Boreal Wetland Well Site Reclamation across Alberta: Implications for Restoration of Linear Disturbances

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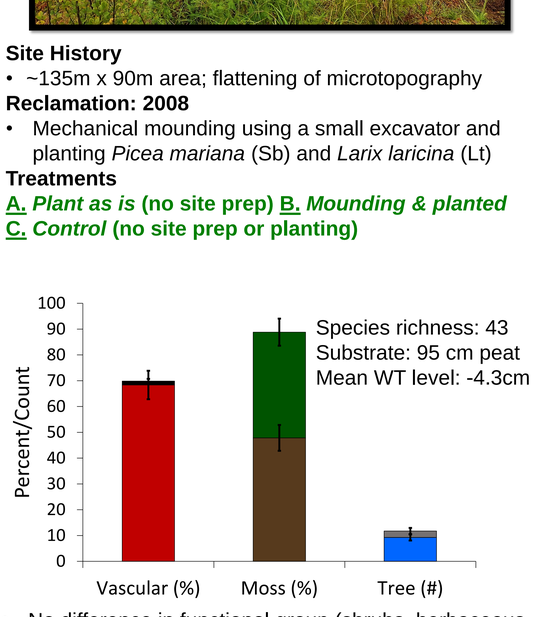
OIL SANDS EXPLORATION (OSE)

Site History
- ~135m x 90m area; flattening of microtopography

Reclamation: 2008
- Mechanical mounding using a small excavator and planting *Picea mariana* (Sb) and *Larix laricina* (Lt)

Treatments
A. *Plant as is* (no site prep) B. *Mounding & planted* C. *Control* (no site prep or planting)

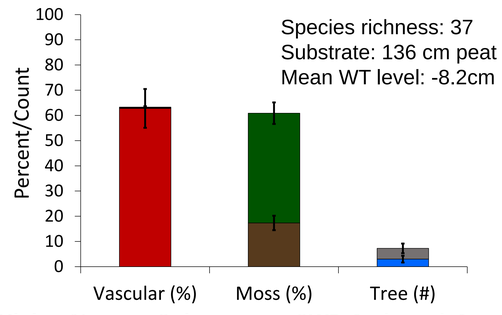


- No difference in functional group (shrubs, herbaceous, moss) % cover between A., B. & C.
- Trees **tallest** in ***Mounding & planted*** ($p<0.001$), but no difference in tree count between A., B. & C.

Site History
- ~60m x 90m; flattening of microtopography

Reclamation: 2012
- Mechanical mounding using a small excavator, planting Sb and Lt, and the addition of coarse woody debris (CWD)

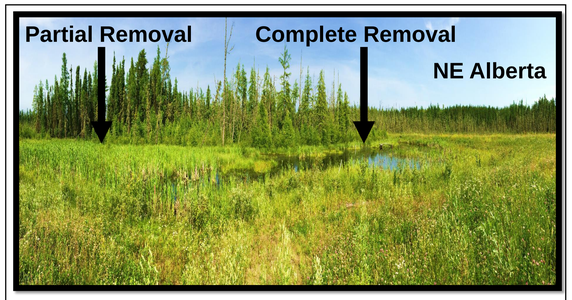
Treatments
A. *Mounding & planted* B. *CWD & planted* C. *Mounding, CWD, & planted* D. *Plant as is* (no site prep)



- **Higher % cover *Sphagnum*** at ***CWD & planted***, & ***plant as is*** than at ***Mounding & planted*** ($p=0.01$)
- No difference in tree height or count between treatments

Desirable
Undesirable
Brown
Sphagnum
Picea mariana
Larix laricina

CLAY WELL PADS

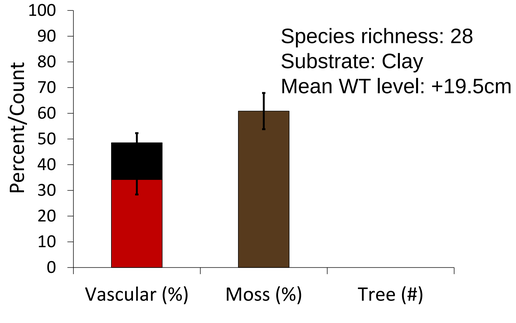


Site History
Multi-well pad and borrow area (2.15ha) constructed 2002, including placement of ~1.5m clay on geotextile over peat; clay berm around pad

Reclamation: 2008
- Clay removed (with track hoe)
- Natural revegetation

Reclamation: 2009
- More clay removed (with track hoe) and re-contouring

Treatments
A. *Complete Removal* B. *Partial Removal*



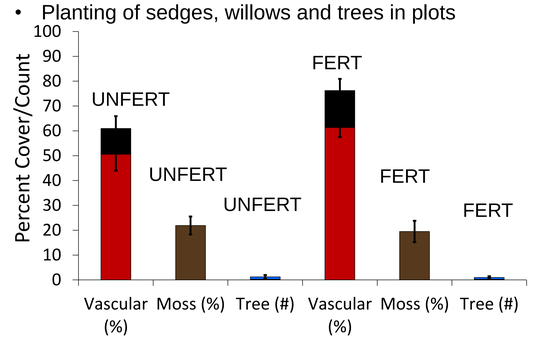
- No difference in functional group % cover (shrubs, herbaceous, moss) between A. & B.

Site History (Vitt et al. 2011)
- 2 mineral filled well sites decommissioned early 2000s

Reclamation: 2007
- 2 30m x 100m areas leveled
- Half the area of each pad graded to a lower elevation (4-6 cm above seasonal water level) than the other half (15 cm above season water level)
- 6 ditches ~20cm deep across each site

Reclamation: 2008
- Half of each water level area cultivated (using rototiller)

Treatments
- 1 site **fertilized** (twice) with 30 g 10:10:10 fertilizer
- Planting of sedges, willows and trees in plots



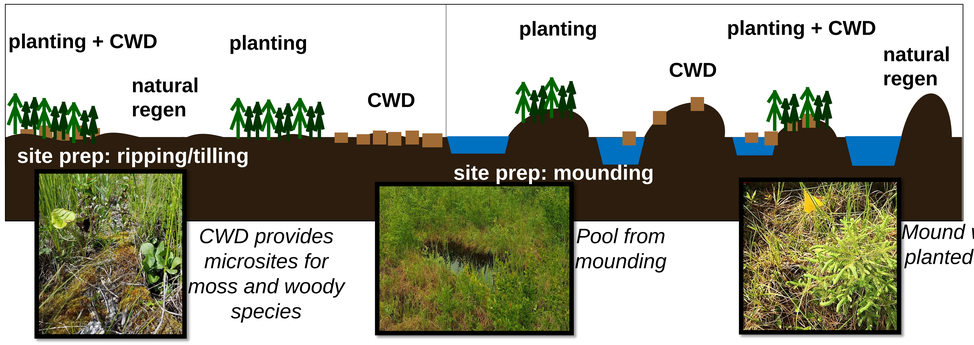
Species richness: 16
Substrate: Clay
Mean WT level: -31.7cm

Species richness: 16
Substrate: Clay
Mean WT level: -43.4cm

TEMPORARY LINEAR FEATURES

peat | planted | coarse woody debris (CWD)

Linear feature with high peat compression



CWD provides microsites for moss and woody species

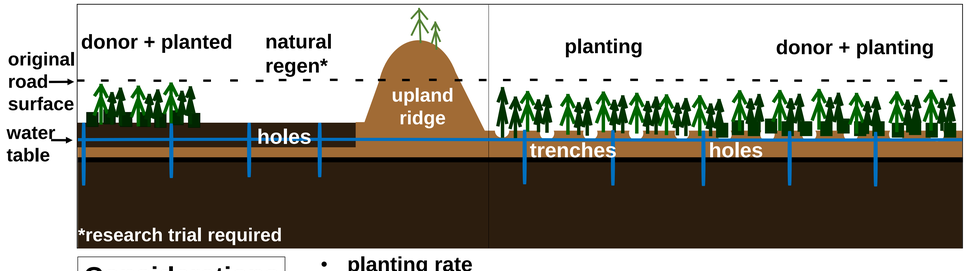
Pool from mounding

Mound with planted Sb

Considerations
- **planting rate**
- **CWD rate (m^3/ha)**
- **mounding rate (mounds/ha)**
- **depth of mound pool (m)**

PERMANENT LINEAR FEATURES

peat | clay | geotextile liner | planted | planted upland | live donor transfer



Considerations
- **planting rate**
- **donor spread (ratio; evenly vs. islands)**
- **trench/hole rate (trench, hole/ha)**

Reference:
Vitt, D.H., et al. 2011. Peatland establishment on mineral soils: Effects of water level, amendments, and species after two growing seasons. Ecological Engineering 2: 354-363.

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