IMPROVING MONITORING EFFICACY FOR MULTIPLE LAND USE AND DATABASE IMPROVEMENT

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Reclamation as a process

Planning

Implementation  Monitoring
Planning

- Location
- Land use goals
- Regulatory requirements

Reference Site Selection/Baseline Inventory

- What’s available/affordable (seed mixes)?
# Reclamation Requirements

<table>
<thead>
<tr>
<th>Field Office</th>
<th>Percent Cover</th>
<th>Erosion Control/Soil Stability **</th>
<th>Weeds ++</th>
<th>Grass Richness *</th>
<th>Forb Richness</th>
<th>Forb Density Or Frequency</th>
<th>Shrub Richness</th>
<th>Shrub Density or Frequency</th>
<th>Plant Vigor **</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jonah Interagency Office</td>
<td>Greater than or equal to reference site</td>
<td>Site must be stable according to BLM Tech Note 346</td>
<td>No noxious weeds or highly competitive Invasives</td>
<td>At least 2 bunch grass species and 3 total species</td>
<td>Equal or greater than reference</td>
<td>At least 75% of reference</td>
<td>Equal to or greater than reference</td>
<td>At least 50% of reference with no more than 10% rabbitbrush</td>
<td>Plants must be resilient as displayed by root system, flowers, and seed heads</td>
</tr>
<tr>
<td>Pinedale Anticline Project Office</td>
<td>Plant community sufficient to minimize visual impacts, provide habitat and forage, impede noxious weed invasion</td>
<td>Plant community must stabilize soils</td>
<td>No state or federally listed noxious weeds. Active treatment in place for weedy bromes</td>
<td>At least 2 bunch grass species and 3 total species</td>
<td>Equal to or greater than reference</td>
<td>At least 75% of reference within 5 years</td>
<td>Equal to or greater than reference within 5 years</td>
<td>At least 50% of reference within 5 years</td>
<td>Plants must be resilient as above. Removal of external influences required for at least 1 year</td>
</tr>
<tr>
<td>Kemmerer BLM</td>
<td>Greater than or equal to 80% of reference site</td>
<td>Disturbed areas are immediately stabilized by mulching</td>
<td>Less than or equal to 10% of total vegetative cover</td>
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<tr>
<td>Rawlins BLM</td>
<td>Greater than or equal to 80% of reference site</td>
<td>Erosion features equal to or less than reference</td>
<td>No noxious weeds</td>
<td></td>
<td></td>
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<tr>
<td>WDEQ</td>
<td>Greater than or equal to 70% of reference</td>
<td>Grass must extend to any active roadway unless permanent anchor in place</td>
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</tbody>
</table>
Reference Sites (SERI 2004)

- Reference Ecosystem – A model for planning a restoration project

- Natural Ecosystem – Developed by natural processes and is self-organizing and maintaining

- Cultural (or semi-natural) Ecosystem – Developed under the joint influence of natural processes and human-imposed organization
Implementation
A sound monitoring plan should be:

- Cost-effective
- Defensible (Quantitative, Repeatable, etc.)
- Able to measure ‘Core indicators’ or ‘key performance indicators’
- Able to meet needs of multiple stakeholders/regulatory criteria
- Able to Improve Decision Making
Current Monitoring Practices

- Ocular estimates
- Daubenmire frames
- Line-point intercept (along transect)
- Step-point
Using images and spatially balanced sampling design

- Image-based monitoring (Cagney et al. 2011)
- SamplePoint (Booth and Cox 2006)
  - Free, easy to use software for image analysis
- Balanced acceptance sampling (Robertson et al. 2013)
  - “It makes intuitive sense to spread the sample evenly over the study area”
Figure 1. Selecting $n = 30$ spatially well-balanced BAS points in a two-dimensional study area. Points denoted ● are in the study area and points denoted ▲ are not. A total of $v = 47$ random-start Halton points were used to obtain the sample.
Utilizing Geo-tagged Imagery and Spatially Balanced Sampling
(Curran et al. In Review – Restoration Ecology)
Report Generation

Quantitative Data

Species & Site Specific

- Improve statistics
- Answer Multiple Regulatory Criteria
- Improve Future Practices with Species Specific Reports
WDEQ/SGEO/Field Office Criteria

- **WDEQ SWPPP**
  - 70% cover compared to reference

- **SGEO**
  - 2 native forb species, 2 native grass species (1 bunch), within 60 m of => 5% sagebrush

- **BLM Field Offices**
  - Each one different
  - JIO/PAPO most stringent in state
  - Appendix M
JIO Criteria

- Ground cover on reclaim must be =/> reference (pass)
- Forb richness =/> reference (pass)
- Forb density =/> 75% reference (pass)
- Shrub density =/> 50% reference (pass)
- Shrub richness =/> reference (fail)
- Grass richness (3 grasses, at least 2 bunch) (pass)
- Site stable/lack of erosion features (pass)
  - * documented outside of SamplePoint
- Plants resilient based on seed heads (pass), flowers (pass), roots(?)
Collect Once, Use Many Times
MOM Tool Example

Disruptive Features
- O&G Count: 405
- Mining Count: 0
- Waterbody Count: 0
- Disruption/sq mi: 32.23
- Disturbance/2 mi Buffer: 26.33% (2118 acres)

Disturbance Features
- Oil & Gas: 1871
- Mining: 0
- Powerlines: 2
- Agricultural: 0
- Fire: 0
- Rangeland: 0
- Pipelines: 254
- Roads: 192

Pad Reclamation
- No Data
- 63 Acres
- 0 Acres
- 0 Acres
- 30 Acres
- 383 Acres
- 0 Acres
- Satisfies Regulatory Criteria
- Meets SGE0
- 327 Acres
Pocket Gopher
Operator Dashboard

Pre-monitoring. Obtain quantitative data.
- 0 Forbs. Re-seed with forb mix.
- 1 Native Perennial Forb. Re-seed with forb mix.
- 2-4 Native Perennial Forbs. Consider re-seeding.
- >5 Native Perennial Forbs. No action.
- Site meets rollover criteria, not SGEO.
- Site meets SGEO, regardless of rollover.
Large scale (Warren Resources/Anadarko/Southland/EFTS)

- 1,800 pads monitored prior to Aug 1.
- Quantitative reports generated daily
- Geo-spatial component allows for data/photos to be linked to site
- Technicians (1 person team) doing 10-12 sites per day (data collection and report generation)
  - Transect method (2 person team) was doing ~7 sites per day (data collection)
Drawbacks

- SamplePoint does not measure height, canopy gap, or basal coverage
- Sometimes tough to ID grass to species
- Images are large files (cumbersome data)
- Added expense of camera
Positives

- Improved data quality
- Reduction of time spent collecting data
- Permanent record
- Spatially-explicit
- Overall cost saving
Future Research

- Direct comparison between methods
- Improving reference site selection
- Life cycle monitoring for reclaimed sites
WRRC-BLM Study (Buffalo & Rawlins offices)
Ecological Site Descriptions: Suggestions for Improvements and Use as Reference Sites (Curran et al. in prep.)
Acknowledgements

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- BLM
- WGFD
- WWNRT
- PAW
- CPNPP