REVEGETATION TRENDS AND LESSONS – MONTANA COAL
“The secret of managing is to keep the guys who hate you away from the guys who are undecided.”

Casey Stengel
“Can't anybody here play this game?”

Casey Stengel
MONKEY SEE – MONKEY DO
SPRING CREEK AND DECKER COAL MINES

SOUTH-CENTRAL MT  
3500’ ELEV. (1,070 m)  
10.8” (27 CM) ANNUAL PRECIP.  
~ CLAY LOAM  
3 SUBSTRATES: SPOIL, SCORIA, SALVAGED TOPSOIL
SCM HAS 9 MAJOR SEED MIXES

MAY USE SEVERAL IN ONE FIELD E.G., 1 OR 2 UPLAND ALLUVIAL SPECIAL SUBSTRATES SHRUB MOSAICS
COAL DISTURBANCE MT

63 mi$^2$ = 163 km$^2$

0.2% OF CROPLAND

28,000 mi$^2$ = 73,000 km$^2$
SMCRA 1977

REVEG. DIVERSE, EFFECTIVE, PERMANENT

NATIVE SPP. EXCEPT PASTURES

≥ PREMINE COVER AND PROD.

CONTROL EROSION
COAL RECLAMATION BECOMES THE CRUCIBLE FOR WESTERN REVEGETATION
MT COAL AND URANIUM MINE RECLAMATION WEAKENED 2003

STILL REQUIRES “PERIODIC” MONITORING and CORRECTIVE MEASURES AS NECESSARY TO COMPLY WITH THE PERMIT OR AS THE DATA INDICATE.
MINIMUM 10 YEAR TO EVALUATE PHASE 3 BOND RELEASE
Table 10. Shrub survival as a function of field age, Sodic Overburden Test Plots.

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<td>11</td>
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Table 1. Premine (baseline) vegetational attributes, SCCM.

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<tr>
<th>VEGETATION TYPE</th>
<th>PERENNIAL COVER %</th>
<th>PERENNIAL PSC KG/HA*</th>
<th>SHRUB DENSITY INDIV/HA**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steppe Types (minor)</td>
<td>43</td>
<td>800</td>
<td>700</td>
</tr>
<tr>
<td>Sagebrush Types</td>
<td>48</td>
<td>625</td>
<td>8,400 (3,400/A)</td>
</tr>
</tbody>
</table>

* Air-dried; excluding tree productivity. Multiply by 0.89 for pounds/acre.
** For shrubs/acre divide by 2.47.
Table 2. Technical vegetation standards, SCCM. Revegetation must meet 90% of the standards with 0.1 Type 1 error.

<table>
<thead>
<tr>
<th>PERFORMANCE PARAMETER</th>
<th>GRAZING LAND</th>
<th>WILDLIFE HABITAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHRUB DENSITY</td>
<td>1,110/HA</td>
<td>5,740/HA</td>
</tr>
<tr>
<td>PERENNIAL COVER</td>
<td>50%</td>
<td>46%</td>
</tr>
<tr>
<td>PEAK STANDING CROP</td>
<td>775 KG/HA</td>
<td>NA</td>
</tr>
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TURNING TO TRENDS

GENERALIZATIONS THAT MAKE THE COMPLICATED APPEAR SIMPLE
Growth-Form Dynamic
South Fork Spring Creek, Bighorn Co., MT

Canopy Coverage

- Annual Forbs
- Annual Grasses
- Perennial Grasses
- 3X Annual Precip.
FOCUS ON 3 TRENDS FOR BOND RELEASE

PERENNIAL COVER
PERENNIAL PRODUCTIVITY
SHRUB DENSITY
PERENNIAL PSC TRENDS IN REVEGETATION

FIELD AGE

Kg/Ha

YOUNG

MID

10+ YEARS
PERENNIAL C-COVERAGE IN REVEGETATION

Perennials in revegetation:
- **Young**
- **Mid**
- **10+ Years**

**Percent Canopy Coverage**

<table>
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<tr>
<th>Field Age</th>
<th>Young</th>
<th>Mid</th>
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<tbody>
<tr>
<td>Coverage</td>
<td>30%</td>
<td>60%</td>
<td>75%</td>
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TREND: SHRUB DENSITY DECLINES WITH TIME. 82% SURVIVAL AT THE CONCLUSION OF SAMPLING
QUICK LOOK AT 3 SPP.

CHEATGRASS
WESTERN WHEATGRASS
SHEEP FESCUE
2012
PRECIP. 10.5”
2015 PRECIP. 11.5”

2015 PRECIP. 11.5”
NATIVE
by
PAR 5 ATM
WESTERN WHEATGRASS

REVEG ALL-STAR ORIGINATES LOCALLY VIGOROUS RHIZ. SPREAD
In the 2007 monitoring at DCM, 80% of perennial cover (relative cover) came from a single species:

Western Wheatgrass.
PAR 3 SEEDED 1997

PAR 1G SEEDED 10/06
AND 4/11
WESTERN WHEATGRASS C-COVER SCCM

PERCENT RELATIVE COVER

FIELD AGE

YOUNG

MID

10+ YEARS
SHEEP FESCUE

REVEG ALL-STAR INTRODUCED TO U.S.

SMALL TUFTED BUNCHGRASS SPREADS BY COPIOUS SEED PRODUCTION
SHEEP FESCUE COVER -- SEEDED

PERCENT RELATIVE COVER

FIELD AGE

YOUNG

MID

10+ YEARS
SHEEP FESCUE COVER -- UNSEEDED

PERCENT CANOPY COVERAGE

FIELD AGE

YOUNG

MID

10+ YEARS
NO TIME FOR HOW TO GROW SHRUBS FROM SEED

NEXT 3 PHOTOS FROM A SINGLE FIELD, DIFFERENT SEEDINGS
DEALING WITH ANNUAL-BIENNIAL WEED PATCHES IN REVEGETATION
TYPICAL PROGRESSION IN A POOR SEEDING

KOCHIA → TUMBLEMUSTARD → CHEATGRASS
Kochia roots 2 weeks
MANAGE TO PREVENT KOCHIA

DON’T LEAVE COVERSOIL UNSEEDDED ANY LONGER THAN NECESSARY

ERADICATE KOCHIA RESERVES ON THE MINE
KOCHIA

MOW IT

RELEASE OVERTOPPED

PERENNIALS

KOCHIA CAN STILL

PRODUCE SEED
KILL KOCHIA WITH GLYPHOSATE AND A WEED WIPE
CAN TRY INTERSEEDING IF SOME KIND OF SEEDBED
FULLY INTERSEEDED 5 YEARS AFTER ORIGINAL SEEDING
ANNUAL-BIENNIAL FORBS AND CHEATGRASS

PRE-EMERGENT CHEMICAL CONTROL FOLLOWED BY LITTER REDUCTION THEN SEEDING
SKIP ONE GROWING SEASON SEED IN SPRING JUST WESTERN AND CHENOPOD SHRUBS
SEED TOO SOON – CHEMICALS INHIBIT THE SEEDING

SEED TOO LATE – WEEDS RETURN WITH THE PERENNIALS
THERE ARE OTHER LESSONS