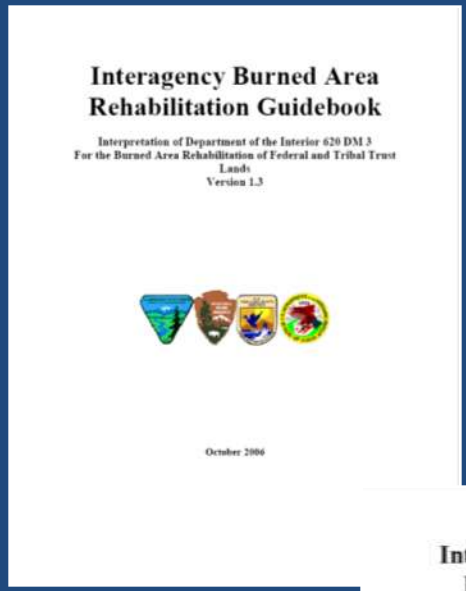
Best Practices Close to the Ineffective Margins of Successful Seeding

"Even in the Desert, Plants Need Water to Grow"

Bruce A. Roundy and Nathan L. Cline
Brigham Young University

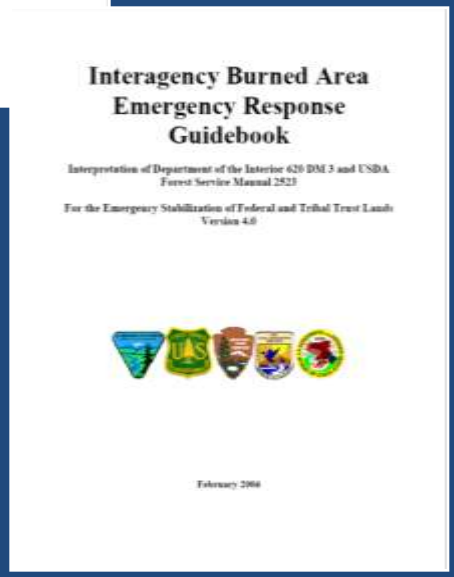
ES & BAER Lofty Objectives

- Public safety
- Stabilize- prevent further degradation
- Invasive weed treatments
- Revegetation where insufficient natural regeneration
  - Minimize erosion
  - Reduce non-native invasion
  - Prevent impairment to critical habitat for T&E species


Interagency Burned Area Rehabilitation Guidebook

Interpretation of Department of the Interior 620 DM 3
For the Burned Area Rehabilitation of Federal and Tribal Trust Lands
Version 1.3

October 2006


Interagency Burned Area Emergency Response Guidebook

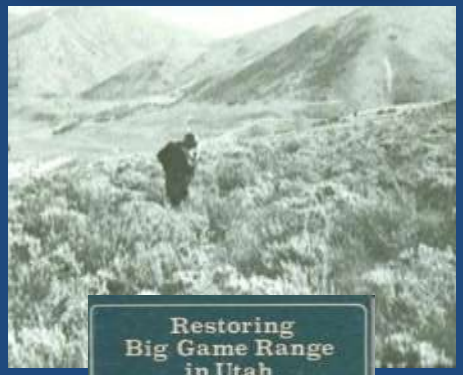
Interpretation of Department of the Interior 620 DM 3 and USDA Forest Service Manual 2523

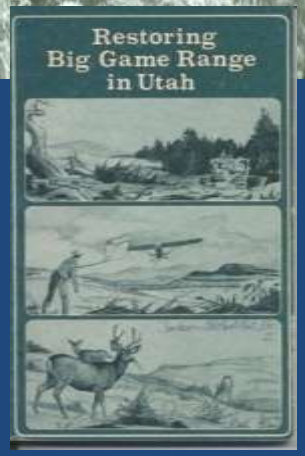
For the Emergency Stabilization of Federal and Tribal Trust Lands
Version 4.0

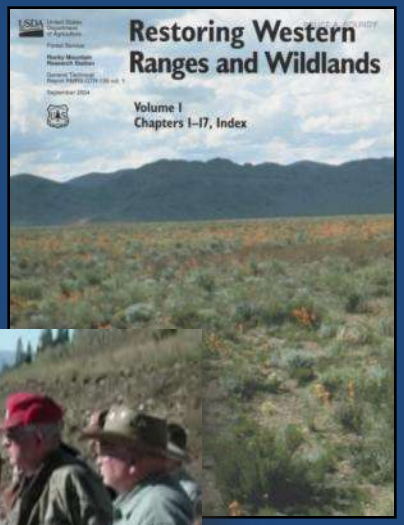
February 2006

Rangeland Revegetation Principles

- Adequate precipitation
  - No rain, no success
- Control competition
  - Enough is enough
- Sow sufficient germinable seed before wet season
  - If some is good, is more better? When?
- Plant adapted species able to establish
  - Willie Survive? Is well begun half done?
- Seedbed and sowing adapted to species and site
  - “some fell on good ground”
- Post seeding management to allow persistence
  - Boomerang or baseball / What is success?

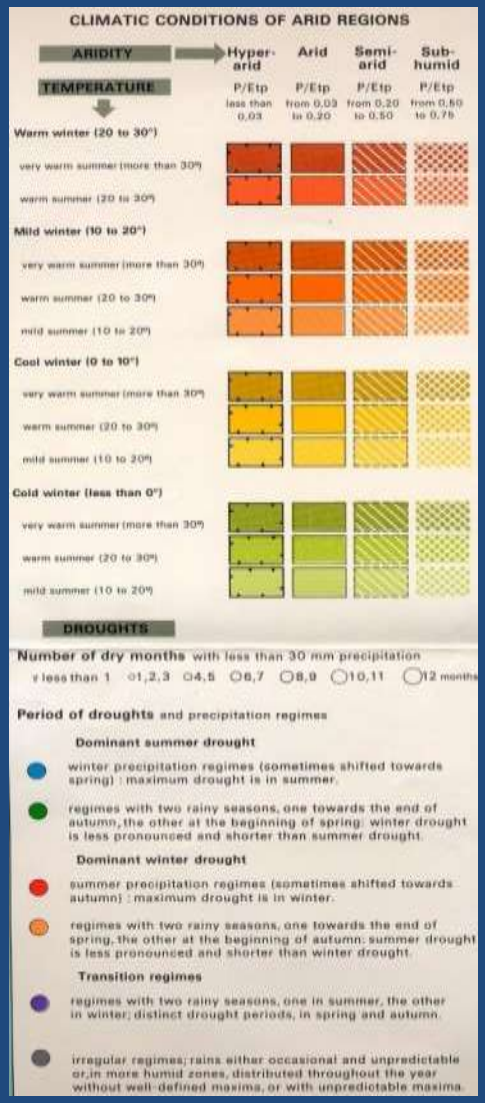


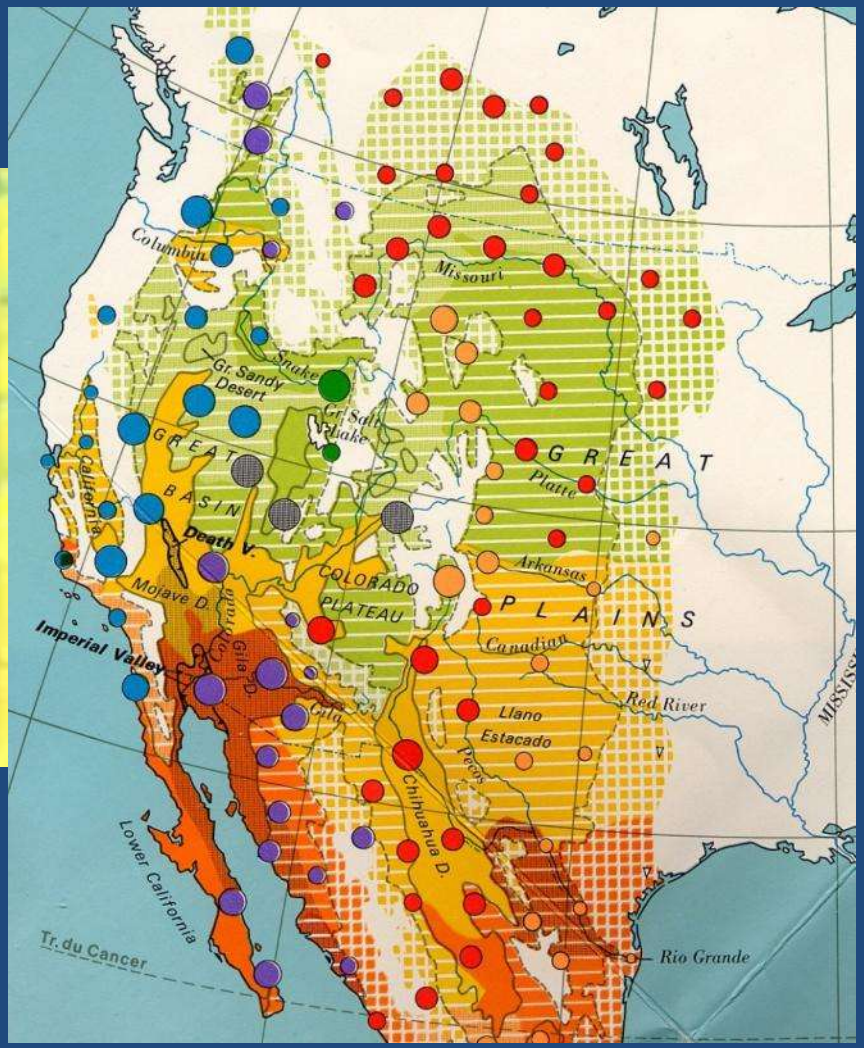




Adequate precipitation- No rain, no success

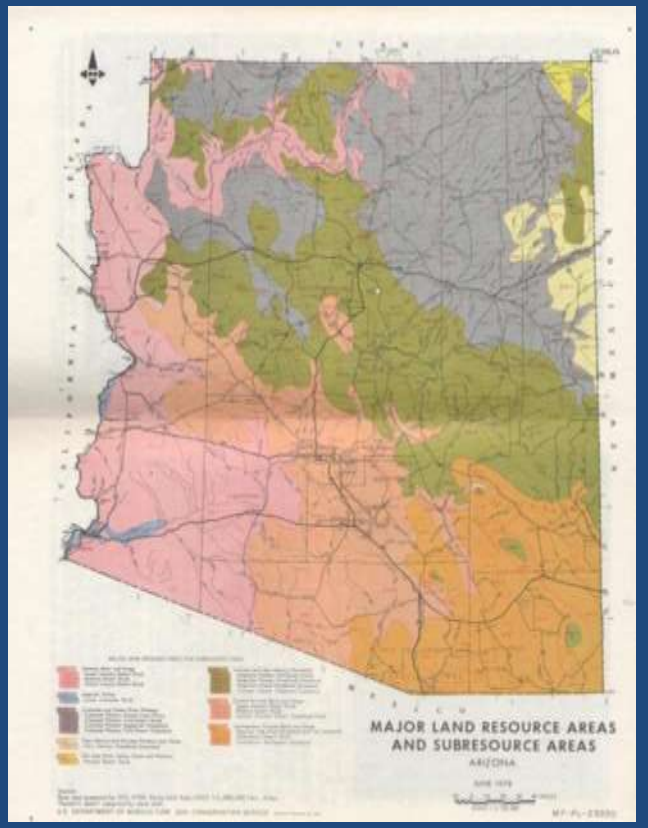
What are the margins?





Annual precipitation and revegetation potential

- > 24 in. Excellent
- 16-24 in. Good
- 12-16 in. Some risk
- 8-11 in. Risky
- < 8 in. Major risk
- Jordan's limits:
  * **warm deserts**: 5-6 in. following spring, summer seedings
  * **cold deserts**: 4-5 in. after spring seedings, 3-4 in. after fall seedings



Revegetation potential

- **Good**:
  - gambel oak, snowberry, true mountain mahogany, mountain big sagebrush, aspen
- **Good to fair to borderline**:
  - pinyon, juniper, Wyoming big sagebrush, velvet and honey mesquite, black sagebrush
- **Poor, but sometimes possible in wetter years**
  - salt desert shrub, blackbrush, greasewood, winterfat, creosotebush, paloverde, bursage

Ecological and genetic potential

- Episodic or opportunistic establishment; longevity; nurse plants

- Changing environments and invasives

Soils and potential

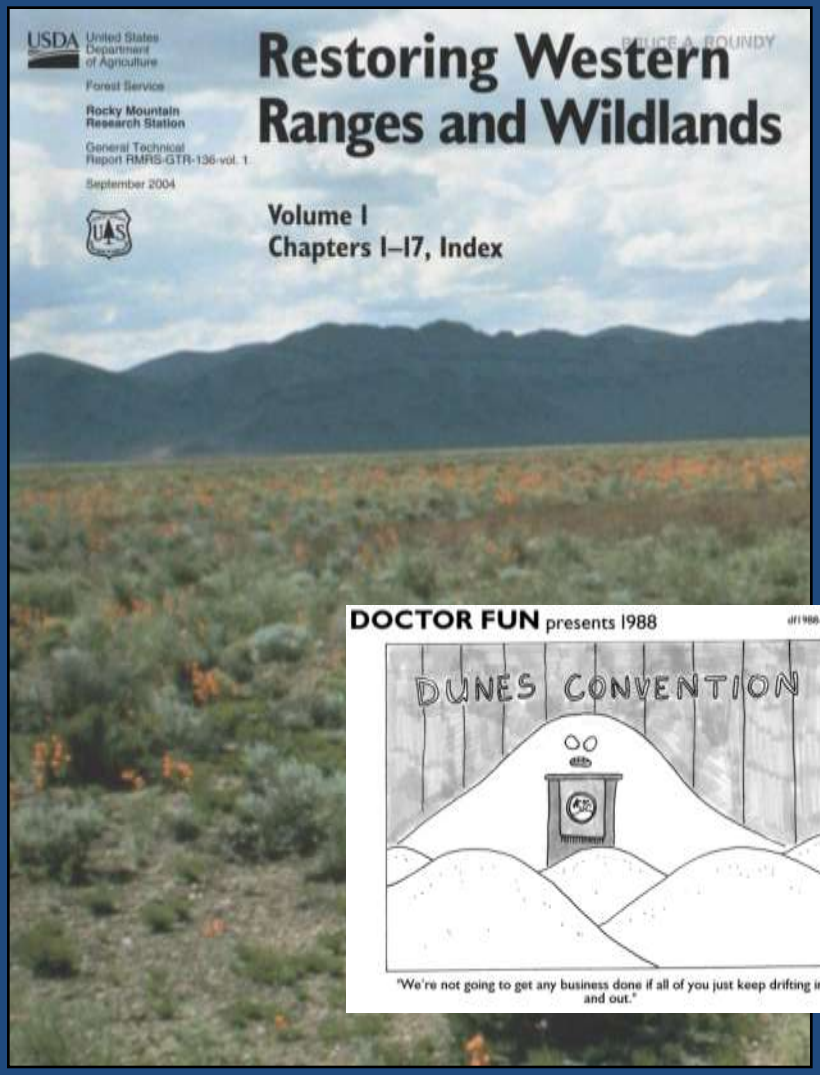


Table 1—Table for evaluating soil characteristics for productivity potential and possible improvement.

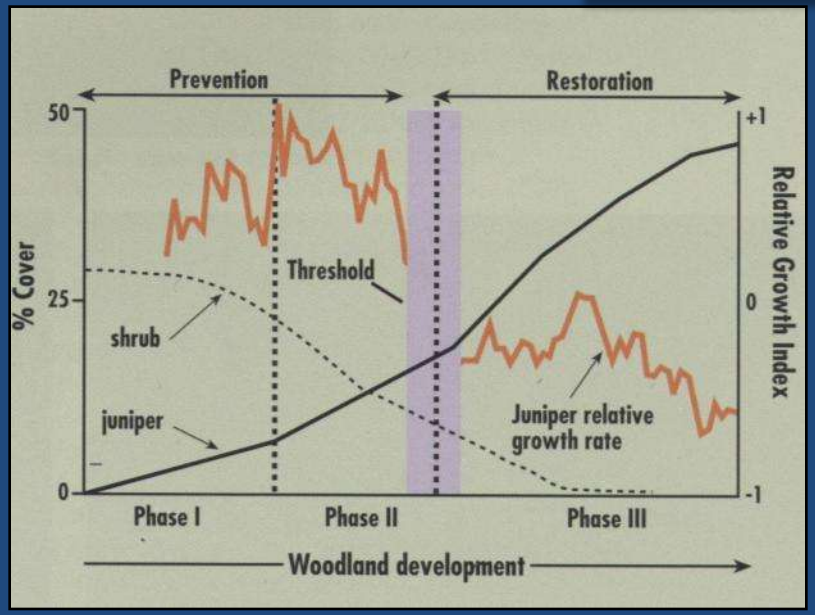
Soil property or quality	Level of suitability: Low (essentially unsuitable)	Moderate	High	Reference
USDA texture	Loamy sand, sand (<18% clay)	Clay, silty clay, (>35% clay)	Sandy loam, sandy clay loam, loam, clay loam, silty clay, loam (18-35% clay)	Brady 1974
Soil structure	Massive, single grain	Platy, blocky prismatic	Granular	Soil Survey Staff 1962
Bulk density (g/cm^3)	>1.6 cc	1.4-1.6	<1.4	Daddow and Warrington 1983; Russell 1973; White 1979
Permeability (cm/hr)	(<0.5) or (>15.0)	5.0-15 and 0.5-1.5	0.6-5.0	Soil Survey Staff 1962
Available water-holding capacity (cm H_2O/ cm soil)	<0.08	0.08-0.16	>0.16	Brady 1974; Broadfoot and Burke 1958
Coarse frag content (%)/wt	>35	15-35	<15	Soil Survey Staff 1962
Depth to limiting layer (cm)	<50	50-100	>100	Soil Survey Staff 1962
Slope %	20-30	10-20	<10	USDA 1965a; Forest Service Handbooks 2209.21 and 2209.31
Organic matter (%)/wt surface soil	<0.5	0.5-2.0	>2.0	Donahue and others 1977; Foth 1978; Hendricks and Alexander 1957
pH	(<5.1) (>8.4)	(5.1 to 6.5) or (7.4 to 8.4)	6.6 to 7.3	Soil Survey Staff 1962
Salinity (mmhos/cm)[*]	>8	4-8	<4	Richards 1954
Exchangeable sodium percentage (ESP)[†]	>15	2-15	<2	Richards 1954

[*] Measured in terms of conductivity of saturated soil extract.
[†] ESP refers to exchangeable sodium percentage.

Controlling competition

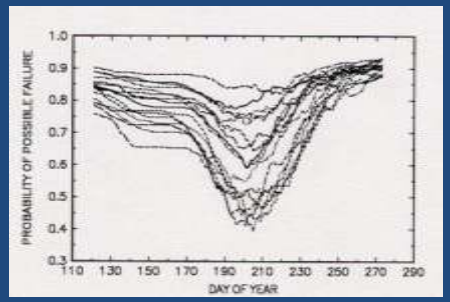
Enough is enough

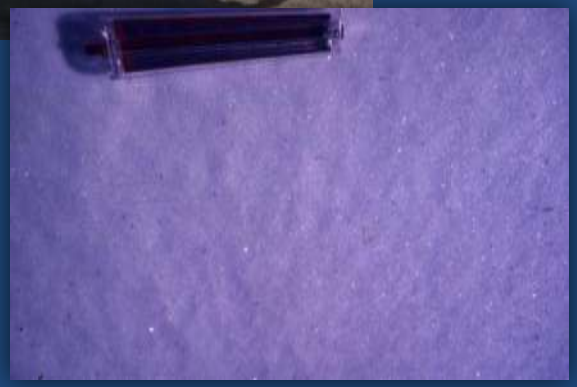
- Residuals and need to seed
- Post-fire weed control- Oust wind erosion problem
- Seeding in post-fire window



Sow sufficient germinable seed before wettest time of year- is more better?

- Drill vs broadcast rates
- Standard or higher rates?
- Fall for winter moisture areas
- Sagebrush broadcast late fall-on snow
- Spring or mid-summer for summer rainfall areas

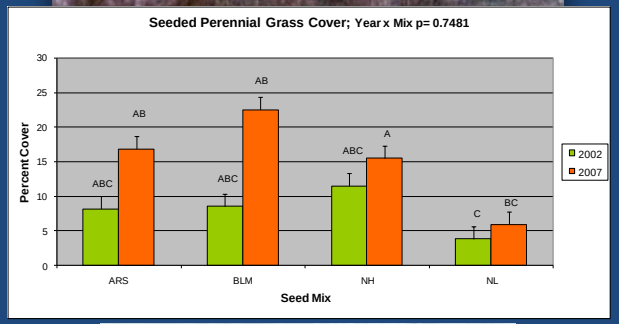


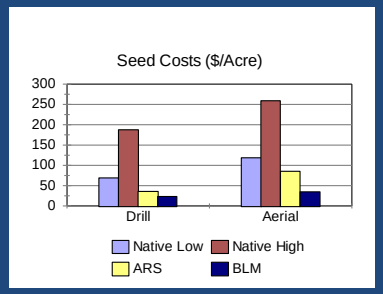


Plant adapted species able to establish

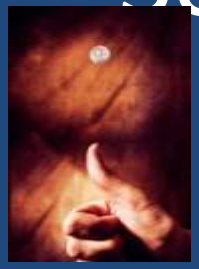
Willie Survive?- Is well begun, half done?

- Non-natives permitted for BAER objectives but natives preferred
- Historical success of introduced wheatgrasses
- Natives can be successful, especially grasses
- Lack of native seeds for some areas
- Pick your exotic- is kochia better than annual weeds?
- First 2 years critical

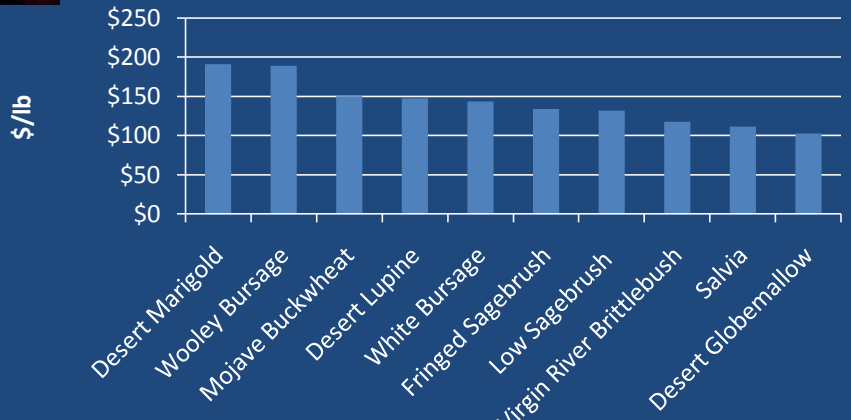




Seed costs and use Courtesy Scott Lambert



10 Most expensive species



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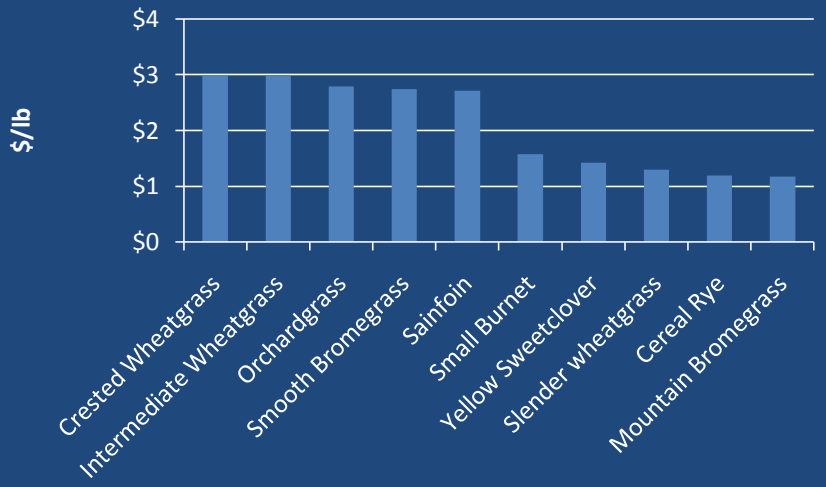

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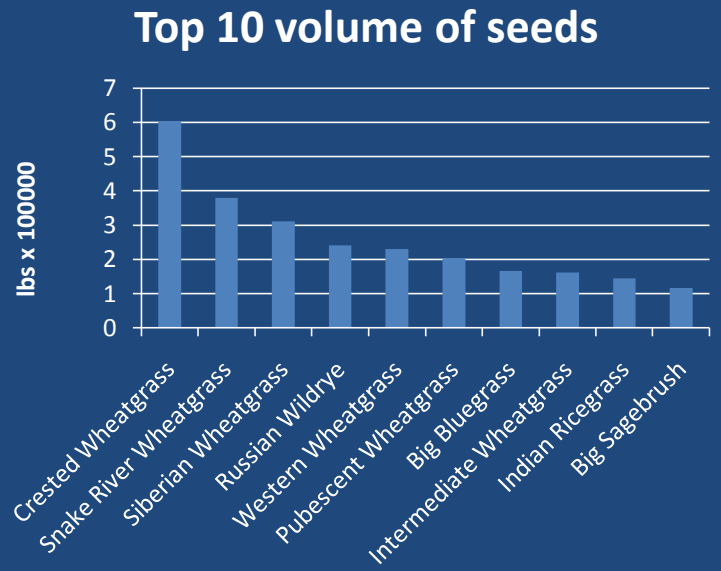
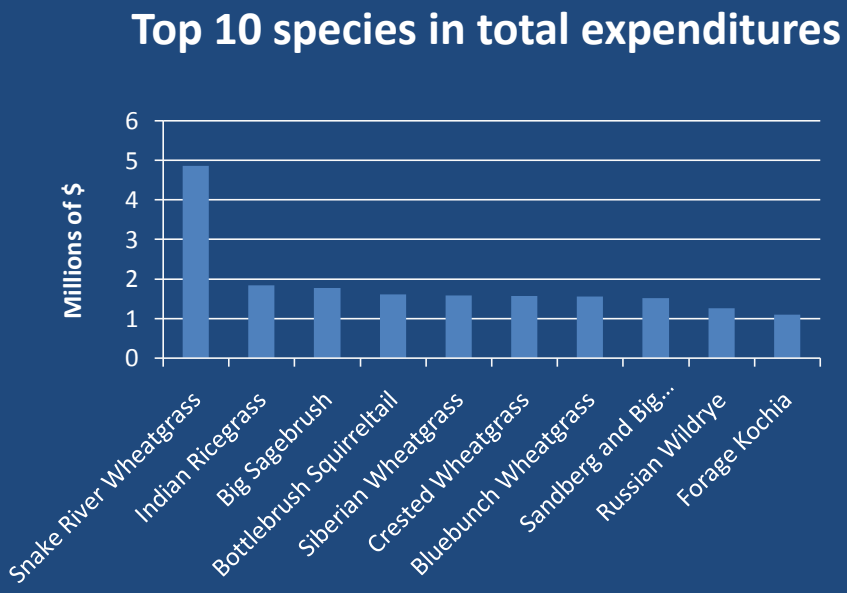
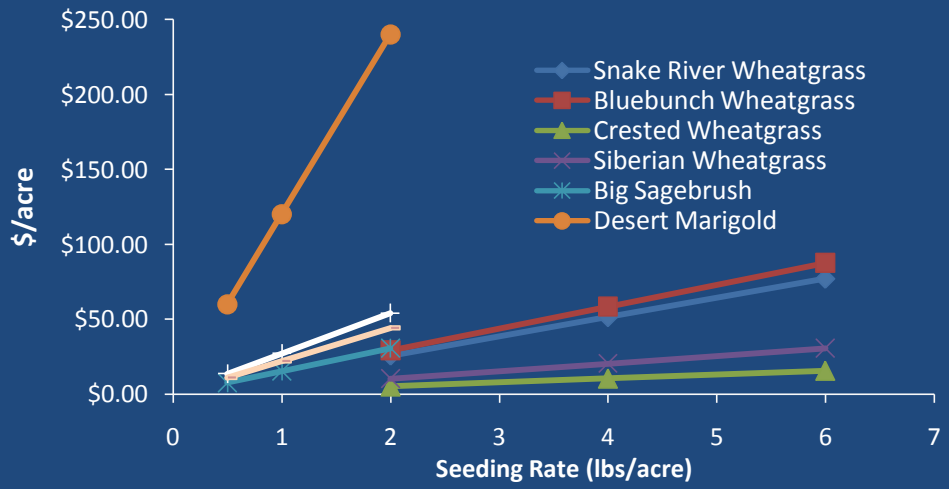






Seedbed, sowing adapted to seeded species, site- "some fell on good ground"

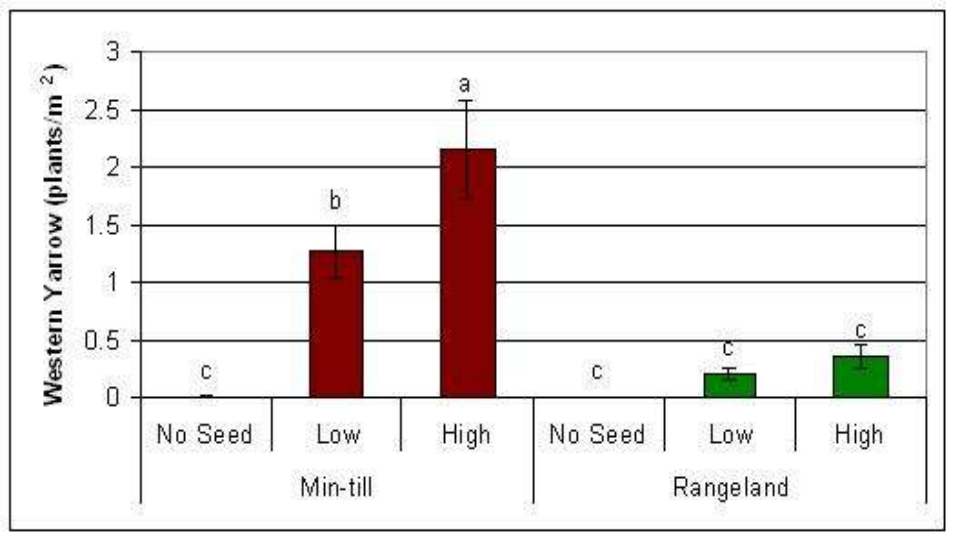
- Drill or aerial broadcast
- Standard vs new drills
- Chain or not?
- Seedbed modifications

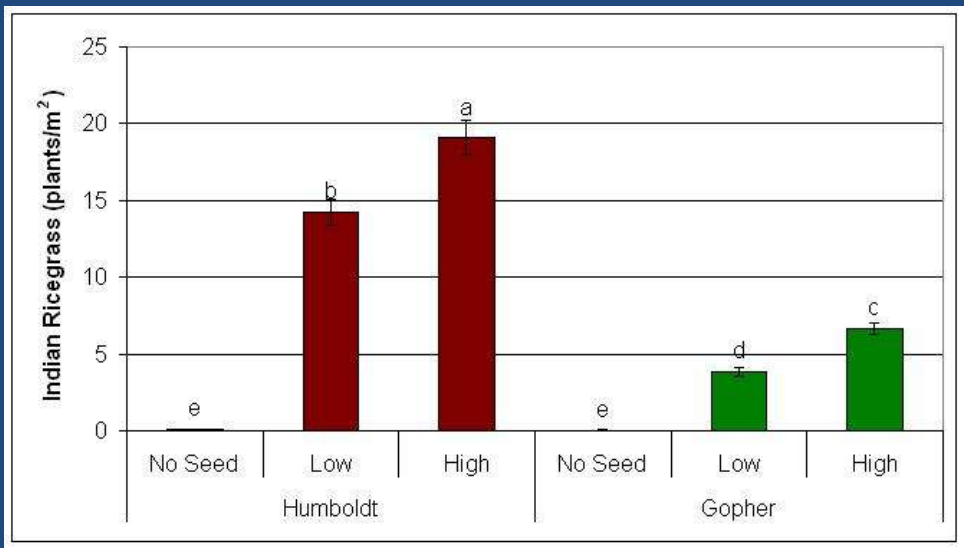
Seed Drills Courtesy Rob Cox and Nancy Shaw

Results: Density of Seeded Species

Courtesy Cox and Shaw

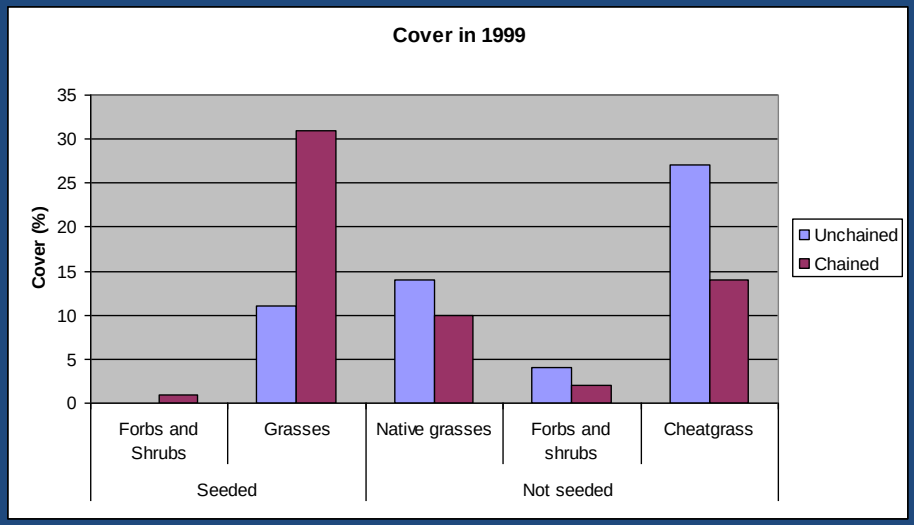
- Broadcast Species:
  - Significantly higher emergence at both low and high seeding rates from minimum-till drill
- Drilled Species:
  - No difference between drill types



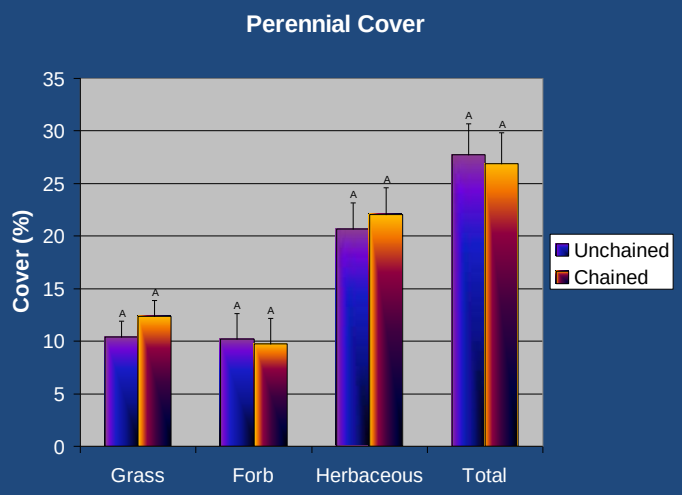


To chain or not to chain?

- Ott study- 1996 fires

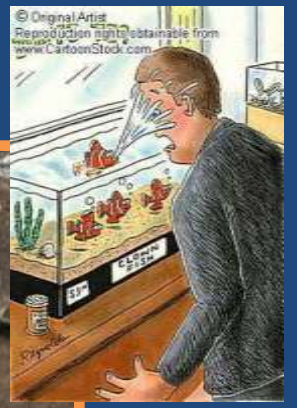


- Henry Mountain study



Courtesy Matt Madsen

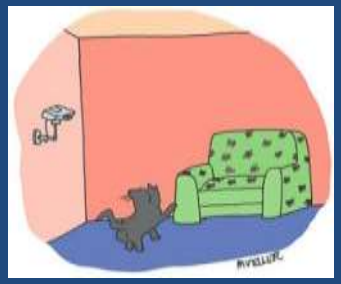
Chaining may reduce water repellency



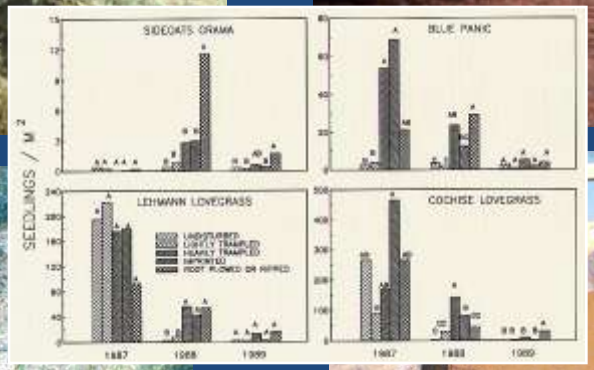
Maximizing chances in marginal areas

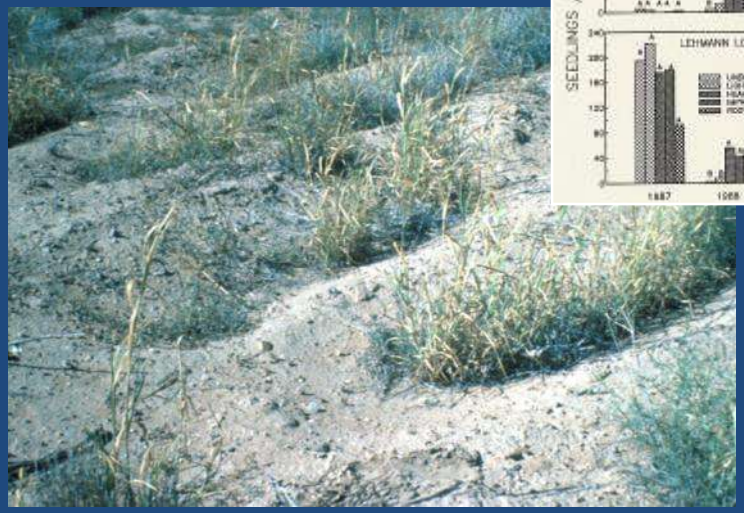
Small-scale approaches

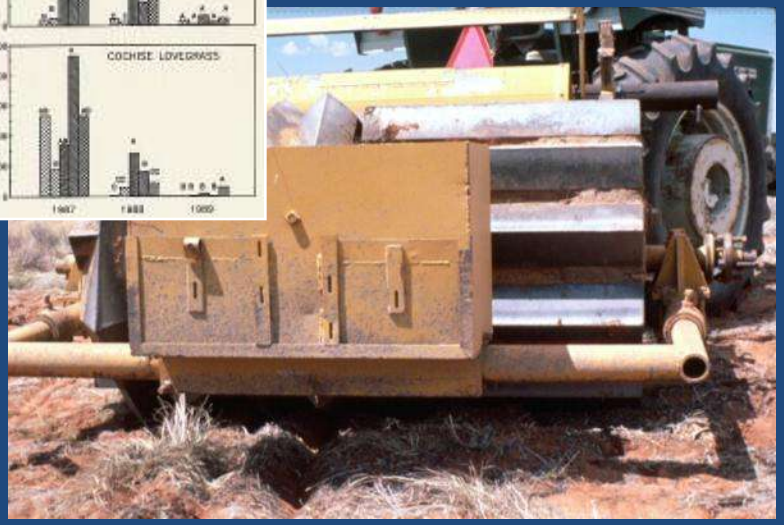
- Transplant to avoid seedling stage
- Spot or large-scale irrigation
- Capture water: runoff-run-in approaches
- Pitting, contour furrowing



Seedbed modifications to enhance direct-seeding establishment



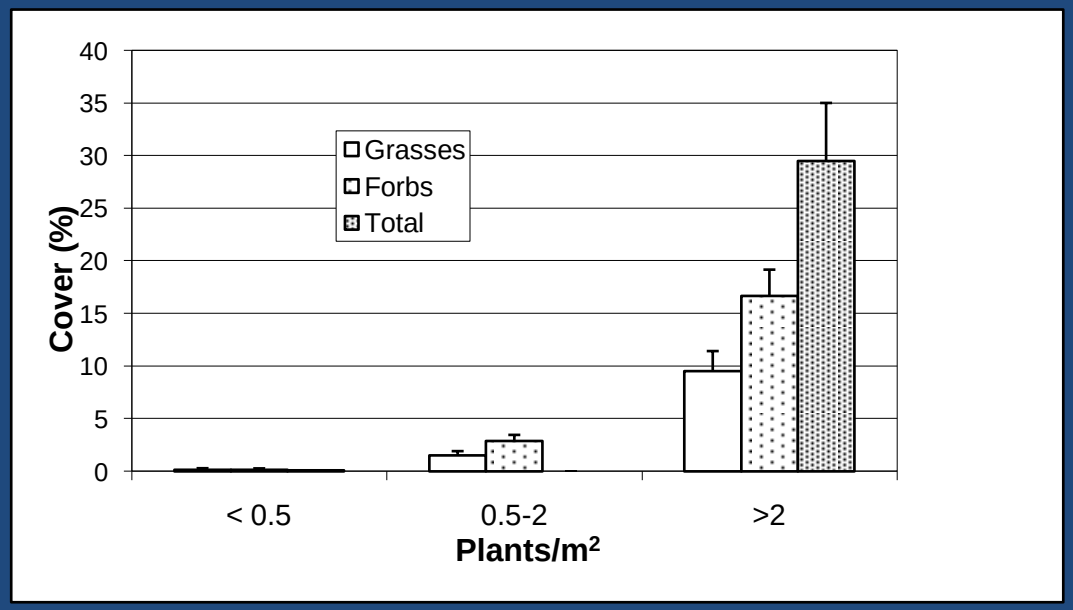




Post-seeding monitoring and management- Boomerang or baseball?

What is success?

- Initial density of weeds and seeded species?
- Initial success categories?
- Cover of desirable/seeded species?



- Information
  - Projects
  - Designed
    - Small scale
    - Large scale
    - Mechanistic

Observations from the field

- Seeding species native to community with no proven establishment ability often results in failure
- Chaparral and mountain brush have better success than lower elevation sites, but don't need seeding as much
- Broadcast kochia is establishing in burned blackbrush
- Forbs like small burnet, blue and Lewis flax, and yarrow have success in some aerial seedings, persistence varies
- Native and introduced wheatgrasses most successful
- Grazing by wildhorses, wildlife, rodents can damage seedings
- Some managers think more time is needed to determine success, but seed longevity? Sagebrush may show up later.

Conclusions

- Direct seeding is risky for lower elevation and precipitation zones
- Bury seeds to improve success
- Broadcasting small-seeded species works sometimes
- Use proven introduced species on drier sites to break invasive fire cycle
- Use native grasses when available, other native species when feasible
- Avoid expensive, unproven species
- Pray for rain
- Monitor