Sagebrush Reclamation in Wyoming's Big Horn Basin Bentonite Mining Areas

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Participants:

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•Big Horn Basin Sage-Grouse Working Group (WY Game and Fish Department)
•Shell Valley Consulting,; M.I. Swaco; Wyo-Ben, Inc; Bentonite Performance Minerals; and American Colloid Company

WYOMING



Taken from Wyoming Mining Association and Matt Call, Wyo-Ben, Inc.

The Bighorn Basin located in north-central Wyoming has some of the largest deposits of quality bentonite throughout the world (Schuman et al. 1985).

Problem

- Decades of human activity has reduced available sagebrush habitat in the Big Horn Basin.
- Historic bentonite reclamation practices have not restored pre-mine sagebrush habitat.
- Reduced sagebrush habitat has had negative effects on sagebrush obligate species such as Greater Sage-grouse (*Centrocercus urophasianus*) (Hagen et al. 2007).



Historically WY-Land Quality Division mining regulations HAVE NOT required, by law, the reestablishment or reseeding of sagebrush species on non-coal mined areas

Historic sagebrush reclamation efforts have:



•Applied sagebrush seed with multi-species seed mixtures with strong representation from perennial grass species.

•Not resulted in reliable or consistent sagebrush establishment.



Two Separate Studies

Study #1 Goal

2007 & 2008. Investigated alternative sagebrush establishment techniques:

-Supplemental watering -gel-packs

-coated seed





Study #2 Goal

•2010 &2011. Investigated success of historic sagebrush establishment efforts on bentonite reclamation in the Big Horn Basin. (presented by Zack Liesenfeld) Study 1: May-September 2007 Supplemental Irrigation Project

<u>3 reclaimed study sites (all between Greybull and Lovell in <8 inch ppt. zone)</u> •Sagebrush tubeling transplants

~450 each of 4 inch & 10 inch plants; supplemental water applied

~150 each of 4 inch & 10 inch plants; non-irrigated control

•Each site had two 450 gallon water tanks; 1/2 inch diameter plastic drip-lines with preinstalled drip emitters at 24 inch intervals.



•Supplemental water applications: May (1); June (3); July (2); August (1) •Average rate for each application was 0.2 gallon/plant

<u>Study Site & Size</u>	Av. Survival Rates (3 reps)	
1	<u>irrigated</u>	<u>control</u>
4 inch/10 inch	37%/63%	<1%
2	irrigated	<u>control</u>
4 inch/10 inch	34%/73%	<1%
3	<u>irrigated</u>	<u>control</u>
4 inch/10 inch	0%	0%

Av. end-of-season (2007) sagebrush survival rates by study site, tubeling size & treatment.



Site 1-Surviving sagebrush tubelings (March 2008).



Site 2-Surviving sagebrush tubelings (May 2008).

2008 Gel-pack Transplants



-two study sites, coated sagebrush seed, hand broadcasted as monoculture, supplemented with Zeba & mycorrhizal pellets

-four study sites, 100 sagebrush tubelings/site, supplemented with rainbird® gel-packs, Zeba® pellets and coconut mats.
-five tubelings were clustered with one ¹/₂ gallon gel-pack

2008 Zeba®-Coated Sagebrush Seed



Conclusions

Supplemental Irrigation

- Survival of 10 inch tubelings exceeded 50% after two growing seasons on 2 of 3 sites.
- Soil quality caused 100% mortality on 3rd site
- 2011 visual assessments (no data) indicate survival rate remains high but many with moderate to poor vigor compared to individuals established from seed.

Gel-Packs

- Cumulative single season survival rates for 2008 gel-pack plantings averaged 74%.
- However, subsequent 2011 visual assessments (no data) indicate poor long-term tubeling survival at 3 of 4 sites

Broadcast Seeding with Coated Seed

- Promising results were obtained by broadcast seeding Zeba® pre-treated sagebrush seed with Mycorrhiza inoculant and granular Zeba® (24 individual sagebrush seedlings/sq. ft. after one growing season).
- Soil Quality and Timing of subsequent precipitation are critical elements to be considered.

These studies were not designed to statistically isolate effects of natural precipitation from supplemental water sources. Future research should focus on this issue.

Purpose of Study

• To determine if sagebrush communities are reestablishing on reclaimed bentonite mined lands in the Bighorn Basin through the use of conventional reclamation techniques

In regards to the loss of sage grouse habitat due to mining and the poor response of sagebrush to reclamation methods
 As some sites were seeded with sagebrush seed while others were not

Site Selection

- Sites located on reclaimed bentonite mine lands around Thermopolis and Greybull WY
- Site selection
 - Based on presence of reclaimed shrub communities
 - Native reference sites located directly adjacent to reclaimed sites

Materials and Methods

- Primary Transect located in reclaimed shrub community
 - One, 50 meter primary transect
 - Twenty, 25 meter secondary transects
- Vegetation data gathered
 - Point intercept
 - Line intercept
 - Sagebrush belt transect
- Used a two-tailed t-Test
 - SAS program



Results

- The five older reclaimed sites (> 15 years old) had greater densities of sagebrush than younger sites (<15 years old)
- Sites 3-15 years old (6 sites) had reduced amounts of sagebrush compared to the native reference sites
- Older sites (5 sites) had greater amounts of sagebrush but were still statistically less than the native reference sites



winter habitat from Connelly et at. 2000

Findings- Greybull Sites

Canopy Cover (%)



Findings – Greybull Sites



Thermopolis Reclaimed Site (1983) (No Sagebrush Seed)

Sage-grouse hen and chicks on reclaimed site

Conclusions

- On reclaimed sites older than 15 years the levels of sagebrush were comparable to native reference sites
- On the sites younger than 15 years the levels of sagebrush was less than the older sites
 - Establishing sagebrush communities are NOT products of current reclamation efforts, but due to the natural reinvasion of sagebrush from off site seed sources
 - However new methods and techniques of seeding sagebrush are showing promise in the reestablishment of sagebrush communities on disturbed mining areas

Literature Cited

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Questions?