Effects of remediation techniques on selected grass species seeding's associated with legacy brine waste pits in north-central North Dakota

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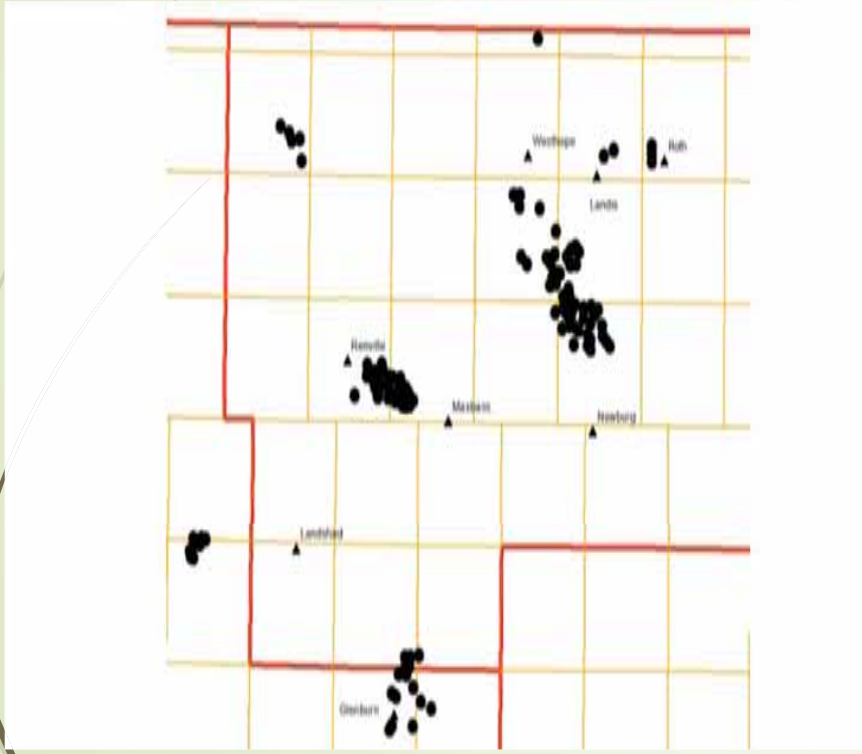
Legacy Brine Pits in North Dakota



Electrical Conductivity (EC) of selected legacy sites in north-central North Dakota

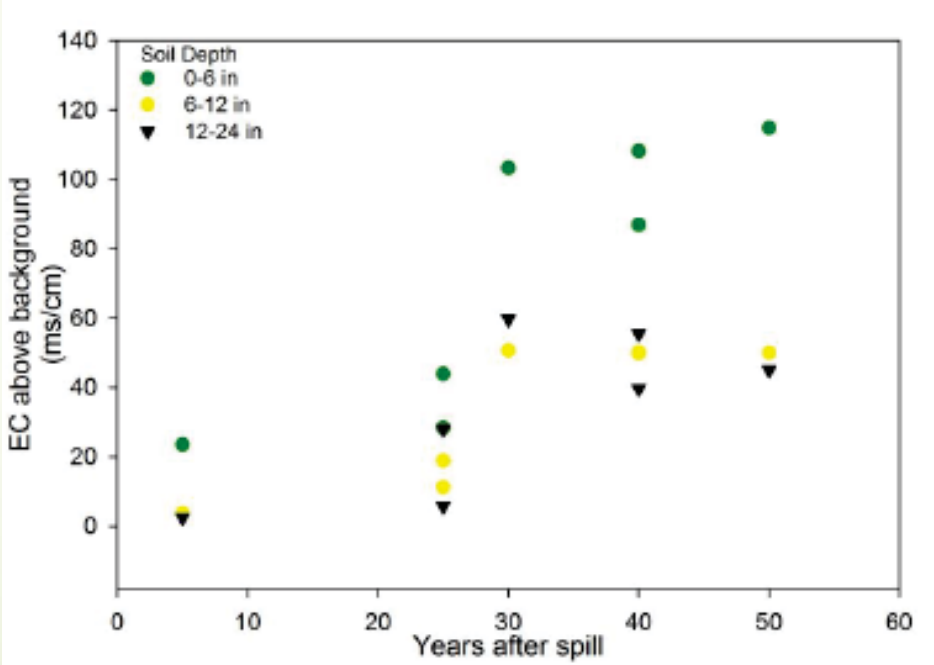
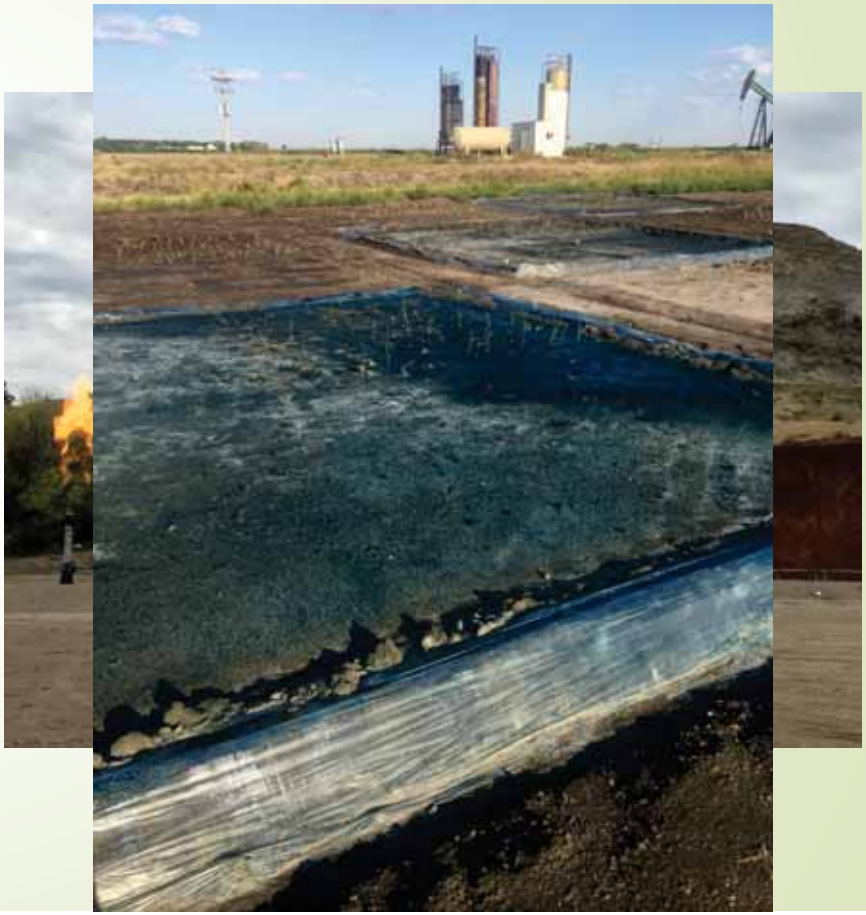


Figure 2. Soil salinity at three depths at recent brine spills and legacy brine waste pits in north central North Dakota.

Brine Contamination

Studies at North Dakota State University

- Long-term Objective
  - Determine and publish best management practices
    - Reclamation
    - Compaction
    - Remediation of brine impacted soils



Studies at North Dakota State University

- For this presentation
  - Determining EC thresholds of halophytic and selected non-halophytic grasses
  - Determine if seed conditioning with NaCl will enhance survivability under different EC levels of selected grass species

Studies at North Dakota State University

- For this presentation
  - Study different brine remediation techniques on establishing select perennial grasses

Study Areas in North Dakota

Study Areas in North Dakota

- Green house and laboratory projects conducted at North Dakota State University
- Remediation study (Phase One) occurred on both crop and range land – 11 total sites
  - Determine if brine impacted soils will return to pre-spill EC levels with time
- Remediation study (Phase two) occurred on three study locations – all cropland
  - Tested select remediation agents at different EC levels (3.26 to 89.6 $dS\ m^{-1}$) on perennial grass establishment

Will Brine Impacted Soils (Crop and Range) improve with Time?

50 Year Old Brine Spill

EC Threshold Study

EC Threshold Study – 100% Seedling Survival

- Nuttall's alkaligrass *(Puccinellia nuttalliana)*: 36+ dS m^{-1}
- Inland saltgrass *(Distichlis spicatum)*: 36+
- Foxtail barley *(Hordeum jubatum)*: 36+
- Alkali sacaton *(Sporobolus airoides)*: 36 (90%)
- Western wheatgrass *(Pascopyrum smithii)*: 20
  - 40% @ 36 dS m^{-1}

EC Threshold Study – 100 % Survival at the Late Vegetative – Pre-boot Growth Phase

- Nuttall's alkaligrass: 36+ dS m^{-1}
- Alkali sacaton: 36+
- Foxtail barley: 36+
- Inland saltgrass: 20
  - 80% @ 36 EC
- Western wheatgrass: 20
  - 62% @ 36 EC

- Green needlegrass: 16
- Blue grama 20
- Little bluestem: 20

Field Test – 2016

Survivability of Grass Plugs and Seedlings on Legacy Brine Spills using Amendments

Amendments

- Compost
- Gypsum
- Combination of Compost and Gypsum
- Ferric hexacyanoferrate ($C_{18}F_7N_{18}$) crystallization inhibitor
- Control

Plugs and Seed Survivability

- Plugs planted in August
- Seeds planted in October (dormant seeding)
  - *Western wheatgrass*
  - *Inland saltgrass*
  - *Alkali sacaton*

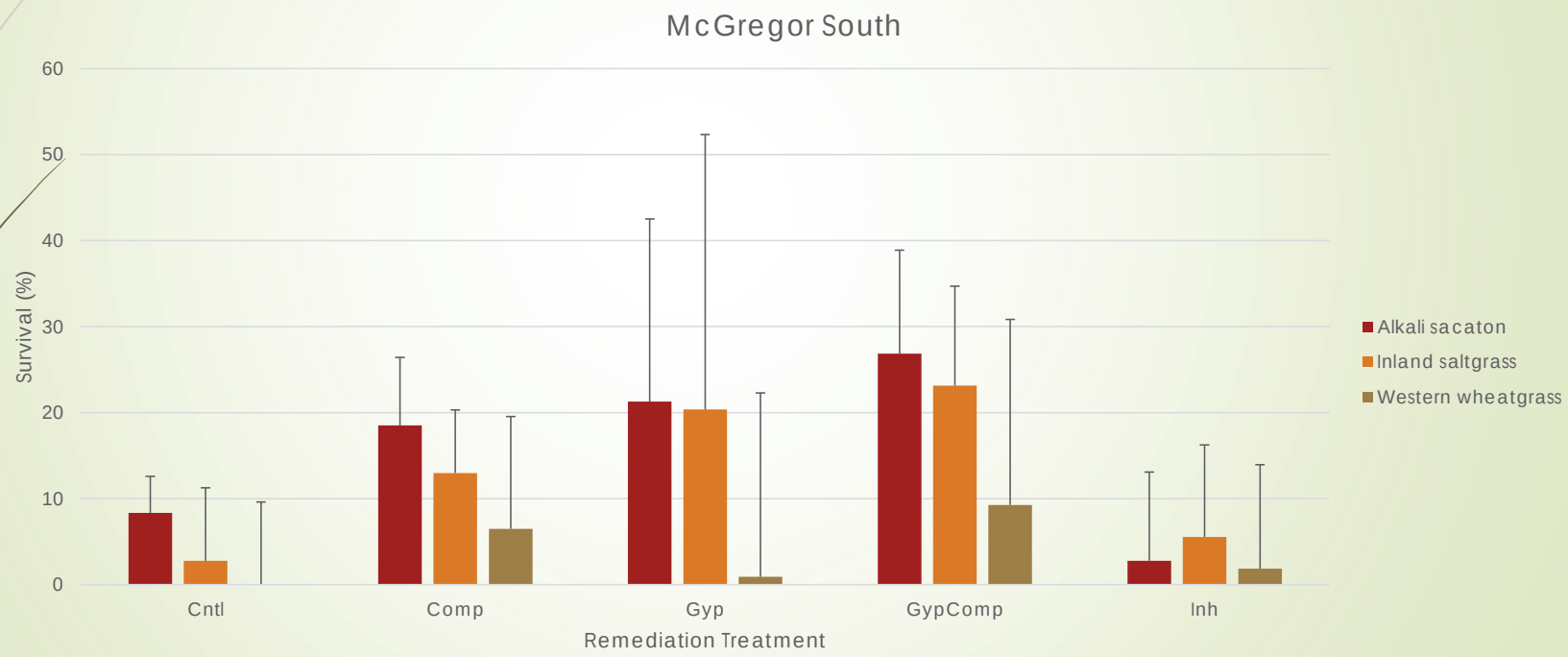
North of Glenburn, ND in Bottineau County(T157N, R82W, NW1/4 Section 36)

North of McGregor, ND in Burke County(T160N, R94W, SW1/4 Section 19)

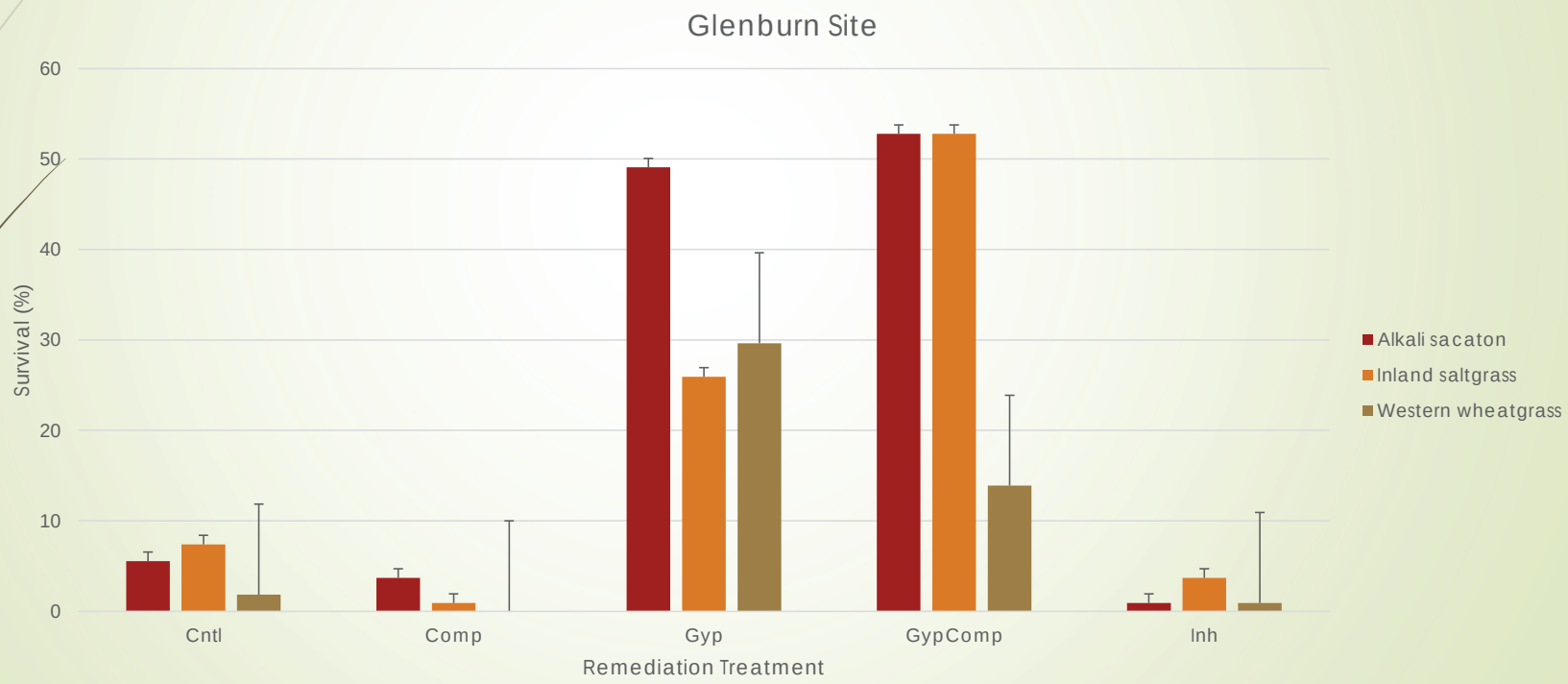
North of McGregor, ND in Divide County(T160N, R95W, SE1/4 Section 25)

Treatments after amendments applied

Survivability of Grass Plugs on Legacy Brine Contaminated Sites



Survivability of Grass Plugs on Legacy Brine Contaminated Sites



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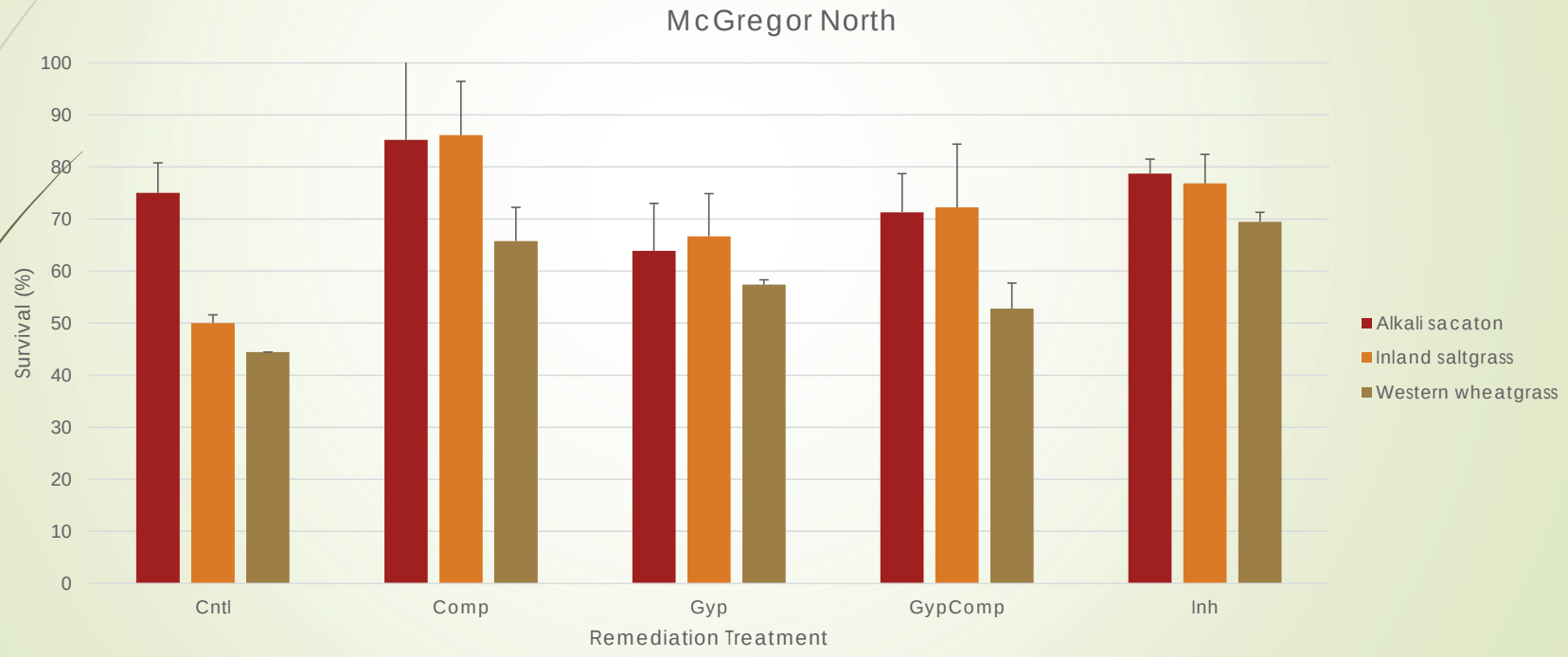

Planned for 2017

Summary

- Brine impacted soils DO NOT self remediation – Basically, remediation needed to improve contaminated soils
- Nuttall alkaligrass, alkali sacaton, inland saltgrass were superior grass species to plant on brine impacted soils with gypsum or gypsum/composite amendments
  - Western wheatgrass worked successfully on soils with EC levels < 20 dS m^{-1}
- Using plugs appeared to withstand higher EC levels than seedlings (based on green house project)

Any Questions