Reclamation in Southeastern Wyoming: Beauty is in the Eye of the Beholder

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Outline

- Industrial characteristics
  - Extent of oil and gas disturbance in SE WY
  - Extent of uranium mining in SE WY
  - Other disturbances
- Factors in SE WY
  - Geology: Sandstone Formations
  - Climate
  - Ecological Site Descriptions
    - Sandy
    - Limy
    - Rock Hills
- Reclamation in Sandy Soils Lessons Learned
  - WDEQ-LQD
  - Leonardite Mine
  - Glenrock Coal Mine
  - Guernsey National Guard Facility
  - WYDOT
Wyoming in tourist catalogues?
Wyoming....the reality.
How different the four corners are.
Oil & Gas Disturbance in SE Wyoming
Information obtained from WOGC – Note only the SE portion of WY is displayed here

http://wogccms.state.wy.us/flexviewers/unitmap/
Wyoming Wind Projects on State Trust Lands

Wind Project Status
- Application (14)
- Inquiry (5)
- Lease (Initial Phase) (18)
- Lease (Operational Phase) (4)

Project locations are approximate.
AML Map

Map Courtesy of AML. Red dots indicate an abandoned mine site. Blue dots indicate reclaimed sites. Single dots indicate a single site at that location. Circles with numbers indicate the number of sites clustered together in that location as shown at that map scale.
Gravel Quarries

Martin-Marietta quarry west of Cheyenne. Photo by R.E. Harris.

http://www.wsgs.uwyo.edu/research/minerals/aggregate.aspx
Orange, purple, and yellow all have sandstone components.

Purple has limestone as well as sandstone present.

Beige has variegated red to gray, brown, and gray mudstone and sandstone; conglomeratic lenses

Beige with blue dots has locally radioactive sandstone, claystone, and conglomerate.

http://www.wsgs.uwyo.edu/research/minerals/aggregate.aspx
Climate – 2013 Temperatures High and Lows
Scale: -20 to 100°F

http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wy1730
Climate – 2013 Precipitation Distribution

Accumulated Precipitation

http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wy2685
Wind Speeds in SE WY
MLRA: 067A- Central High Plains
Northern Part

- Elevation: 4,000-6,500’
- Annual Precipitation: 12-17 inches
- Wind Speed: 7 -10 mph, gusts more than 75 mph
- Growth of native cool season plants: April 1 – July 1
- Growth of warm season plants: May 15 - August 15
- Air Temperature: 31 – 59.3 (average min/max)

Sandy (Sy) Ecological Site Description

- Site Type: Rangeland
- MLRA: 067A- Central High Plains, Northern Part
- Landforms: Hill, alluvial fan, stream terrace
- Slope: 0-30%
- Runoff class: Very low – medium
- Major Soil Series correlated to this site include: Alice, Bayard, Manter, Jayem, Phiferson, Moskee, Vetal, Otero, Keeline, Turnercrest, Altvan, Glendive, Parshall, Busher, Dailey, Dunday, Sarben, Anselmo, Satanta, Valent, Ashollow, Scoville, Tripp, Vebar, Chappell
- Surface texture: (1) Sandy loam (2) Loam
- Subsurface texture group: Sandy
- Depth: 20-60 inches
- EC: 0-4 mmhos/cm
- SAR: 0-5
- Available water capacity: 2.0-7.8 inches in the upper most 60”

Limy Upland (LiU)
Ecological Site Description

- Site Type: Rangeland
- MLRA: 067A- Central High Plains, Northern Part
- Landforms: Hill, ridge
- Slope: 3 - 20%
- Runoff class: Negligible – High

- Major Soil Series: Colby, Keota, Mitchell, Buffinton, Sulco
- Soils are deep and well drained to somewhat excessively drained
- Surface texture: Loam, Sandy loam, Very fine sandy loam
- Subsurface texture group: Loamy
- Depth: 40-60 inches
- EC: 0-4 mmhos/cm
- SAR: 0-5
- Available water capacity: 3.0- 6.3 inches in the upper most 60”

Rocky Hills (RH)
Ecological Site Description

- Site Type: Rangeland
- MLRA: 067A - Central High Plains, Northern Part
- Landforms: Hill, alluvial fan
- Slope: 1 - 50%
- Runoff class: Low – High

- Major Soil Series: Tyzak, Rentsac, Stormitt, Sunup, Trimad, Pinelli, Redthayne
- Soils are shallow to very deep and well drained
- Surface texture: Cobbly Loam, Very channery Clay Loam
- Subsurface texture group: Loamy
- Depth: 20-60 inches
- EC: 0-2 mmhos/cm
- SAR: 0-3
- Available water capacity: 0.70 – 1.00 inches in the upper most 60”

Main Challenges of Sandy Soil Reclamation in SE WY

- Right seed mix
  - Climate
  - Soils
- Physical challenges of the soil
  - Droughty
  - Abrasive
  - Move
  - Firm seedbed
WDEQ – Land Quality Division, Gravel Quarries/Large and Small Mines

Lessons Learned

Information from:
Lowell K. Spackman, District I Soil Scientist
WYDEQ/Land Quality Division and
Robin Jones, District I
# Recommended Seedmix

## Eastern WY, Sandy Soil (non-coal), 8-14 inch precipitation zone

<table>
<thead>
<tr>
<th>Species</th>
<th>lbs. P.L.S./acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western wheatgrass (<em>Agropyron smithii</em>)</td>
<td>1 to 3 (2 to 5 Broadcast Rates)</td>
</tr>
<tr>
<td>Bluebunch or Beardless Bluebunch wheatgrass (<em>Agropyron spicatum</em> or <em>A. interme</em>)</td>
<td>2 to 3</td>
</tr>
<tr>
<td>Indian ricegrass (<em>Oryzopsis hymenoides</em>)</td>
<td>3 to 5</td>
</tr>
<tr>
<td>Prairie sandreed (<em>Calamovilfa longifolia</em>)</td>
<td>2 to 4</td>
</tr>
<tr>
<td>Sand Bluestem (<em>Andropogon hallii</em>)&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3 to 5</td>
</tr>
<tr>
<td>*b (one or more species from list below)</td>
<td>Recommended Rates</td>
</tr>
<tr>
<td>*c (Minimum three from list below)</td>
<td>Recommended Rates</td>
</tr>
</tbody>
</table>

<sup>a</sup> Little bluestem (*Schizachyrium scoparium*) 3 to 5 (substitute species for *A. hallii*)

<sup>b</sup> Buffalo grass (*Buchloe dactyloides*) 2 to 4

Blue grama (*Bouteloua gracilis*) 1 to 2

Prairie junegrass (* Koeleria cristata/macrantha*) 1 to 4

Side oats grama (*Bouteloua curtipendula*) 3 to 5

Sheep fescue (* Festuca ovina*) 2 to 4

Sandberg bluegrass (*Poa sandbergii*) 2 to 4

Sand dropseed (*Sporobolus cryptandrus*) 1 to 2.5

* Include a minimum of 3 of the following species (drill seed rates)

- Western yarrow (*Achillea millefolium* or *lanulosa*) 0.75 to 1.5
- Pacific aster (*Aster chilensis*) 0.5 to 1
- Lance-leaved coreopsis (*Coreopsis lanceolata*) 1 to 2
- Purple coneflower (*Echinacea purpurea*) 1 to 3
- Sulfur flower buckwheat (*Eriogonum umbellatum*) 1 to 2
- Blaskamson (*Echinacea angustifolia*) 1 to 3
- Blanket flower (*Gaillardia aristata*) 1 to 2
- Blue flax (*Linum lewisii*) 0.5 to 1
- Wild lupine (*Lupinus perennis*) or Silky lupine (*Lupinus sericeus*) 1 to 3
- White eveningprimrose (*Oenothera pallida*) 1 to 2
- Rocky Mountain penstemon (*Penstemon strictus*) 0.75 to 1
- White prairie clover (*Dalea candida* or *Pedalostemon candidus*) 1 to 3 or
- Purple prairie clover (*Dalea purpurea* or *P. purpurea*, use inoculated seed) 0.75 to 2
- Scarlet or Munro globemallow (*Sphaeralcea coccinea* or *S. munroana*) 0.75 to 2
- Purple verbena (*Verbena stricta*) 0.5 to 1
- Mexican hat (*Ratibida columnifera* forma *pucherrima*) 0.5 to 1.5
- American vetch (*Vicia americana*) 1.5 to 4
- Fourwing saltbush (*Atriplex canescens*) 0.5 to 1
- Rubber Rabbitbrush (*Chrysothamnus nauseosus*) 1 to 4

Double the recommended seed rates for broadcast seeding Species from lists b and c.
### Species that grow well on Sandy Soils

#### Tall Grass Prairie
- Little bluestem
- Canada wildrye
- Sideoats
- Prairie dropseed
- Indian ricegrass
- Needleandthread
- Salina wildrye
- Rusty lupine
- Sandhill muhly
- Scurfpea
- Blowout grass
- Wildrye

#### Mixed Grass (Elements)
- Western wheatgrass
- Threadleaf sedge
- Sheep fescue (similar to threadleaf sedge)
- Blue grama
- Sandberg bluegrass
- Little bluestem
- Sideoats
- Indian ricegrass
- Sand dropseed
- Yucca (often has good regrowth)
- Prairie sandreed
AML- Abandoned Mine Lands

Lessons Learned

Photographs and Information from:
Marcia Murdock
AML NEPA Coordinator/AML Database
Manager/AML Project Manager
Abandoned Mine Land Division, Department of
Environmental Quality
Main AML projects in SE WY

- Limestone, e.g., Sunrise Mine north of Guernsey
- Other hard rock mines
Grass Creek Fire
Reclamation
Gas Hills Reclamation

Sagebrush Tablestakes area became hybrid traditional and natural regrade project.

D9 Spoils - first natural regrade project.

D9 & K-Pits Area
AML: Pitting is used in coarse textured soils
Leonardite Mining

Lessons Learned

Information from Bruce Lawson with Black Hills Bentonite

http://www.bhbentonite.com/lignite.html
Sandy Soils Reclamation
Lessons Learned- Leonardite Mining

- Location: Near Glenrock, WY
- Soil Type: Sandy
- Seeding Method:
  - Re-spread topsoil in the Spring
  - Seed sterilized cover crop (green mulch) like Quickguard, in the Spring after re-spread topsoil
  - Use a No-Till Drill in the fall to seed in the permanent seed mix
- Results: Has had good results with this method of seeding on sandy soils.
Reclaimed Coal Mine/Wind Farm

Lessons Learned

Information and Photographs from Chet Skilbred,
Interwest Mining Company- Glenrock Coal Company
Sandy Soils Reclamation
Lessons Learned-
Dave Johnston Glenrock Coal Mine
Sandy Soils Reclamation and Low Precipitation

• Biggest concern when planting into sandy soils is the Wind!
• Seedbed preparation is similar to high intensity farming
• May need to work the Area up to 5 times before it is actually planted
  • 1st pass: deep rip spoil material to relieve compaction
  • 2nd pass: after the topsoil is placed, deep rip or chisel plow 12-16 inches
  • 3rd pass: roller-harrow to break up the soil after deep rip and prepare a firm seedbed
  • 4th pass: based on soil conditions, roller-harrow again if necessary
  • 5th pass: seed with drill
Seedbed Preparation
Seedmix

- All seeding will be done on a Pure Live Seed (PLS) bases and utilize a drill with ½” depth bands on the seed openers.
- The drill will be calibrated to seed at a bulk rate that equates to the required (PLS) seeding rate.
- All individual seeds used in the seed mixture will have seed certifications.
- The seed mixture will be pre-blended by (seed source/vendor) to the yield the designated seed mixture and per acre seeding rate.
- Site seeding will occur from **November 1 through March 31**.

Approved seedmix for ROW

- Thickspike wheatgrass
- Streambank wheatgrass
- Western wheatgrass
- Beardless bluebunch
- Prairie sandreed
- Sheep fescue
- Sandberg bluegrass
- Indian ricegrass
- Green needlegrass
- Blue flax
- Fourwing saltbush
- No substitutions of Species

Seed when it is not convenient for you!
Russian Thistle Usefulness Example

Usually NOT a Problem and It is Not Removed If Grass Seedlings are Sufficient Underneath

- Leave Russian Thistle in Place to Provide Increased Snowcatch and to Act as Mulch During the Next Growing Season
- Prevents Antelope From Grazing the Shrubs
• Seed across (perpendicular to) the general prevailing winds
  This may bury the seed some and help prevent seeds from blowing away

• Double normal seeding rates
  • It is inherent that you will lose seed due to the winds
  • Expect that you may need to interseed (with drill seeder) into a few areas the next year due to blowouts
Guernsey National Guard Facility

Lessons Learned

Information provided by
Dustin J. Kafka, ITAM Coordinator
Camp Guernsey Training Center
Lessons Learned at Guernsey National Guard Facility

- Sandy soils common in the southern portion of facility
- Firm seed bed by using roller packer
- Seeding occurs throughout the year and they have seen some good results from July seeding
- Utilize grain cover crops such as wheat, oats, and barley (time planting/grazing before they head out)
- Fire is common
Lessons Learned at Guernsey National Guard Facility

- Plant native and non-native (ecological bridge) species
  - Native species:
    - Buffalo grass
    - Blue grama
    - Western wheatgrass
    - First strike slender wheatgrass
  - Non-native (Ecological Bridge) species:
    - Vavilov II Siberian Wheatgrass (*A. fragilis*)
    - Bozoisky II Russian Wildrye
    - These two species planted together have been keeping the cheatgrass out. There are several studies underway to see why this occurs.
Ability to harvest their own seed using a seed stripper
Lessons Learned

Information and Photographs from John Samson, WYDOT
Lessons Learned from WYDOT

- Sandy or sand soils are well drained
  - Readily uptake brief summer showers
- Use of grass drill placement is better than hydroseeding
- Like everything in reclamation, it boils down to species selection.
  - Some species really like sandy soils but there are many that “refuse to grow there”.
- Standardized seed mixes that work for ROW projects in both salty clays and sandy soil types are very unlikely to meet state or federal regulation requirements.
- WYDOT I-25 reclamation
- Near Wheatland, WY
Keys to Reclamation Success in Sandy Soils

• Create a firm seedbed
  • May also need to stabilize the area upwind of the disturbance

• Choose the right seed mix
  • Select a seed mix with species that grow well in sandy soils
  • Double the PLS lbs./acre of seed
    ◦ Some seeds will blow away
  • Seed generally in the Fall/Winter; cover crop possible depending on timing of seeding
  • Seed right before its wet
    ◦ It is useful to have your own equipment so this is possible
    ◦ May need to seed when it is not convenient to you

• Be aware of the primary wind direction
  • Seed perpendicular to the prevailing winds
  • Minimize wind impact

• After seeding complete, limit grazing for first two growing seasons or time it in dormant season
Summary

- This area may get more precipitation than other areas in WY and is often lower elevation
- Distribution of precipitation and sandy soils often select for warm season grass species
- Select your seed mix carefully to be adapted to such conditions
- Be aware of the need for a firm seedbed in sandy soils
- Be aware of the detrimental effects of wind and sandy soils on newly seeded ground
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