RECLAMATION OF Na-AFFECTED SOILS IN A WYOMING NATURAL-GAS PRODUCTION AREA: GYPSUM, LANGBEINITE, ELEMENTAL S, & COMPOST

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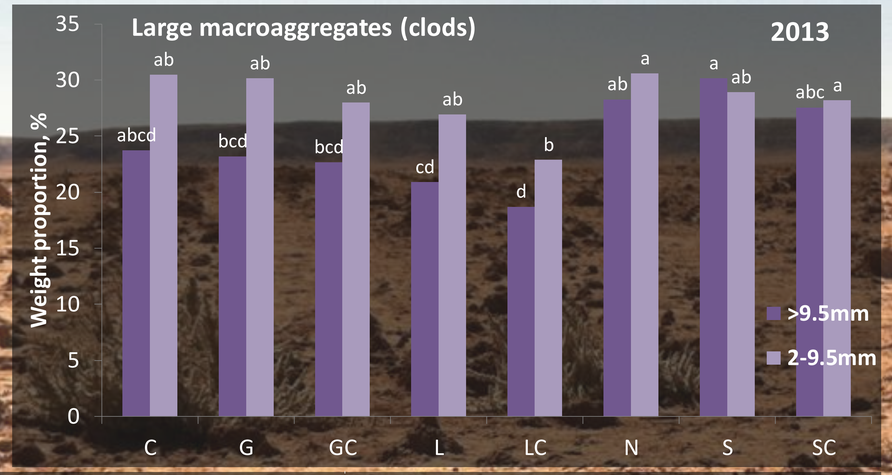
Objective : To evaluate, under field conditions, the impacts of gypsum (G), elemental S, langbeinite (L), and MSW compost (C) on the soil properties of two disturbed well pad soils (one sodic, one saline-sodic). We were specifically interested in improving soil structure that results from excess Na, and in soil properties that will eventually impact native plant reestablishment.

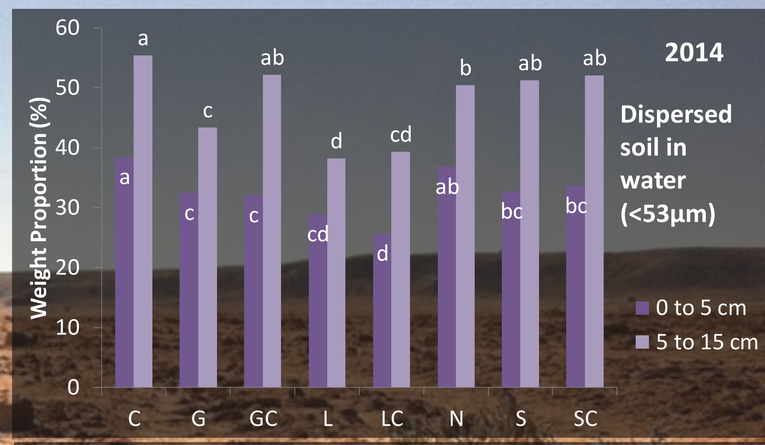
Introduction

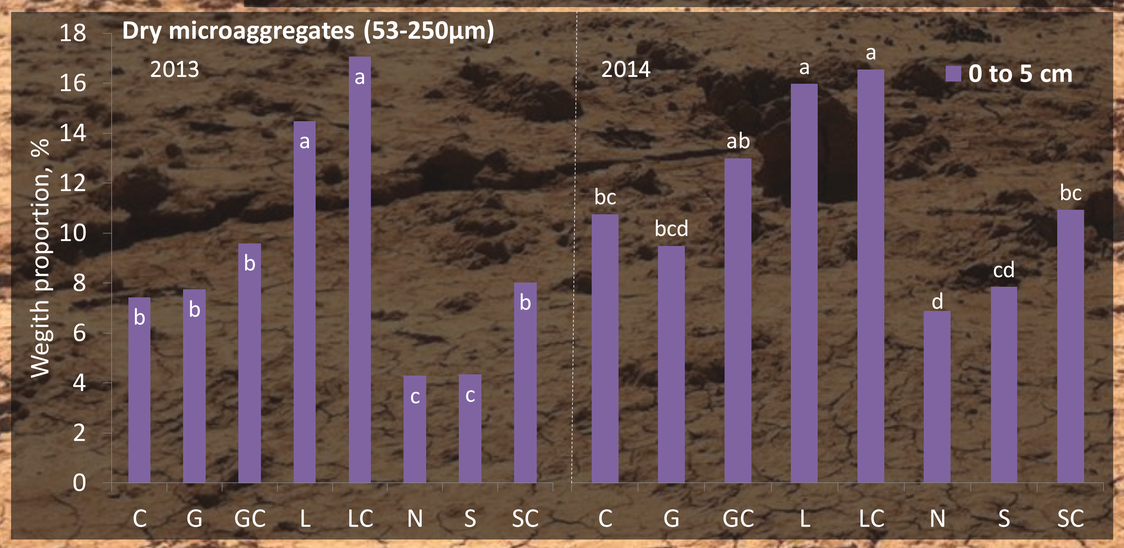
Wamsutter is the largest natural gas operation in Wyoming, where more than 2,000 wells have been drilled since the 1950's.Success in reclamation projects is difficult in Wamsutter because of its fragile cold desert soil and plant communities. Reclamation sites in Wamsutter often exhibit redistribution of subsurface salts and/or sodium to surface soil, losses in soil structure due to mechanical stripping and stockpiling, and losses in organic matter.

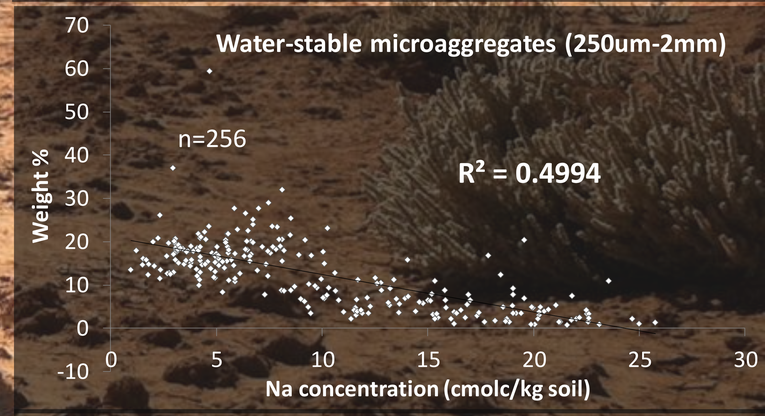
Methods

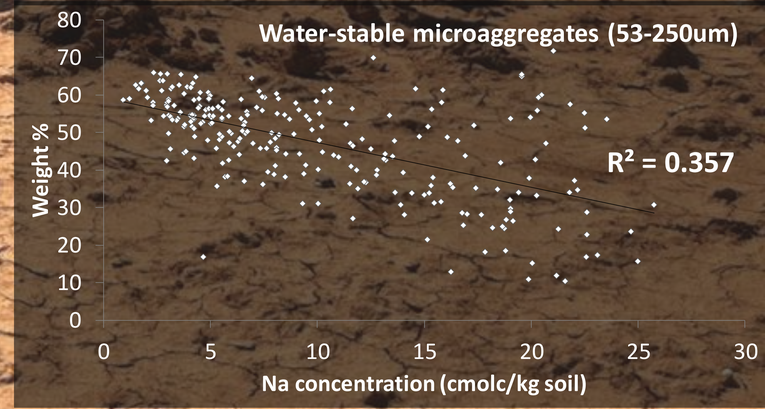
- Pre-treatment samples taken Aug 2012
- Treatments: G, GC, L, LC, S, SC, C, and Control. 8 trts, replicated 4 times
- 2 sites; 32 seven by seven m plots on each site
- Treatments applied and incorporated Oct 2012. Samples at 0-5 and 5-15cm in June 2013 and June 2014 (2 year study)
- Analyses: dry and water-stable aggregate distributions, bulk density, electrical conductivity (EC), pH, concentrations of Ca, Mg, K, and Na, soil organic C (SOC), total N, root biomass, surface CO2 flux, and vegetation counts











Results & Discussion

- Treatments had no significant effects on Na concentration or ESP in 2013 or 2014. This is most likely due to insufficient moisture from natural precipitation to allow for dissolution of amendments and displacement of Na, as well as leaching of Na to deeper positions in the soil profile.
- Treatment effects on soil structure are shown in figures: less clods under langbeinite, more microaggregates, less dispersed soil (<53µm)
- Depth effects on Na, EC, and ESP show lower in 0-5 than 5-15cm, so some evidence of…
- …salt movement by the end of 2 years.
- Improvements in soil structure under L and LC have tradeoffs: increased EC, about twice as high as control.
- Increased SOC/total N under compost trts, but no trt effects on veg, roots, or CO2
- A 1-yr study on saline-sodic soil showed lower Na under langbeinite; that study received about 10 cm more precip per year. Increased EC means cations are available for Na displacement, but not enough moisture yet.
- S/SC ineffective, G/GC moderately effective (low solubility)

Conclusions : Overall, reclamation on these drastically disturbed, Na-affected sites will take several more years of avg precipitation, or a few years of above-average precip. to fully dissolve amendments, leach Na & salts, restore biological activity, and support native plant growth. With these amendments we are attempting to expedite soil development and "skip" successional steps that normally take centuries in arid ecosystems. Trade-offs of amendment choices (time to displace Na, solubility..) must be considered.