The use of soil amendments in the revegetation process of smelter-impacted soils

Cassandra Specht

1. Growth chamber trial

2. Field Trial

- Flin Flon and Creighton overview
- Field Design
- Challenges
- Preliminary results

Location of Flin Flon, MB/ Creighton, SK in Canada. Satellite image taken from *Google Earth* (*ver. 6.1.0.5001*, Image acquired 01 March 2013; accessed on 01 March 2013).

Flin Flon, MB & Creighton, SK

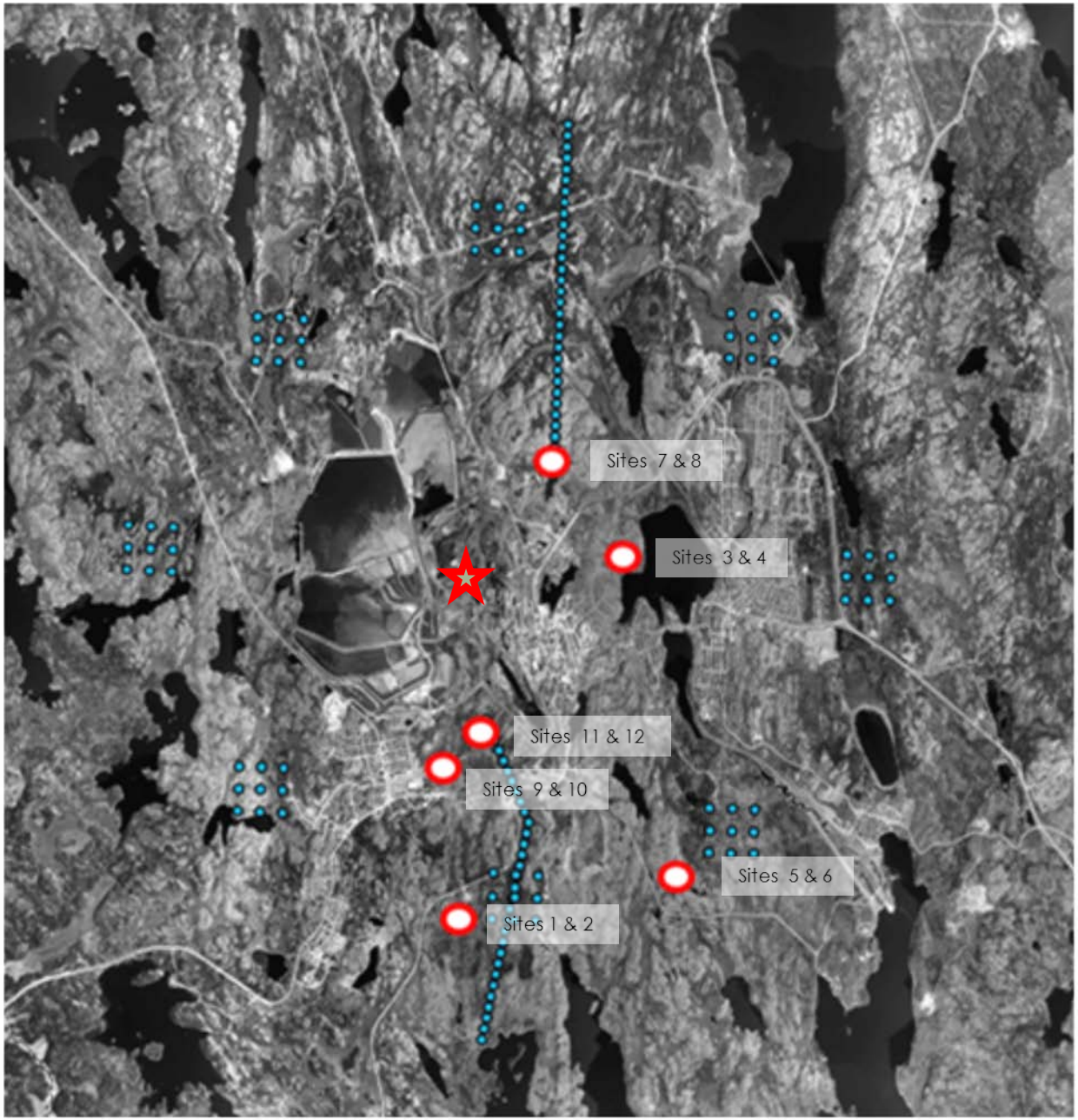
- Deposition of heavy metals (Cu, Fe, Al, Zn, Mg)
- Under 30m in height but then built to 251m in 1974
- Forest fires and logging
- Pockets of soil in rock outcrops
- Vegetation die back

Green Project

- Community based and volunteer coordinated project
- Dolomitic lime
- Professor Keith Winterhalder from Laurentian University in Sudbury, Ontario

Objective

To assess the benefits of soil amendments in the growth and survival of vegetation in smelter affected soils on site at Flin Flon, MB.



Site Selection

- Surface area
- Soil Depth
- Composite
- Surrounding landscape

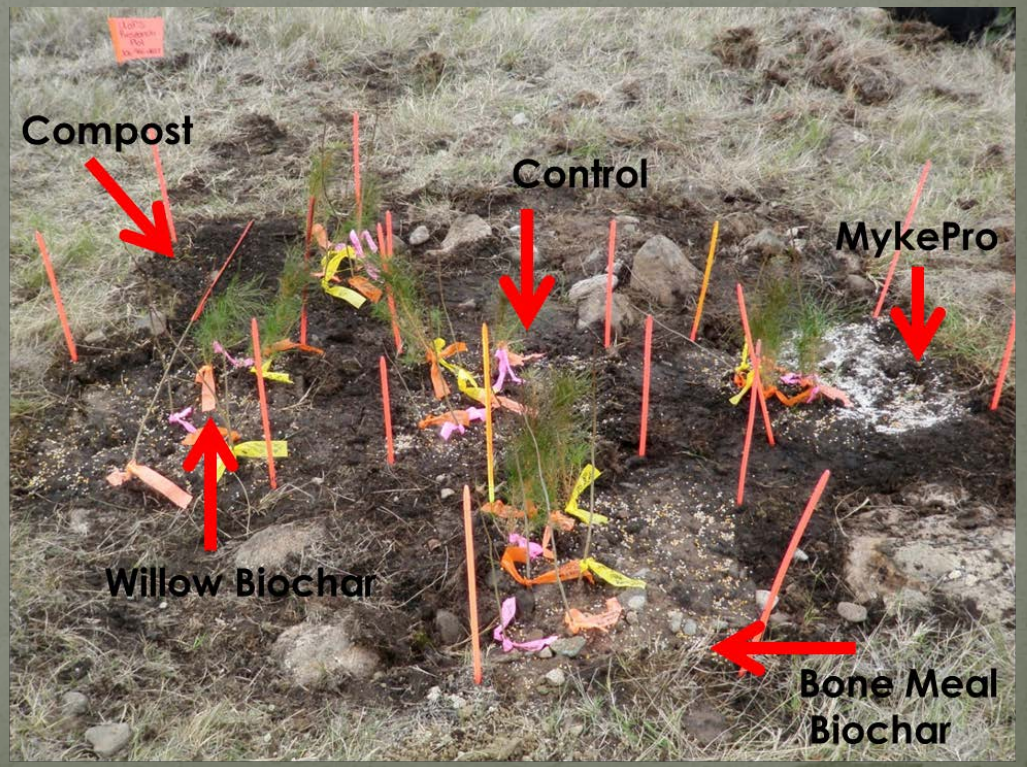
Plant species

- Two tree species Trembling Aspen (*Populus tremuloides*) and Jack Pine (*Banksiana pinus)*
- Two understory species American vetch (*Vicia americana*) and Tufted hair grass (*Deschampsia cespitosa*)

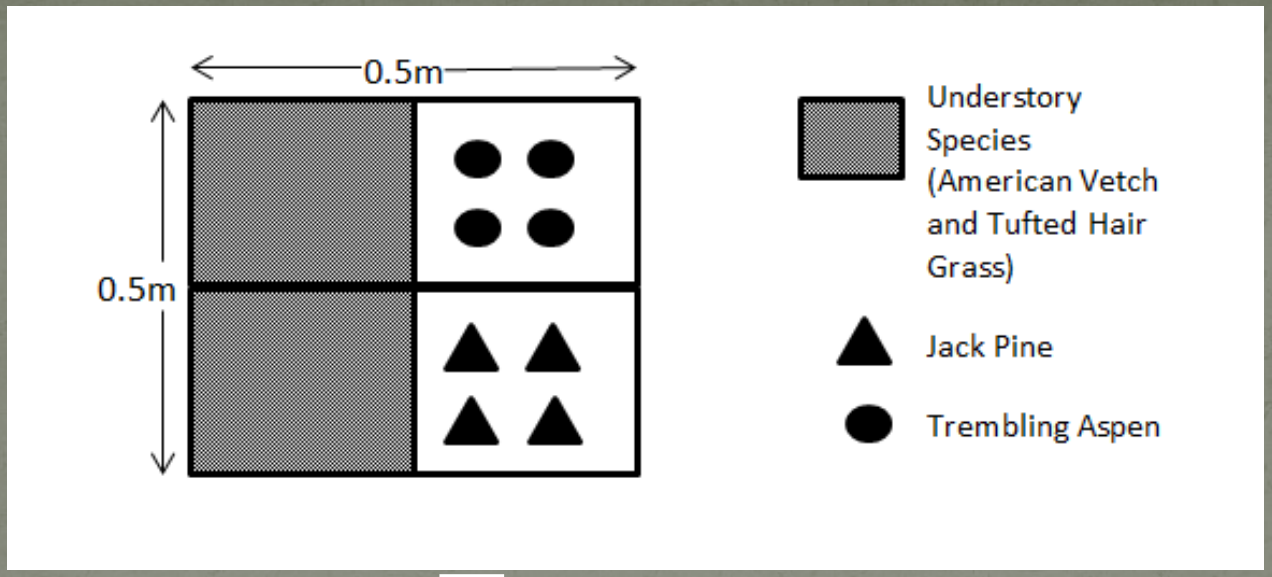
Amendments

- Meat and Bone Meal Biochar
- Willow Biochar
- Compost
- EMF/AMF Inoculant

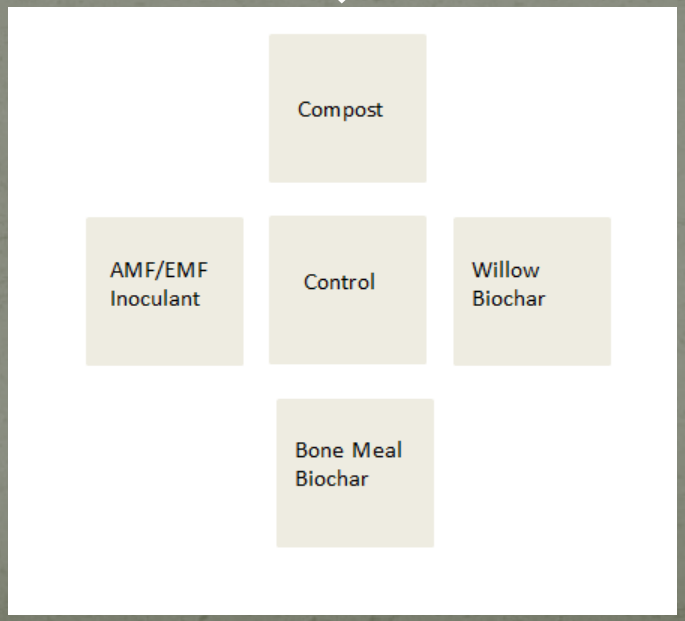
-Ease of application



Calculated rates based on plot area, 2.5cm depth, bulk density and 10% w/w



X 5



- 60 plots in 12 sites
- Total of 240 Trembling Aspen and 240 Jack Pine were planted

- Plots were staked
- NPK fertilizer (20-17-10)
- Crushed dolomitic lime
- Watered

Rainfall

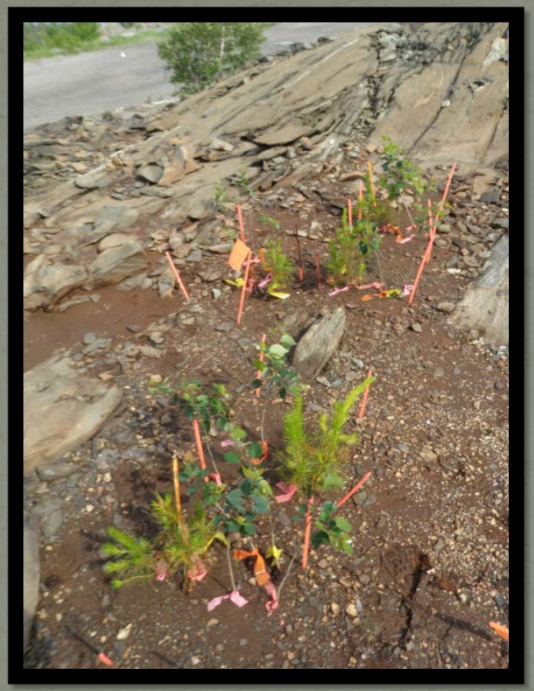
- Sites 2,3,4,6,7,9 and 11 were re-amended
  - Average rainfall: July 75.5mm, Aug 61.8 mm
  - 2011 rainfall: July 149.4mm, Aug 141.0mm
  - July 20th, 2011: 72mm

In field measurements

- Sites in 2011 were visited twice in July and once in September and tree height and diameters were measured
- August 2012 sites were measured and harvested
- Soil was sampled at the time of planting as well as at time of harvest
- Percent survival before harvest was recorded

Site 1

Site 3

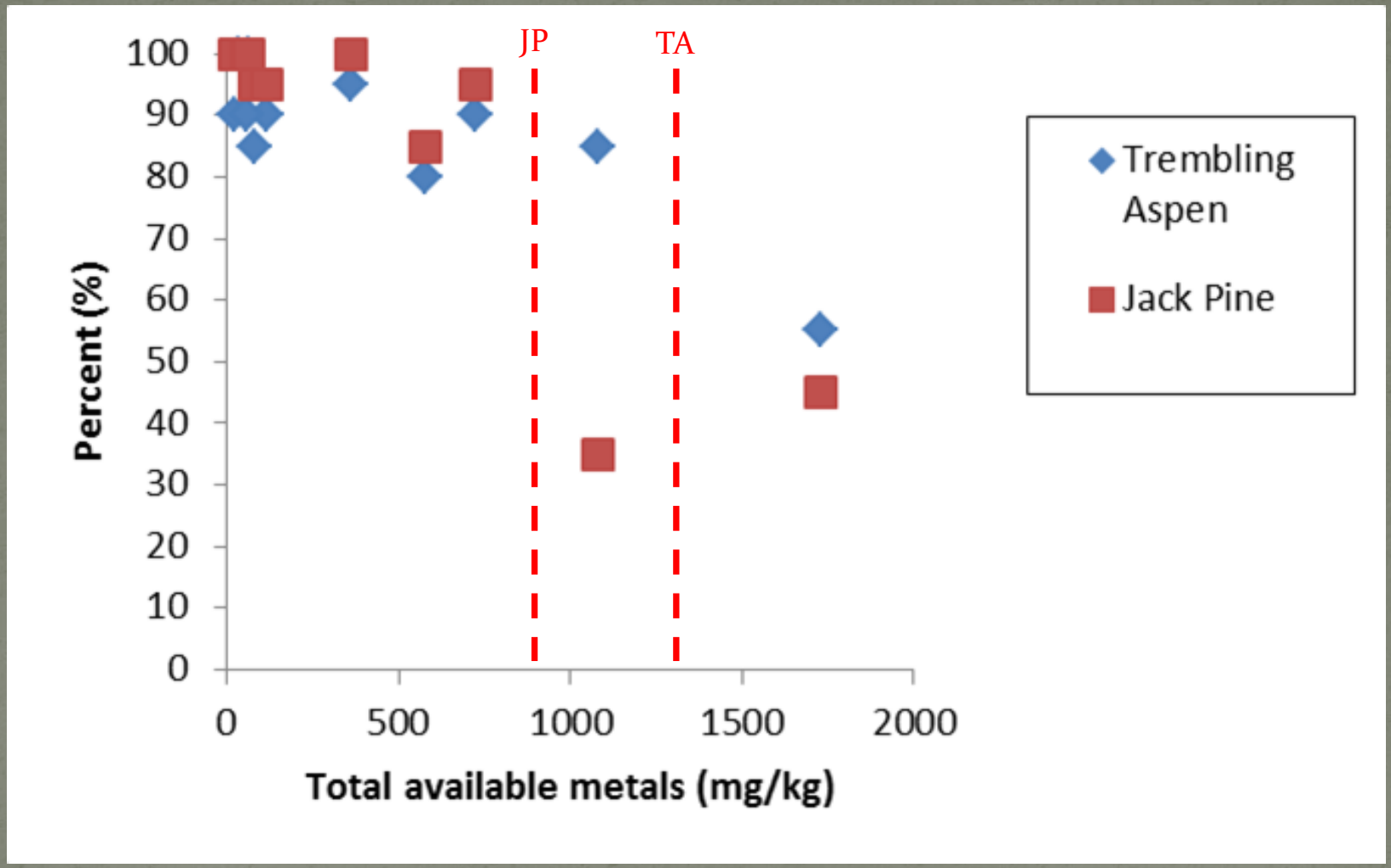


Site 10

Lab measurements

- pH for each site at the time of planting and harvest
- Biomass weights for roots, shoots and understory
- Available metals in the soil (Zn, Cd, Cu, Al)
- Total metals in roots, shoots and understory
- Total carbon and available sulfur in soil

Tree species Trembling Aspen (TA) and Jack Pine (JP)

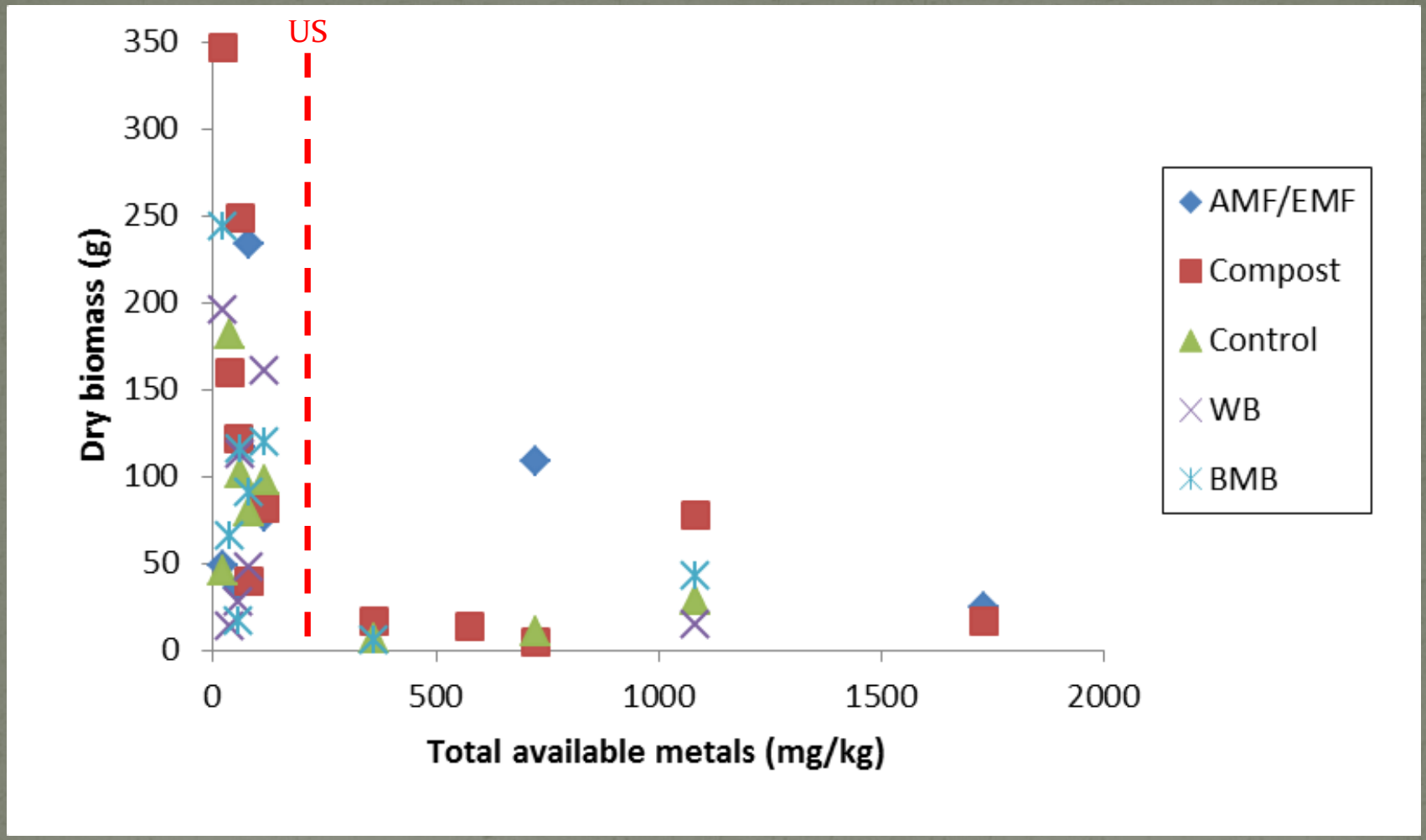


Understory survival and growth

- 68% of the 60 plots had understory establishment of some type. Site 3 is the only site that had no understory establish under any of the treatments.

- The American Vetch grew in the first season at 5 of the 12 sites but comprised less than 5% vegetative cover in any one individual plot. After the winter season no American Vetch was present at any of the sites.

Understory (US)



Amendment Practicality

- The willow biochar amendment was not well-suited for field application because it is relatively light and the majority applied was lost from the site either by wind or water within 30 d after planting.

- The other three amendments were unaffected by heavy rains and wind in most cases. The AMF/EMF for the trees needed to be placed in the transplant hole compared to the others that are amenable to surface application.

Acknowledgements

- Advisors Dr.Walley and Dr. Knight
- Committee members Dr.Farrell and Dr.Kimaro
- Hudbay Minerals
- NSERC
- Flin Flon/Creighton *Green Project*
- Saskatchewan Ministry of Agriculture Strategic Program-Soils & Environment.
- Dr. Walley and Dr. Knight/ Dr. Farrell lab groups


Questions?