Evaluating Historic Seeding Treatments in Western Grasslands and Shrublands using the Land Treatment Digital Library

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Act 1. Brief Introduction to the LTDL

Act 2. Evaluating Historic Seeding Treatments

Act 3. A Brief Demonstration of Potential Applications
Act 1. Brief Introduction to the LTDL

Land Treatment Digital Library

A centralized digital library for federal agencies to store and retrieve data on land treatments in the western U.S.
Land Treatment Digital Library

Where did it come from?

- Joint Fire Science Program (2009-10)
- Bureau of Land Management (2010 – 2014)
What is it?

The Land Treatment Digital Library integrates planning and implementation information, seed information, monitoring data, and GIS data with original documents and photos associated with a project or treatment.
How does the LTDL get its data?

**STEP 1:** Paper files are scanned and computer files are copied at field offices and stored as PDFs with project GIS data.

**STEP 2:** Data are entered into the LTDL, treatment polygons are imported, and links are created to original documents.

**STEP 3:** Data and maps are checked for accuracy with field office personnel.

**STEP 4:** Project and treatment data can be viewed, queried, or exported as tables or maps.
Land Treatment Digital Library

- The LTDL is designed around a single project record with one or more treatments.
## Land Treatment Digital Library

Treatments can be queried and summarized.

<table>
<thead>
<tr>
<th>Treatment Name</th>
<th>1940s</th>
<th>1950s</th>
<th>1960s</th>
<th>1970s</th>
<th>1980s</th>
<th>1990s</th>
<th>2000s</th>
<th>2010s</th>
<th>Total</th>
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<td>77</td>
<td>56</td>
<td>123</td>
<td>482</td>
<td>910</td>
<td>0</td>
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<td>157</td>
<td>364</td>
<td>186</td>
<td>338</td>
<td>463</td>
<td>457</td>
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<td>1990</td>
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<td>71</td>
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<td>56</td>
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<td>237</td>
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<td>679</td>
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<td>40</td>
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<td>31</td>
<td>42</td>
<td>34</td>
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<td>296</td>
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<td>0</td>
<td>234</td>
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<td>Thinning/Cutting</td>
<td>4</td>
<td>14</td>
<td>22</td>
<td>44</td>
<td>44</td>
<td>82</td>
<td>438</td>
<td>4</td>
<td>652</td>
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<tr>
<td>Herbicide Application</td>
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<td>43</td>
<td>182</td>
<td>33</td>
<td>35</td>
<td>162</td>
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<td>0</td>
<td>670</td>
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<tr>
<td>Fence</td>
<td>11</td>
<td>91</td>
<td>131</td>
<td>66</td>
<td>229</td>
<td>594</td>
<td>845</td>
<td>5</td>
<td>1972</td>
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<tr>
<td>Livestock Closure</td>
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<td>66</td>
<td>87</td>
<td>72</td>
<td>177</td>
<td>298</td>
<td>390</td>
<td>5</td>
<td>1097</td>
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<td>Total</td>
<td>62</td>
<td>542</td>
<td>1066</td>
<td>585</td>
<td>1292</td>
<td>2732</td>
<td>4139</td>
<td>30</td>
<td>10448</td>
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</table>
Act 2. Evaluating Historic Seeding Treatments
A cursory assessment...
Seeding Treatments

Seeding Types
n≈4,800

Aerial
n≈1,625

Drill
n≈2,000

Other
n≈1,175
4,800 Seeding Treatments
Seeding Treatments

Seeding Status
n≈4,800

Implemented
n≈3,900

Planned
n≈900
Seeding Treatments

- Seeding Status
  - Implemented: n≈3,900
    - Seed List: n≈3,825
    - No Seed List: n≈75
  - Planned: n≈900
    - Seed List: n≈800
    - No Seed List: n≈100
Seeding Treatments

Seeding Status
n≈4,800

Implemented
n≈3,900

Seed List
n≈3,825

Confirmed List
n≈2,500

Unknown List
n≈275

List From Plan
n≈1,050

No Seed List
n≈75

Planned
n≈900

Seed List
n≈800

No Seed List
n≈100

List From Plan
n≈1,050
4,800 Seeding Treatments
650 Seeding Treatments with

- Implement Record
- Confirm Seed List
- Success Reported
Seeding Treatments

Success reported as:
- Successful
- Partially Successful
- Failure

Seeding Status
- Implemented
  - Seed List
    - Confirmed List
      - Success Reported
    - Unknown List
      - Success Reported
    - List From Plan
      - Success Reported
  - No Seed List
    - Success Reported
- Planned
  - Seed List
  - No Seed List

n≈4,800
n≈3,900
n≈3,825
n≈2,500
n≈275
n≈1,050
n≈8
n≈800
n≈100
n≈75
n≈650
n≈50
n≈275
n≈8

USGS
What is “Successful”?

“Monitoring indicated that there were 6 perennial plants per sq m as of June of 2007. Crested wheatgrass was the primary grass found in the monitoring plots, but bottlebrush squirreltail, prairie junegrass and Sandbergs bluegrass were also common in the plots. Bladderpod, astragalus and prairie lupine were the dominant forbs. Grass cover averaged 5% and perennial forb cover averaged 3%. Annual forb and cheatgrass cover was less than 1%, but this could be due to the dry winter and spring in 2007. Seedlings of grasses were common throughout the seeding. There were also a number of grass plants that survived the fire. New grass plants could easily be pulled from the soil surface. A second season of rest will help increase root biomass and resistance to being pulled out of the soil.”

From Craters_C4XR Project
What is “Failure”?  

“One monitoring plot was established in the drill seeding area. Qualitative observations showed poor to fair germination of the drill seeded species. Spring moisture was below normal levels. Extended drought conditions over the summer may have an effect on survival of germinated species. Overall, the density of seeded grass plants was still below established quantitative objectives. There were no seeded forbs documented in the plots. Annual exotic vegetation continues to dominate the area. A minimal amount of the seeded grass species (crested wheatgrass) were found in the plot. Based on the extreme cover of annual exotic vegetation on the plot and very low density of seeded species the seeding will be considered a failure.”

Reunion_Burned_Area_Rehabilitation_C4MR_2006 Project
Success of Seeding Treatments

![Bar chart showing the success rates of different treatment types: Aerial, Drill, and Other. The chart indicates the number of treatments for each category, with Aerial having the highest success rate.]

- **Aerial**: High success rate.
- **Drill**: Moderate success rate.
- **Other**: Low success rate.
### Species Seeded in ‘Successful’ Treatments

<table>
<thead>
<tr>
<th>Rank</th>
<th>Species</th>
<th>Common</th>
<th># times in Top Ten</th>
<th>Ave Rate lbs/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Artemisia sp.</td>
<td>Sagebrush sp.</td>
<td>107</td>
<td>0.8</td>
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<tr>
<td>2</td>
<td>Agropyron desertorum</td>
<td>Crested Wheatgrass</td>
<td>84</td>
<td>3.7</td>
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<tr>
<td>3</td>
<td>Poa secunda</td>
<td>Sandbergs Bluegrass</td>
<td>83</td>
<td>0.8</td>
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<tr>
<td>4</td>
<td>Elymus wawawaiensis</td>
<td>Snake River Wheatgrass</td>
<td>54</td>
<td>2.6</td>
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<tr>
<td>5</td>
<td>Pseudoroegneria spicata</td>
<td>Bluebunch Wheatgrass</td>
<td>54</td>
<td>3</td>
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<tr>
<td>6</td>
<td>Achillea millefolium</td>
<td>Western Yarrow</td>
<td>50</td>
<td>3</td>
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<tr>
<td>7</td>
<td>Agropyron fragile</td>
<td>Siberian Wheatgrass</td>
<td>42</td>
<td>2</td>
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<tr>
<td>8</td>
<td>Medicago sativae</td>
<td>Alfalfa</td>
<td>42</td>
<td>0.7</td>
</tr>
<tr>
<td>9</td>
<td>Leymus cinereus</td>
<td>Great Basin Wildrye</td>
<td>39</td>
<td>2.7</td>
</tr>
<tr>
<td>10</td>
<td>Achnatherum hymenoides</td>
<td>Indian Ricegrass</td>
<td>34</td>
<td>1.8</td>
</tr>
<tr>
<td>Rank</td>
<td>Species</td>
<td>Common</td>
<td># times in Top Ten</td>
<td>Ave Rate lbs/acre</td>
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<tr>
<td>------</td>
<td>--------------------------</td>
<td>-------------------------</td>
<td>--------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>1</td>
<td>Artemisia Sp.</td>
<td>Sagebrush Sp.</td>
<td>52</td>
<td>0.9</td>
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<td>2</td>
<td>Agropyron desertorum</td>
<td>Crested Wheatgrass</td>
<td>49</td>
<td>4.2</td>
</tr>
<tr>
<td>3</td>
<td>Agropyron fragile</td>
<td>Siberian Wheatgrass</td>
<td>29</td>
<td>2.4</td>
</tr>
<tr>
<td>4</td>
<td>Elymus lanceolatus</td>
<td>Thickspike Wheatgrass</td>
<td>23</td>
<td>1.4</td>
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<tr>
<td>5</td>
<td>Atriplex canescens</td>
<td>Fourwing Saltbush</td>
<td>21</td>
<td>1.1</td>
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<td>6</td>
<td>Psathyrostachys junceus</td>
<td>Russian Wildrye</td>
<td>20</td>
<td>1.2</td>
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<td>7</td>
<td>Achnatherum hymenoides</td>
<td>Indian Ricegrass</td>
<td>18</td>
<td>1.5</td>
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<tr>
<td>8</td>
<td>Linum perenne</td>
<td>Blue Flax</td>
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<td>0.9</td>
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<tr>
<td>9</td>
<td>Medicago sativa</td>
<td>Alfalfa</td>
<td>18</td>
<td>0.8</td>
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<tr>
<td>10</td>
<td>Elymus wawawaiensis</td>
<td>Snake River Wheatgrasss</td>
<td>15</td>
<td>2.5</td>
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## Differences in Seeding Rates

### Success vs Failure

<table>
<thead>
<tr>
<th>Species</th>
<th>Common</th>
<th>Success PLS lbs/ac</th>
<th>Failure PLS lbs/ac</th>
<th>Diff</th>
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<td>Artemisia sp.</td>
<td>Sagebrush sp</td>
<td>0.28</td>
<td>0.44</td>
<td>-0.16</td>
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<tr>
<td>Agropyron desertorum</td>
<td>Crested Wheatgrass</td>
<td>1.27</td>
<td>1.4</td>
<td>-0.13</td>
</tr>
<tr>
<td>Elymus wawawaiensis</td>
<td>Snake River Wheatgrass</td>
<td>2</td>
<td>2.1</td>
<td>-0.1</td>
</tr>
<tr>
<td>Agropyron fragile</td>
<td>Siberian Wheatgrass</td>
<td>1.6</td>
<td>1.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Medicago sativae</td>
<td>Alfalfa</td>
<td>0.5</td>
<td>0.5</td>
<td>0</td>
</tr>
<tr>
<td>Achnatherum hymenoides</td>
<td>Indian Ricegrass</td>
<td>1.5</td>
<td>0.6</td>
<td>0.9</td>
</tr>
</tbody>
</table>
Factors Influencing Success

Elevation

Failure
Partially Successful
Successful
Factors Influencing Success

Temperature

Maximum Temperature (°C)

Failure
Partially Successful
Successful
Factors Influencing Success

Precipitation
Factors Influencing Success

Soils

[Bar chart showing the number of treatments for different soil types, including Bedrock, Clay, Clay Loam, Loam, Sand, Sand Loam, Silt Loam, and Stone Loam, categorized by success, partially successful, and failure.]
Act 3. A Brief Demonstration of Potential Applications
Assisting Managers and Researchers...

- Examples of LTDL Data Calls
  - All land treatments in sage-grouse habitats
  - Wildfire aerial seedings in Boise, Twin, and Elko BLM District Offices
  - Northern Great Basin crested wheatgrass seedings
  - Herbicide sprayings in southern Idaho
A Demonstration

Fire Rehabilitation Effectiveness: A Chronosequence Approach for the Great Basin

David Pyke, David Pilliod, Jeanne Chambers, Matthew Brooks, & James Grace

Goal: Determine if ES&R projects:
- increase perennial plant cover
- improve community composition
- decrease invasive annual plants
- result desirable fuel structure

...relative to no treatment following fires.
Mining the LTDL for Land Treatments

Aerial Seedings

<table>
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<tbody>
<tr>
<td>Confirmed Mix and Monitored</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirmed Mix and Not Monitored</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned Mix and Monitored</td>
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<td></td>
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<tr>
<td>Planned Mix and Not Monitored</td>
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<td></td>
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</tr>
</tbody>
</table>

Seeding Mixture & Monitoring Status

USGS
Limiting Scope, Maximizing Inference

1. Major Land Resource Areas (MLRAs)
2. Precipitation Zones
   - <8 inch
   - 8-12 inch
   - >12 inch
3. Soils – Silty Loam
4. Seeding Type
   - Aerial & Drill
   - Time Since Seeding
For more information:
dpilliod@usgs.gov or justin_welty@usgs.gov