
- Engage with policymakers to translate findings into updates to Alberta's weed-management and forest-reclamation regulations.



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