Seeding Mixes For Sage Grouse Habitat Restoration

Developed by the Western Plant Materials Consortium - 2014

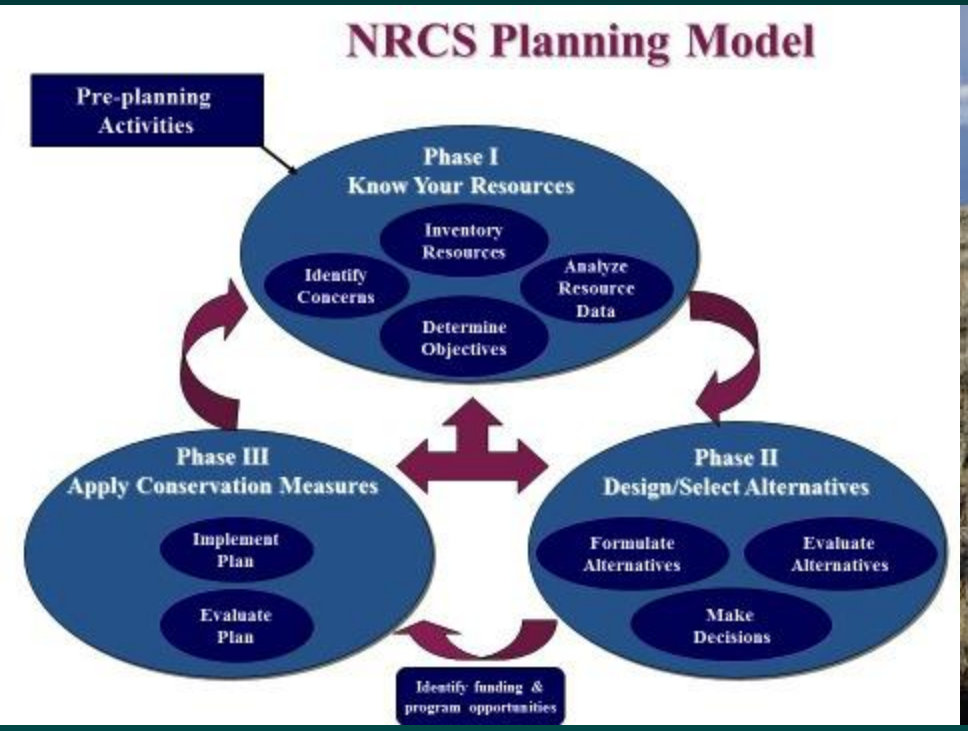
Outline

I. Planning

II. Common Scenarios

III. Developing Seed Mixes

I. Planning


NRCS Planning Model
Pre-planning Activities
Phase I
Know Your Resources
Inventory Resources
Identify Concerns
Analyze Resource Data
Determine Objectives
Phase II
Design/Select Alternatives
Formulate Alternatives
Evaluate Alternatives
Make Decisions
Phase III
Apply Conservation Measures
Implement Plan
Evaluate Plan
Identify funding & program opportunities

Planning Stage Assumptions/Considerations

- USGS results – having the right expectations
  -Many seedings not meeting the desired results
- Primary concern: Wildlife habitat
- Issue of monocultures
- Weed management before and after seeding

To Seed or Not to Seed?

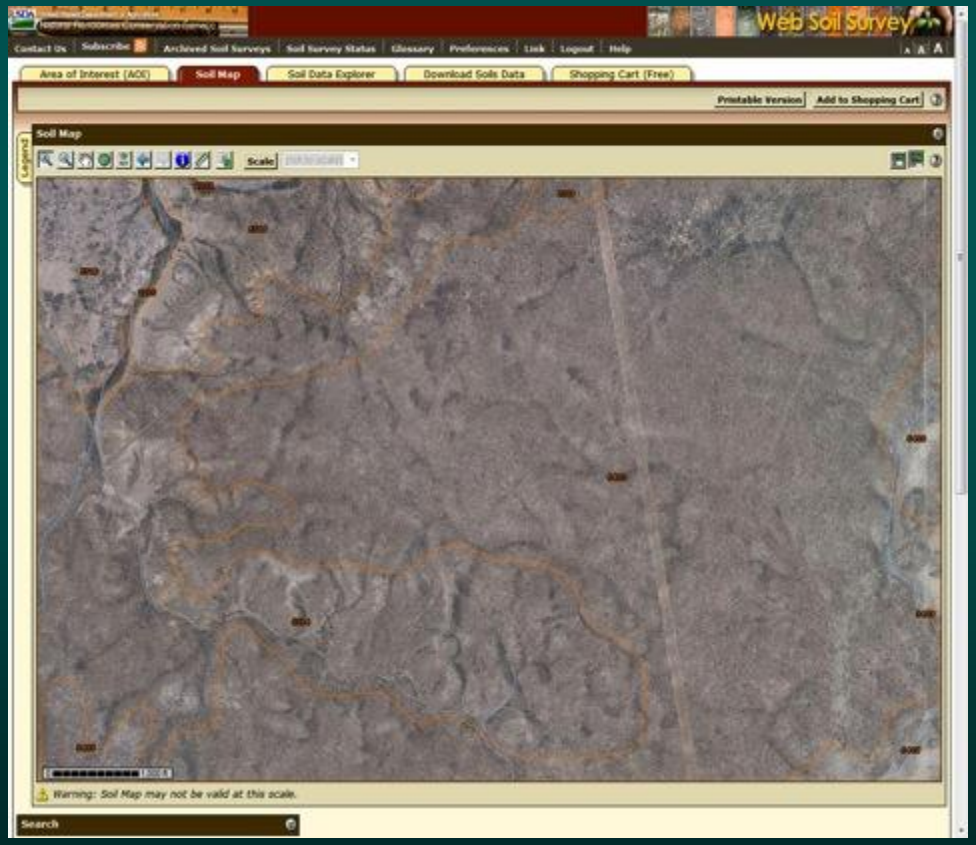
- Consider
  - If desired species represent less than 25% of the existing on-site plants, then consider reseeding.
  - Non-irrigated plantings on rangeland frequently fail
  - 50% failure rate in the Inter-mountain West
    - Highest rates in areas with under 10 inches annual rainfall
  - 80% failure rate in Southwest deserts
  - Reseeding is expensive
    - $45.00 per acre and UP
  - Site preparation and reseeding processes may further degrade the site by encouraging noxious weeds

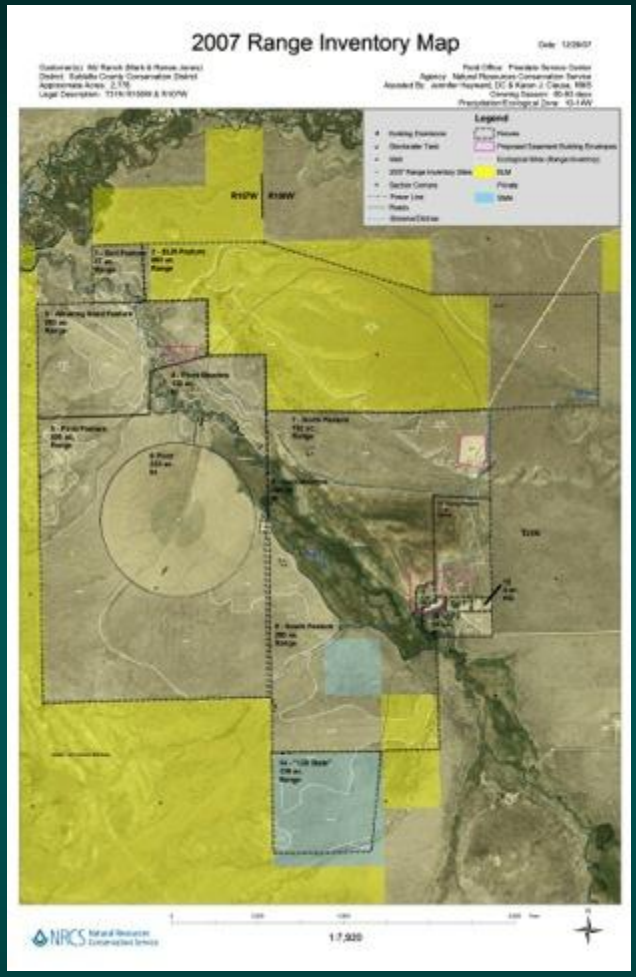
When Not to Seed

- Diversification seedings are risky
  -They may actually make things worse
- Seeding in areas with <12” precipitation is very difficult
- Chances of success improve with precipitation
- Native mixes fair poorly in sites with heavy weed density or seed bank
- Inter-seeding to increase diversity is not recommended

Site and Resource Inventory

- Complete good site inventories
- Don’t jump to species selection
- Document your findings





Inventory - Climate

- Growing season
- High and low temperatures
- Amount and timing of precipitation

Inventory - Soils

- Texture
  - sands
  - silts
  - clays
- Drainage
  - well or poorly drained
- Water holding capacity **(droughtyness)?**
- Chemistry
  - salinity, pH, other properties

Inventory – Weeds?

- Control of weed competition is critical!
- Consider weed seed bank implications
- Consider the possible residual effects of weed control
- Consider time interval needed for preparing a clean seed bed

competition

Inventory - Equipment

- Determine what type of equipment is needed for site preparation and planting and what type of equipment is available

- Broadcast?
- Drill?
- Hydro-Seed?
- Aerial?

Species-Specific Factors When Choosing Your Plants

1. Competitive ability of each species

2. Longevity
   - -Annuals – appropriate for irrigated sites only and to prepare site for future long-lived plantings
   - -Short-lived perennials – appropriate as cover crop for long-lived perennial planting mixtures
   - -Long-lived perennials – appropriate for dryland, rangeland and irrigated plantings

3. Distinctive growth habits of the species

Species Selection

Native Species

- (+) Well adapted to environmental extremes
- (+) Function well as part of native plant community
- (-) May not compete well with introduced weeds
- (-) May be difficult to establish (slow), especially where noxious weeds are prevalent

Introduced Species

- (+) Well adapted to environmental extremes
- (+) May compete well with introduced weeds
- (+) Typically easy to establish (fast)
- (-) May form monocultures with limited diversity
- (-) Concerns about spreading into non-target areas

Why Consider Introduced Species?

Natural recruitment in arid rangelands: 5 to 10 years

Rain has to fall in the right quantities at the right time.

That means a seeding of native species has a 1/5 to 1/10 chance of establishing the year you plant it.

Using more vigorous, drought resistant introduced species increases the likelihood of success in dry years.

II. Common Scenarios

Scenario 1: Low precipitation/ mostly native grasses/ poor cover/ few forbs

- 1) Leave alone
  - Tillage often brings new weed seeds to the surface
  - Interseeding is not recommended and typically fails
  - Consider forb/shrub islands
- 2) If post-fire, good opportunity to seed native mix

Scenario 2: Low precipitation/ introduced perennials or annual weeds dominate

- For establishment of natives, site preparation is recommended
  - Reduce seed bank
  - Tillage and/or chemical fallow for 2+ years
- If site prep is not feasible, reseed to introduced perennials

Scenario 3: Higher precipitation/ strong native plant community

1) Leave alone
   - Natural succession may meet objectives

2) Consider forb/shrub islands

3) If post-fire, good opportunity to seed diverse native mix

Scenario 4: Higher precipitation/ high weed pressure

- If possible, weed seed bank should be controlled
  - Tillage/chemical fallow before seeding natives
  - Establish perennial grasses to control broadleaf weeds
- If post-fire, immediate establishment of natives is possible, however weeds will likely be a problem

Typical Protocol for Preparing a Seedbed Currently in Perennial Vegetation

1) Shred or burn existing litter
2) Apply herbicides 1st spring, again if fall if green-up occurs
3) Apply herbicides 2nd spring, again in fall if green-up occurs
4) Plant new seed mixture as a dormant planting with no- till drill

OR

1) Plow 1st spring
2) Disk 1st fall
3) Disk 2nd spring
4) Disk 2nd fall and mechanically prepare final seedbed
5) Plant new seed mixture as a dormant planting

Proper Site Preparation

Pacific Northwest Weed Management Handbook http://weeds.ippc.orst.edu/pnw/weeds

Montana-Utah-Wyoming Weed Management Handbook http://invasive.org/weedcd/pdfs/wmh.pdf

III. Developing Seed Mixes

What Do I Need to Figure Out?

1) Which species to use (to enhance sage grouse habitat, that match site conditions, that are commercially available, cost effective, etc.)?

2) The relative percentage of each species in the mix (so you hopefully get a desirable, functioning stand composition)?

3) The proper selection, source, and quality of seed?

4) The amount of pure live seed to plant per acre of each species in the seeding mix when broadcast seeding a good site?

5) The amount of pure live seed to plant per acre of each species in the seeding mix when broadcast seeding a critical site?

6) Is the planting successful in terms of my goals? (assessment/evaluation).

Common Mistakes

- Seed mixes contain species requiring more precipitation than the site provides
- Familiar species get over used
- Species not are adapted to the project soils
- Short term cost is given more importance than long term objectives

Which Species and Relative Amounts in the Mix? – Begin with Ecological Site Descriptions (ESDs)

Ecological Site Identification & Concept

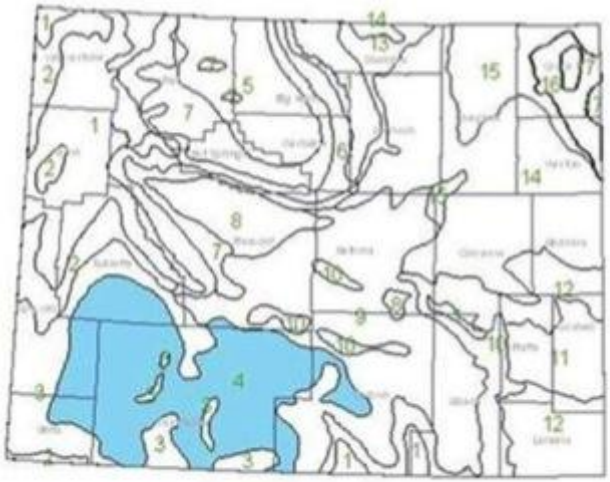
Site name: **Sandy (Sy) 7-9" Green River and Great Divide Basins**

Site type: Rangeland

Site ID: R034AY150WY

Major land resource area (MLRA): 034A-Cool Central Desertic Basins and Plateaus

Precipitation Zones for Rangeland Ecological Site Descriptions



Physiographic Features

This site occurs on nearly level to 30% slopes.

Landform: (1) Hill
(2) Alluvial fan
(3) Stream terrace

	Minimum	Maximum
Elevation (feet):	3800	5100
Slope (percent):	0	30
Flooding		
Frequency:	None	None
Ponding		
Depth (inches):	0	0
Frequency:	None	None
Runoff class:	Very low	Very high
Aspect:	No Influence on this site	

Climatic Features

Annual precipitation ranges from 10-14 inches per year. Wide fluctuations may occur in yearly precipitation and result in more drought years than those with more than normal precipitation. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This is predominantly due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring.

Wind speed averages about 8 mph, ranging from 10 mph during the spring to 7 mph during late summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 75 mph.

Growth of native cool season plants begins about April 1 and continues to about July 1. Native warm season plants begin growth about May 15 and continue to about August 15. Green up of cool season plants may occur in September and October of most years.

The following information is from the "Clearmont 5 SW" climate station:

Mean annual precipitation: 12.4 inches
Mean annual air temperature: 43.2 F (28.4 F Avg. Min. – 57.9 F Avg. Max.)
For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/ website.
Other climate station(s) representative of this precipitation zone include: "Dull Center"

	Minimum	Maximum
Frost-free period (days):	76	132
Freeze-free period (days):	110	145
Mean annual precipitation (inches):	10.00	14.00

Ecological Site Description ESD

Rhizomatous Wheatgrasses, Green needlegrass Community Plant Species Composition

Grass/Grasslike

Group	Group name	Common name	Symbol	Scientific name	Annual Production (pounds per acre) Low	High
1	-Rhizomatous Wheatgrasses				240	560
		streambank wheatgrass, thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	240	560
		western wheatgrass	PASM	*Pascopyrum smithii*	240	560
2	-Other Grasses				240	560
		green needlegrass	NAVI4	*Nassella viridula*	240	560
3	-Other Grasses				60	140
		Cusick's bluegrass, Cusick bluegrass	POCU3	*Poa cusickii*	60	140
4	-Other Grasses				60	140
		blue grama	BOGR2	*Bouteloua gracilis*	60	140
5	-Other Grasses				60	140
		hairy grama	BOHI2	*Bouteloua hirsuta*	60	140
6	-Miscellaneous Grasses/Grasslikes				120	280
		buffalograss	BUDA	*Buchloe dactyloides(syn)*	30	70
		needleleaf sedge	CADU6	*Carex duriuscula*	30	70
		plains reedgrass	CAMO	*Calamagrostis montanensis*	30	70
		prairie Junegrass	KOMA	*Koeleria macrantha*	30	70
		Sandberg bluegrass, big bluegrass, Canby bluegrass, alkali bluegrass	POSE	*Poa secunda*	30	70

Forb

Group	Group name	Common name	Symbol	Scientific name	Annual Production (pounds per acre) Low	High
7					90	210
		yarrow	ACHIL	*Achillea*	30	70
		textile onion	ALTE	*Allium textile*	30	70
		rosy pussytoes, rose pussytoes	ANRO2	*Antennaria rosea*	30	70
		aster	ASTER	*Aster*	30	70
		milkvetch	ASTRA	*Astragalus*	30	70
		tapertip hawksbeard	CRAC2	*Crepis acuminata*	30	70
		white prairie clover	DACA7	*Dalea candida*	30	70
		violet prairie clover, purple prairie clover	DAPU5	*Dalea purpurea*	30	70
		sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	30	70
		scarlet beeblossom, scarlet gaura	GACO5	*Gaura coccinea*	30	70
		desertparsley, biscuitroot	LOMAT	*Lomatium*	30	70
		bluebells	MERTE	*Mertensia*	30	70
		large Indian breadroot, breadroot scurfpea	PEES	*Pediomelum esculentum*	30	70
		upright prairie coneflower, prairie coneflower	RACO3	*Ratibida columnifera*	30	70
		stemless mock goldenweed	STAC	*Stenotus acaulis*	30	70
		American vetch	VIAM	*Vicia americana*	30	70

ESDs - Grasses

Rhizomatous Wheatgrasses, Green needlegrass Community Plant Species Composition

Common name	Scientific name	Annual Production (pounds per acre) Low	High
streambank wheatgrass, thickspike wheatgrass	*Elymus lanceolatus ssp. lanceolatus* *(Critana)	240	560
western wheatgrass	*Pascopyrum smithii* *(Rosana/Rodan)	240	560
green needlegrass	*Nassella viridula* *(Lodorm)	240	560
Cusick's bluegrass, Cusick bluegrass	*Poa cusickii* (wildland)	60	140
blue grama	*Bouteloua gracilis* *(Bad River)	60	140
hairy grama	*Bouteloua hirsuta* (wildland)	60	140

*** Selection (parentheses) added, commercially produced**

ESDs - Forbs

Rhizomatous Wheatgrasses, Green needlegrass Community Plant Species Composition

Common name	Scientific name	Annual Production (pounds per acre) Low	High
yarrow	*Achillea millifolium* *(Great Northern)	30	70
textile onion	*Allium textile* (wildland)	30	70
rosy pussytoes, rose pussytoes	*Antennaria rosea* (wildland)	30	70
aster	*Aster/Eucephalus/Eurybia/Symphyotrichum* (wildland)	30	70
milkvetch	*Astragalus* (wildland)	30	70
tapertip hawksbeard	*Crepis acuminata* (wildland)	30	70
white prairie clover	*Dalea candida* *(Antelope)	30	70
violet prairie clover, purple prairie clover	*Dalea purpurea* *(Bismarck/Kaneb)	30	70
sulphur-flower buckwheat	*Eriogonum umbellatum* (wildland)	30	70
scarlet beeblossom, scarlet gaura	*Gaura coccinea* (wildland)	30	70
desertparsley, biscuitroot	*Lomatium* (wildland)	30	70
bluebells	*Mertensia* (wildland)	30	70
large Indian breadroot, breadroot scurfpea	*Pediomelum esculentum* (wildland)	30	70
upright prairie coneflower, prairie coneflower	*Ratibida columnifera* *(Stillwater)	30	70
stemless mock goldenweed	*Stenotus acaulis* (wildland)	30	70
American vetch	*Vicia americana* (wildland)	30	70

*** Selection (parentheses) added, commercially produced**

ESDs - Shrubs

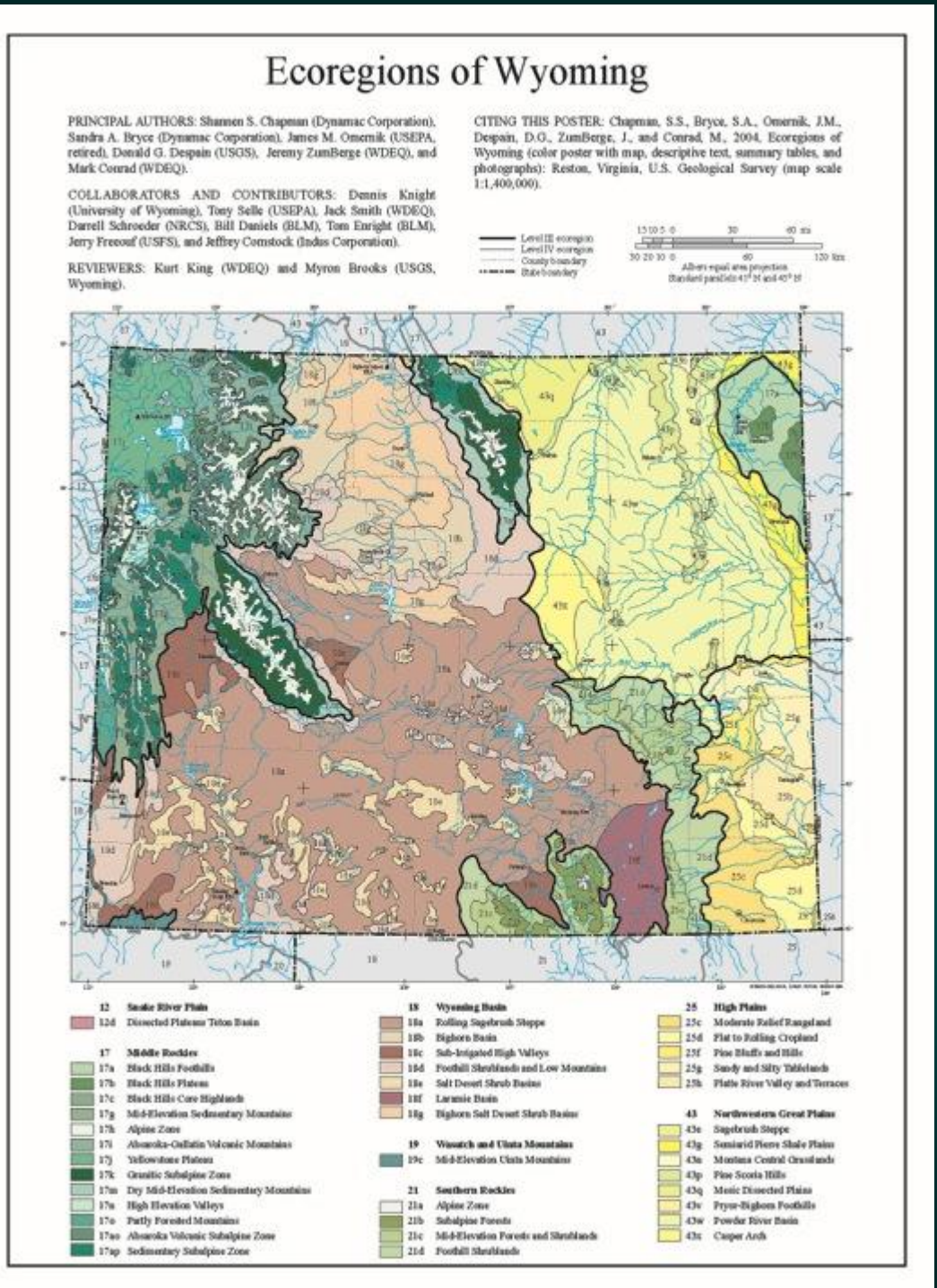
Rhizomatous Wheatgrasses, Green needlegrass Community Plant Species Composition

Common name	Scientific name	Annual Production (pounds per acre) Low	High
big sagebrush	*Artemisia tridentata* (wildland)	60	140
winterfat	*Krascheninnikovia lanata* *(Open Range)	30	70
rubber rabbitbrush	*Ericameria nauseosa* (wildland)	30	70

* Selection (parentheses) added, soon-to-be commercially produced

Ecological Site Description Not Available?

- Major Land Resource Areas (MLRAs)
- Soil Survey information
- Habitat Types
- Botanical surveys
- Study results
- Stand alone publications



Plant Materials Selections and Other Seed Sources for Sage Grouse Habitat Restoration

Species	Region[1]	Cultivar Germplasm	Pure Stand PLS Lbs/ Acre[2]
Bluebunch wheatgrass	GB, IMW, NGP	Whitmar, Goldar, P-7, Anatone	7
Snake River wheatgrass	GB	Secar	7
Bottlebrush squirreltail	GB	Sand Hollow, Fish Creek, Toe Jam Creek	7
Thickspike wheatgrass	GB, IMW, NGP	Critana, Bannock, Schwendimar, Sodar	6
Indian ricegrass	GB, IMW, NGP	Nezpar, Paloma, Rimrock, Ribstone	6
Big bluegrass	GB, IMW, NGP	Sherman	2
Sandberg bluegrass	GB, IMW, NGP	High Plains	2
Basin wildrye	GB, IMW, NGP	Trailhead, Magnar	7
Western wheatgrass	GB, NGP	Rosana, Arriba, Rodan	6
Galleta grass	GB	Viva	4
Slender wheatgrass	GB, IMW, NGP	Revenue, Pryor, San Luis	7
Mountain bromegrass	IMW	Bromar, Garnet	10
Idaho fescue	IMW	Joseph, Nezperce, Winchester	4
Little bluestem	NGP	Badlands	4
Side-oats grama	NGP	Pierre	4.5
Blue grama	NGP	Bad River	2

Species Information

- NRCS Plant Materials Technical Notes in the FOTG provide information on:

- Growth type
- Life span
- Precipitation
- Adaption to soils
- Native or introduced
- Palatability
- Phenology
- Seeds per pound
- Seeding depth
- Seeding rates
- Seedling vigor
- Varieties
- Common uses
- And other species specific information

Information in FOTG
(examples)

- Plant Materials TN 10 (ID, MT, WA) Pasture and Range Seedings (Planning-Installation-Evaluation-Management).

- Plant Materials TN 46 (MT) or Plant Materials TN 24 (ID) Conservation Plant Species for the Intermountain West.

Species Information

Excerpt from Plant Materials Technical Note ID-24.

Wheatgrass, Thickspike *Elymus lanceolatus* ssp. *lanceolatus*
A long-lived, native sod-forming grass widely distributed in the northern part of the Intermountain Region. More drought tolerant than western wheatgrass, it is well suited for wind erosion control on medium to coarse-textured soils. It is adapted to disturbed range sites and dry areas subject to erosion, roadsides, and waterways in the 8-18 inch precipitation areas. Planting depth is ¼ to ½ inch. Average seeds/ft^2 at 1 PLS lb. rate is 3. Recommend pure stand seeding rate is 8 lbs PLS/ac.

Common Name	Scientific Name	Approximate Seeds/Pound	PLS pounds/ acre for Full Stand[1,8]	PLS/ square feet PLS/ linear feet	C versus W [2] I versus D S versus F versus NP	Proven Selections
GRASSES-NATIVE						
cordgrass, prairie	Spartina pectinata	183,000	6	25	W-I-NP	Red River
fescue, Idaho	Festuca idahoensis	450,000	2.5	26	C-D-NP	Joseph, Nezpurs, Winchester
fescue, rough	Festuca campestris	171,000	6	24	C-D-NP	Common
fescue, spike	Leucopoa kingii	144,000	7	23	C-D-NP	Common
needle and thread	Hesperostipa comata (Stipa)	115,000	9	24	C-D-NP	AC Sharptail
needlegrass, green	Nassella viridula (Stipa)	186,000	6	26	C-D-F	Lodorm, Cucharas, AC Mallard
wheatgrass, thickspike	Elymus lanceolatus spp. lanceolatus	152,000	7	24	C-D-NP	Critana, Bannock
wheatgrass, western	Pascopyrum smithii	93,000	10	21	C-I or D-NP	Rosana, Rodan
prairie Junegrass	Koeleria macrantha (K. cristata)	2,300,000	1	53	C-D-NP	Common
prairie sandreed	Calamovilfa longifolia	273,000	4	25	W-D-S	Goshen, Pronghorn

Excerpt from MT Tech Note 46

Drill rate listed is the SINGLE SPECIES rate, i.e. 100% of one species

Adjust the seeding rate to the percentage of the species in the mixture.

Seed Mix Rules of Thumb

- Use 3 to 6 species (more if forbs are included).
- Be mindful of compatibility.
- More species will come in over time with natural succession

Caution – Combining Native and Non-Native Species is Generally Not Recommended.

Extra consideration should be used when combining native and introduced species together.

- Most introduced species are very competitive and may out-compete natives when planted together.

- Introduced forbs are usually OK to mix with native grasses

Developing the Seed Mix

Additional Things to Consider

- Expected life span of species
- Ease of establishment
- Native vs. introduced
- Local ecotypes
- Do the species require a cold stratification period? (native forbs often require stratification)
- Seed physical characteristics – (i.e. will a carrier such as rice hulls, kitty litter, or corn grit need to be added to the mix?)
- Legumes should be inoculated with the proper rhizobacteria

Example Seed Mix Developed from ESD

Species	Recommended Percentage in Mix
	%
Thickspike wheatgrass	25
Western wheatgrass	25
Green needlegrass	25
Yarrow	5
Purple prairie clover	5
White prairie clover	5
Wyoming big sagebrush	*5?*
Winterfat	5

Case Study: Reestablishing a native plant community on a reclaimed well-pad site in sage-grouse habitat near Pinedale.

Section I: Ecological Site Characteristics

Ecological Site Identification and Concept

Site name: **Sandy (Sy) 7-9" Green River and Great Divide Basins**

Site type: Rangeland

Site ID: R034AY150WY

Major land resource area (MLRA): 034A-Cool Central Desertic Basins and Plateaus

Precipitation Zones for Rangeland Ecological Site Descriptions

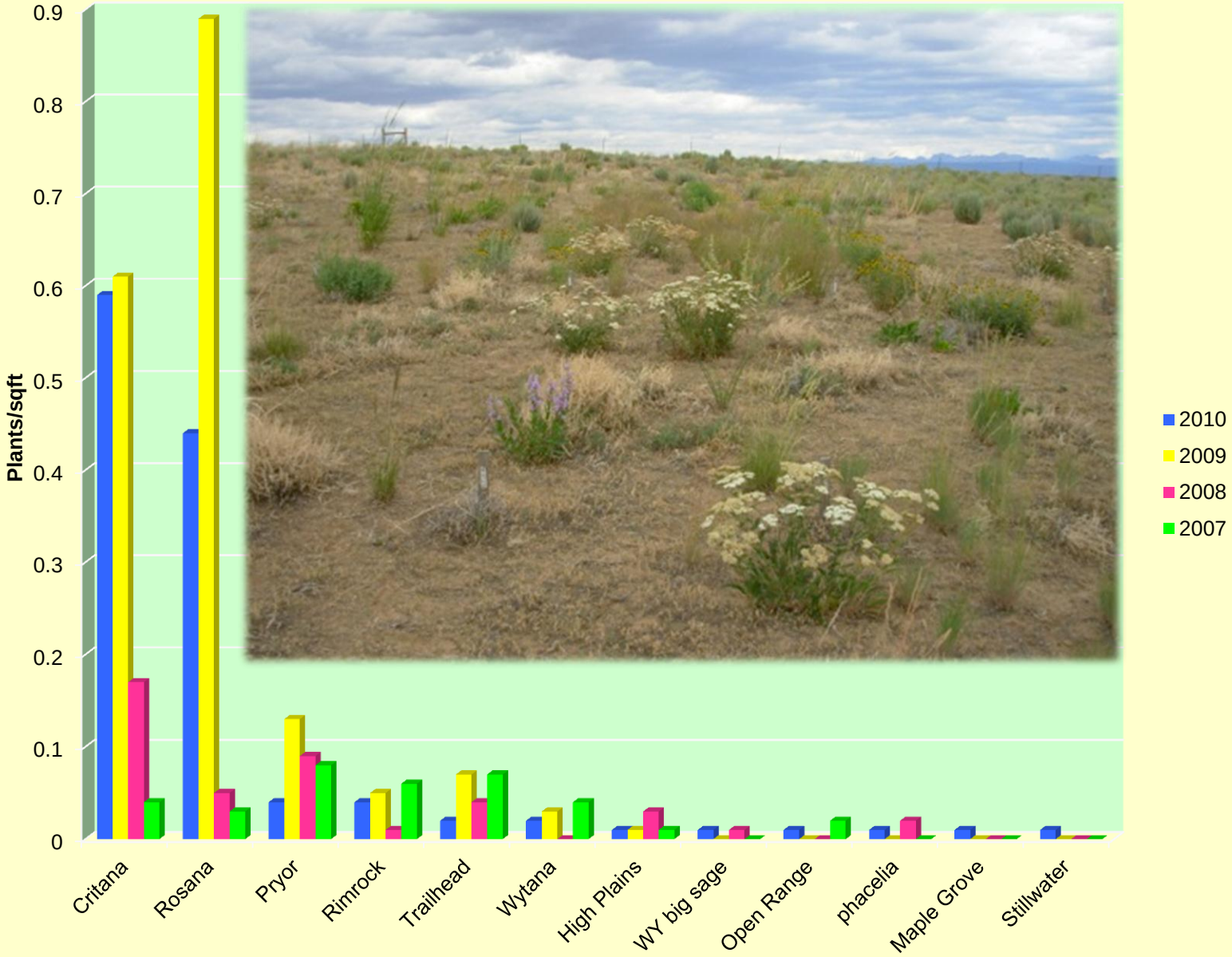
Mix 1 Shell-Pinedale Field Trial

Common name	Mix	Seeding Rate	Drill Rate	Broadcast Rate
	%	*lb/acre*	*seeds/ft²*	*seeds/ft²*
Pryor slender wheatgrass	12.8	2.3	5	10
Critana thickspike wheatgrass	12.8	1.5	5	10
Rosana western wheatgrass	12.8	2.3	5	10
High Plains Sandberg bluegrass	12.8	0.25	5	10
Rimrock Indian ricegrass	12.8	1.4	5	10
Trailhead basin wildrye	7.7	1.0	3	6
Great Northern western yarrow	5.1	0.02	2	4
Stillwater prairie coneflower	5.1	0.15	2	4
Maple Grove prairie flax	5.1	0.31	2	4
Silverleaf phacelia	5.1	0.19	2	4
Scarlet globemallow	2.6	0.17	1	2
Wytana fourwing saltbush	1.3	0.45	0.5	1
Open Range winterfat	1.3	0.06	0.5	1
Wyoming big sage	1.3	0.01	0.5	1
Fringed sage	1.3	0.005	0.5	1
Totals:	100	10	39	78

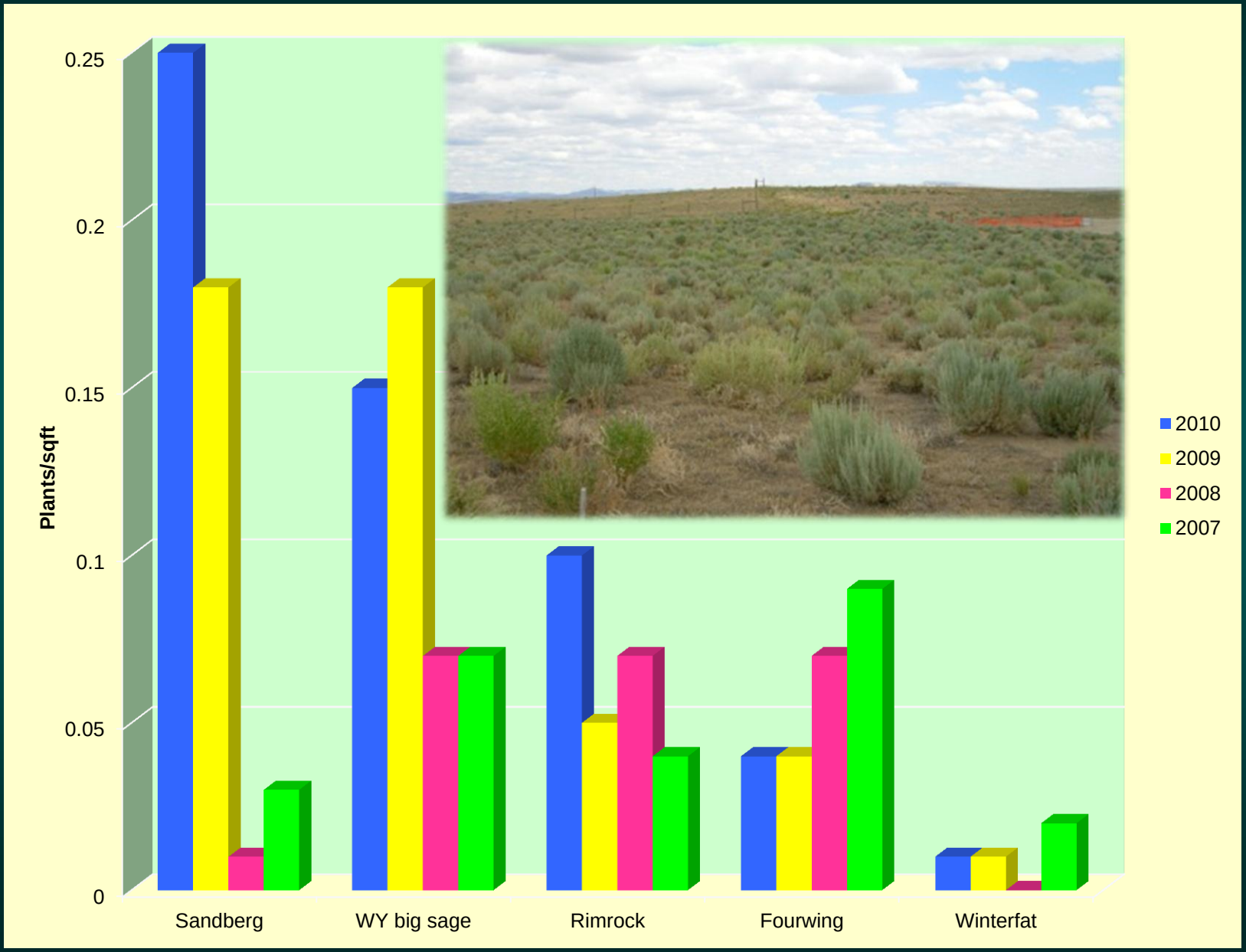
Mix 2 Shell-Pinedale Field Trial

Common Name	Mix	Seeding Rate	Drill Rate	Broadcast Rate
	%	*lb/acre*	*seeds/ft^2*	*seeds/ft^2*
Wyoming big sagebrush	41.50	0.50	28.70	57.40
Sandberg bluegrass	30.71	1.00	21.24	42.48
Fringed sagewort	7.53	0.05	5.21	10.42
Rydberg's penstemon	7.30	0.05	5.05	10.10
Indian ricegrass	4.68	1.00	3.245	6.48
North American white yarrow	4.60	0.05	3.18	6.36
Winterfat – bearded	1.88	1.00	1.30	2.60
Fourwing saltbush	0.86	0.50	0.60	1.20
Scarlet globemallow	0.50	0.03	0.34	0.68
Silvery lupine	0.43	1.00	0.30	0.60
Totals:	100	5.18	69.16	138.16

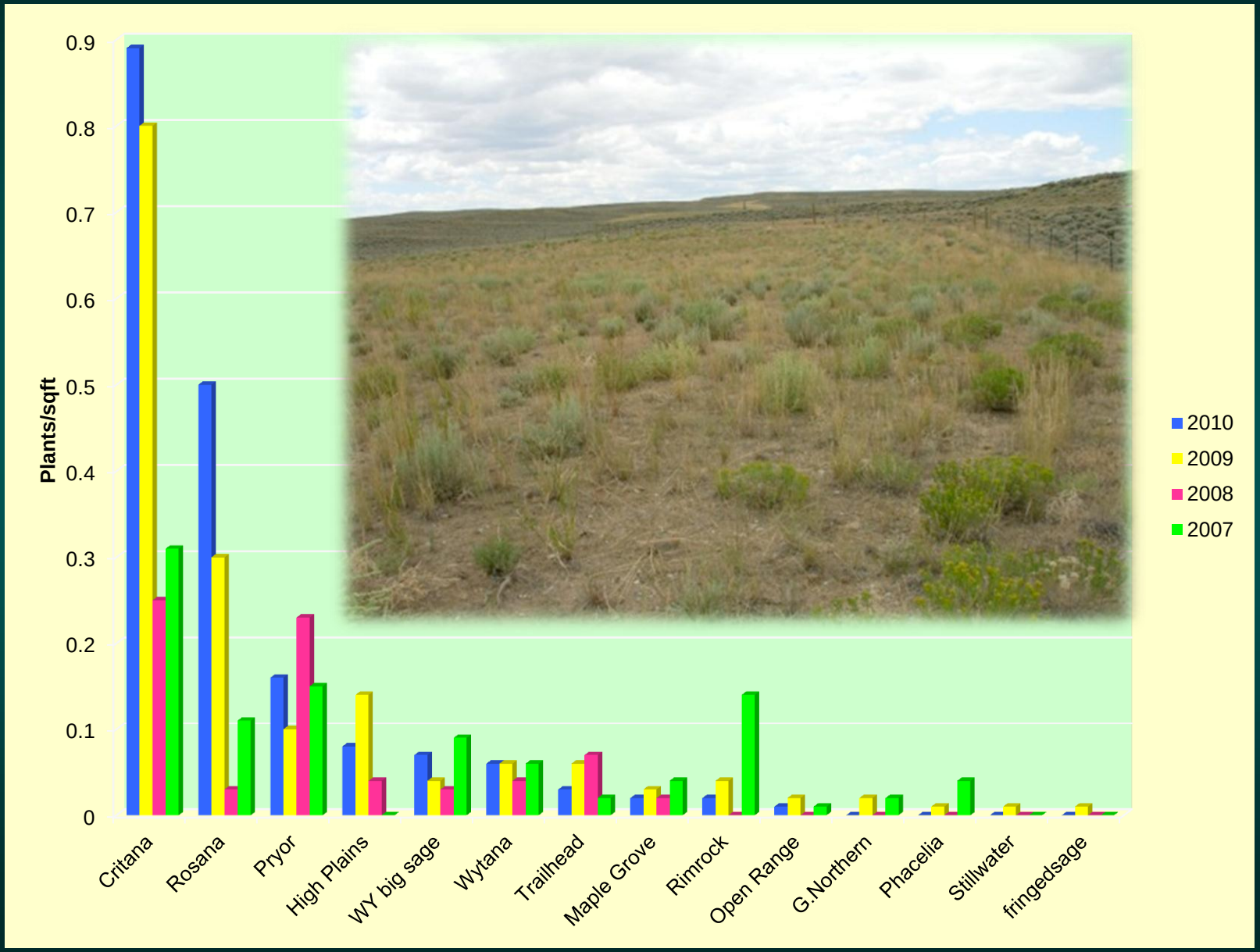
Drill-Seeded Mix 1



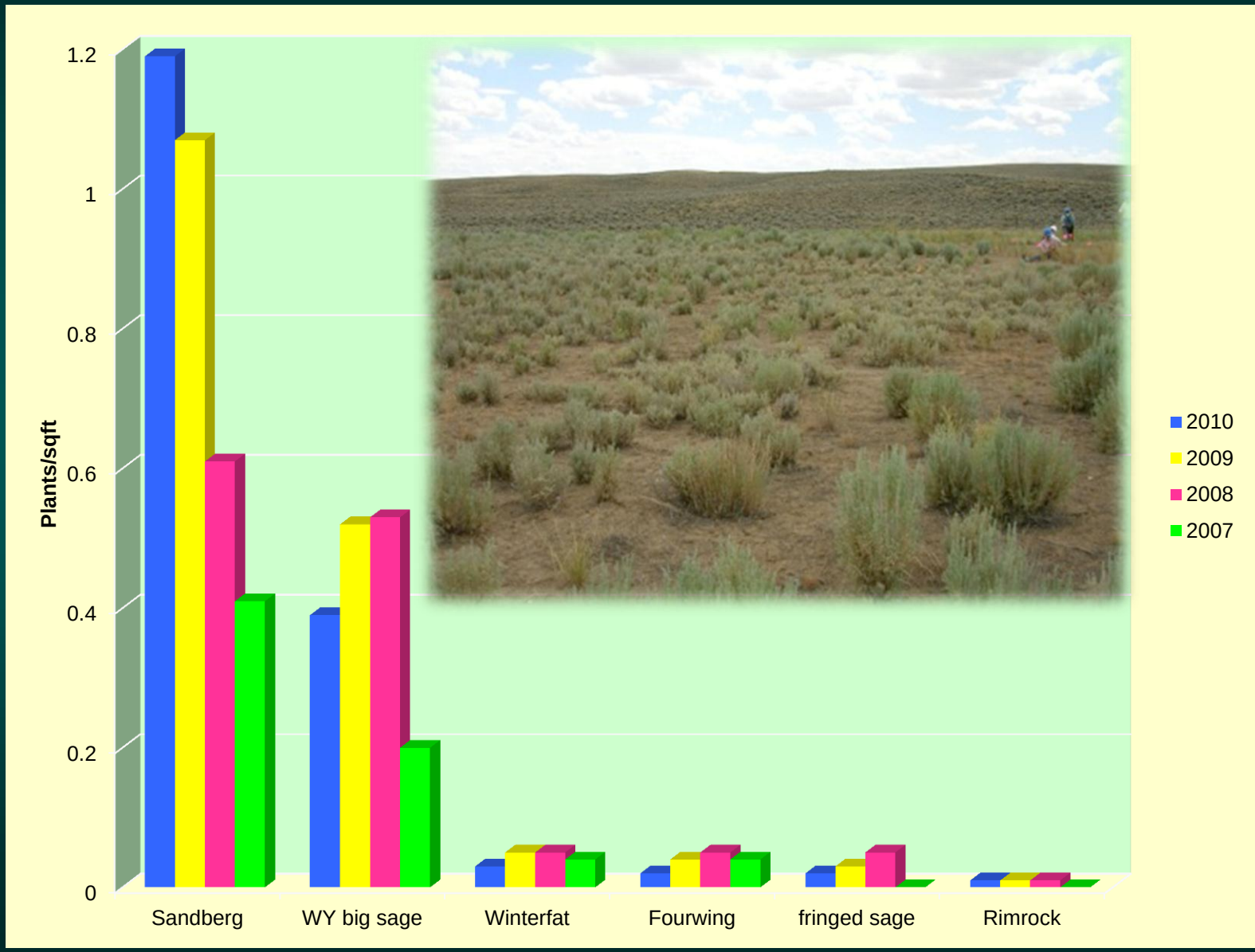
Drill-Seeded Mix 2

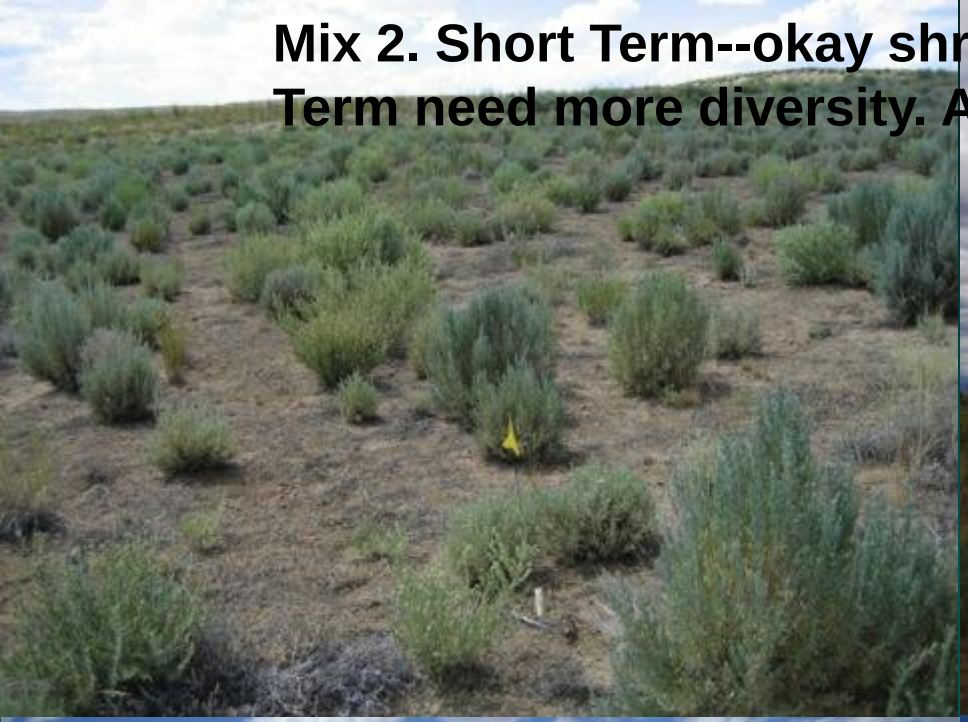


Broadcast-Seeded Mix 1



Broadcast-Seeded Mix 2





Mix 2. Short Term--okay shrub establishment. Long Term need more diversity. Adjust seeding rates down.

Mix 1. Long Term--okay species diversity. Short Term need more shrubs. Adjust seeding rates up.

Useful References

National Plant Materials Program:
http://www.nrcs.usda.gov/wps/portal/nrcs/main/plantmaterials/pmc/west/mtpmc/

Bridger Plant Materials Center (Montana NRCS):
http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/mt/plantsanimals/?cid=nrcs144p2_057491

IDAHO PMC Rice Hull Calculator:
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/id/technical/?cid=nrcs144p2_047763

PLANTS Database:
http://plants.usda.gov/java/

Montana Technical Note Plant Materials MT-46 (rev. 4), *Seeding Rates for Conservation Species in Montana* at:
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mt/plantsanimals/?cid=nrcs144p2_057736

Montana Technical Note Plant Materials MT-38, *Reading Seed Packaging Labels and Calculating Seed Mixtures* at:
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mt/plantsanimals/?cid=nrcs144p2_057621

Questions?

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More information:

- *National Plant Materials website:* http://www.nrcs.usda.gov/wps/portal/nrcs/site/plantmaterials/home/

- *National PLANTS website:* http://plants.usda.gov/java/