

A photograph of a dry, grassy field with some industrial structures in the background. The foreground is dominated by sparse, dry grasses and small green plants growing in cracked, reddish-brown soil. In the background, there are some industrial structures, including a tall metal tower and a large rectangular tank, under a clear blue sky.

Shell Rocky Mountain Pinedale Anticline Revegetation Pilot Project

Overview

Objective:

- Reintroduce native plant species supportive of sage grouse and ungulate habitat to numerous interim reclaimed drill locations over the full length of the Pinedale Anticline gas field.

Variables to be Examined and Tested:

- New “Shell Habitat Blend” seed mix
 - Reduce grass emphasis
 - Based largely on native plant species critical for food and cover for sage grouse/ungulates
- Site or area specific soil amendments to jump-start soil conditions for native species to thrive
- Seeding techniques – range drill and hydroseeding
- Effectiveness of fencing on seeded locations to protect against cattle grazing during first few seasons of new plant growth
- Topsoil pile seeding
 - Seed with grass species that would provide temporary forage, reduce weed infestation and keep soil mycorrhizal conditions favorable for accelerated re-establishment of native habitat during reclamation

FALL 2004 SEEDING

Daniel

Pinedale

Boulder

-  Hydroseeded Pit
-  Drill Seeded Pit
-  Overseeded Pit
-  Hydroseeded Fill/Cut Slope
-  Seeded Topsoil Pile

FALL 2004 SEEDING

Seed Mix

Shell Recommended Sage Habitat Mix

Species	#Acre	Seeds/#	Seeds/Ft2	% Seeds	Justification
Indian Ricegrass, Rimrock	1.00	141,000	3.24	4.68	Good winter forage value for wildlife and cattle, drought tolerant
Four-winged Saltbush	0.50	52,000	0.60	0.86	Valuable browse in winter for big game, attracts insects
Globemallow, Scarlet	0.03	500,000	0.34	0.50	Excellent forage value for deer and pronghorn
Sandberg Bluegrass	1.00	925,000	21.24	30.71	Good for cattle, fair for sheep, deer and pronghorn in spring, early summer
Lupine, Robinson L. polyphyllus	1.00	13,000	0.30	0.43	Sage-grouse food source and habitat for insects for grouse, adds soil nitrogen
Winterfat	1.00	56,700	1.30	1.88	Good winter forage value for wildlife and stock
Yarrow, white N. American	0.05	2,770,000	3.18	4.60	Sage-grouse food, adapted to a wide range of soils at disturbed sites, attracts insects
Penstemon Procerus	0.05	4,400,000	5.05	7.30	Forage value fair for mule deer
WY Big Sagebrush	0.50	2,500,000	28.70	41.50	Provides excellent habitat for sage grouse and winter browse for big game
Fringed Sagewort	0.05	4,536,000	5.21	7.53	Transitional food for juvenile sage-grouse
	5.18		69.15	100.00	

FALL 2004 SEEDING

A large red and white seeding machine is shown in a vast, flat, brown field under a blue sky with scattered white clouds. The machine is emitting a long, thin stream of material from its rear. In the background, there are some distant structures and mountains.

- 8 Reclaimed Pit Locations (31 acres)
 - 3 hydroseeded (all fenced)
 - 5 drill seeded with Truax Rough Rider (BLM)
 - 3 ½ - No Amendments added (split one location)
 - ½ fenced; 3 not fenced
 - 1 ½ - Amendments added (split one location)
 - 1 ½ fenced

A large, dark-colored Truax Rough Rider overseeder is shown from a rear-quarter perspective, moving through a field of dry, yellowish-brown grass. The machine has a yellow canopy and is equipped with multiple rows of seeding equipment. The background shows a vast, flat landscape under a clear sky.

FALL 2004 SEEDING

- 6 Overseed Locations (18 acres) – drill seeded with Truax Rough Rider
 - 3 – No Amendments added
 - 2 fenced; 1 not fenced
 - 3 – Amendments added
 - ½ fenced; 2 ½ not fenced (split one location)

FALL 2004 SEEDING

➤ 5 Fill/Cut Slopes – hydroseeded (1.5 acres)



FALL 2004 SEEDING

- 26 Topsoil Piles seeded w/ Slender Wheatgrass



FALL 2005 SEEDING

Daniel

Pinedale

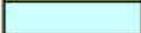
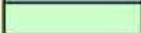
Boulder

-  Hydroseeded Pit
-  Drill Seeded Pit
-  Hydroseeded Misc Location
-  Drill Seeded Misc Location or ROW
-  Hydroseeded Fill/Cut Slope
-  Seeded Topsoil Pile

FALL 2005 SEEDING

seed Mix

Shell Habitat Seed Mix (SH)				
Species	#/Acre	Seeds/#	Seeds/Ft2	% Seeds
Indian Ricegrass, Rimrock	1.00	141,000	3.24	4.68
Four-winged Saltbush	0.50	52,000	0.60	0.86
Globemallow, Scarlet	0.03	500,000	0.34	0.50
Sandberg Bluegrass	1.00	925,000	21.24	30.71
Lupine, Robinson L. polyphyllus	1.00	13,000	0.30	0.43
Winterfat	1.00	55,700	1.30	1.88
Yarrow, white N. American	0.05	2,770,000	3.18	4.60
Penstemon Procerus	0.05	4,400,000	5.05	7.30
WY Big Sagebrush	0.50	2,500,000	28.70	41.50
Fringed Sagewort	0.05	4,536,000	5.21	7.53
	5.18		69.15	100.00

 Truax Range Drill Surface Seed Box (Fluffy Box = Middle Box)
 Truax Range Drill 1/4 Inch Deep Seed Box (Small Seed Box = Front Box)
 Truax Range Drill 1 Inch Deep Seed Box (Grass "Cool Season" Box = Back Box)

FALL 2005 SEEDING

- 11 Reclaimed Pit Locations (61 acres)
 - [2 Locations: hydroseed + drill seed]
 - 5 hydroseeded (incl. 1 partial; all fenced)
 - 8 drill seeded (incl. 1 partial and 1 re-seed)
 - 6 – Truax Rough Rider
 - 4 fenced
 - 2 – Truax Flex II
 - 1 fenced



FALL 2005 SEEDING

- 12 Miscellaneous Sites (14 acres)
 - 2 hydroseeded (4 acres)
 - 10 drill seeded w/ Truax Rough Rider

FALL 2005 SEEDING

➤ 3 Fill Slopes hydroseeded

FALL 2005 SEEDING

➤ 9 Topsoil Piles seeded (hand broadcast)

FALL 2006 SEEDING

Daniel

Pinedale

Boulder

-  Drill Seeded Pit
-  Re-seeded Pit (Truax drill)
-  Drill Seeded Misc Location or ROW
-  Re-seeded Fill/Cut Slope (hand seeding)
-  Seeded Topsoil Pile

FALL 2006 SEEDING

seed mixes

Shell Habitat Seed Mix 2006 (SH-06)

Species	#/Acre	Seeds/#	Seeds/Ft2	% Seeds
Winterfat	1.00	56,700	1.30	1.70
Yarrow, white N. American	0.05	2,770,000	3.18	4.16
Penstemon Procerus	0.05	4,400,000	5.05	6.61
WY Big Sagebrush	0.50	2,500,000	28.70	37.54
Fringed Sagewort	0.05	4,536,000	5.21	6.81
Globemallow, Scarlet	0.03	500,000	0.34	0.45
Sandberg Bluegrass	1.00	925,000	21.24	27.78
	2.00	159,000	7.30	9.55
Indian Ricegrass, Rimrock	1.00	141,000	3.24	4.23
Four-winged Saltbush	0.50	52,000	0.60	0.78
Lupine, Robinson L. polyphyllus	1.00	13,000	0.30	0.39
	7.18		76.45	100.00

Grass Mix for Topsoil Piles (GTP)

Species	#/Acre	Seeds/#	Seeds/Ft2	% Seeds
WY Big Sage	0.25	2,500,000	14.35	16.01
Slender Wheatgrass	4.00	159,000	14.60	16.29
Sandberg Bluegrass	2.00	925,000	42.47	47.40
Bluebunch Wheatgrass secar	3.00	140,000	9.64	10.76
Indian Ricegrass, Rimrock	2.64	141,000	8.55	9.54
	11.89		89.61	100.00

Grass Mix for Fill Slopes (GFS)

Species	#/Acre	Seeds/#	Seeds/Ft2	% Seeds
WY Big Sage	0.25	2,500,000	14.35	16.01
Slender Wheatgrass	4.00	159,000	14.60	16.29
Sandberg Bluegrass	2.00	925,000	42.47	47.40
Bluebunch Wheatgrass secar	3.00	140,000	9.64	10.76
Indian Ricegrass, Rimrock	2.64	141,000	8.55	9.54
	11.89		89.61	100.00

Hand Broadcast Mix

FALL 2006 SEEDING

- 
- **7 Reclaimed Pit Locations (28 acres)**
 - **8 Re-seeded Pit Locations (44 acres)**
 - **All drill seeded w/ Truax Flex II**
 - **No Amendments applied**

A wide-angle photograph of a dry, open field. A dirt road with tire tracks runs diagonally from the bottom left towards the center. To the right of the road, there is a long, narrow strip of earth, possibly a fill slope, that has been re-seeded. The ground is mostly brown and sandy, with some sparse, dry grass and small green plants. In the far distance, a dark vehicle is visible on the road, and the horizon shows rolling hills under a clear sky.

FALL 2006 SEEDING

➤ **5 Fill Slopes re-seeded (hand broadcast)**

FALL 2006 SEEDING



- **2 Topsoil Piles seeded**
- **26 Topsoil Piles re-seeded**
 - **Drill & hand seeded (Truax Flex II drill)**
 - **Grass/sage seed mix**

RESULTS

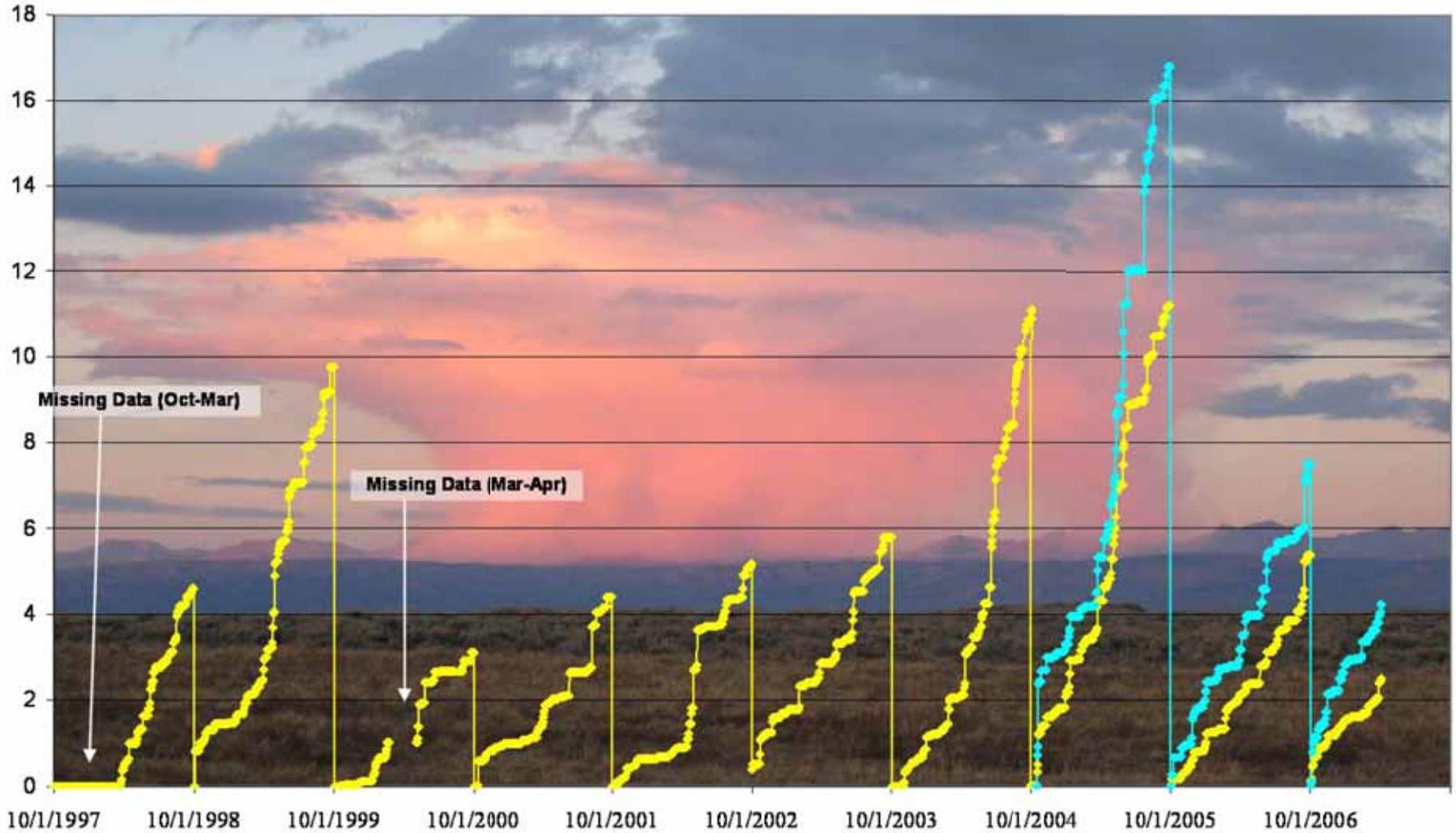
but first, a little context...

HAVE WE DISCUSSED
...RAIN?

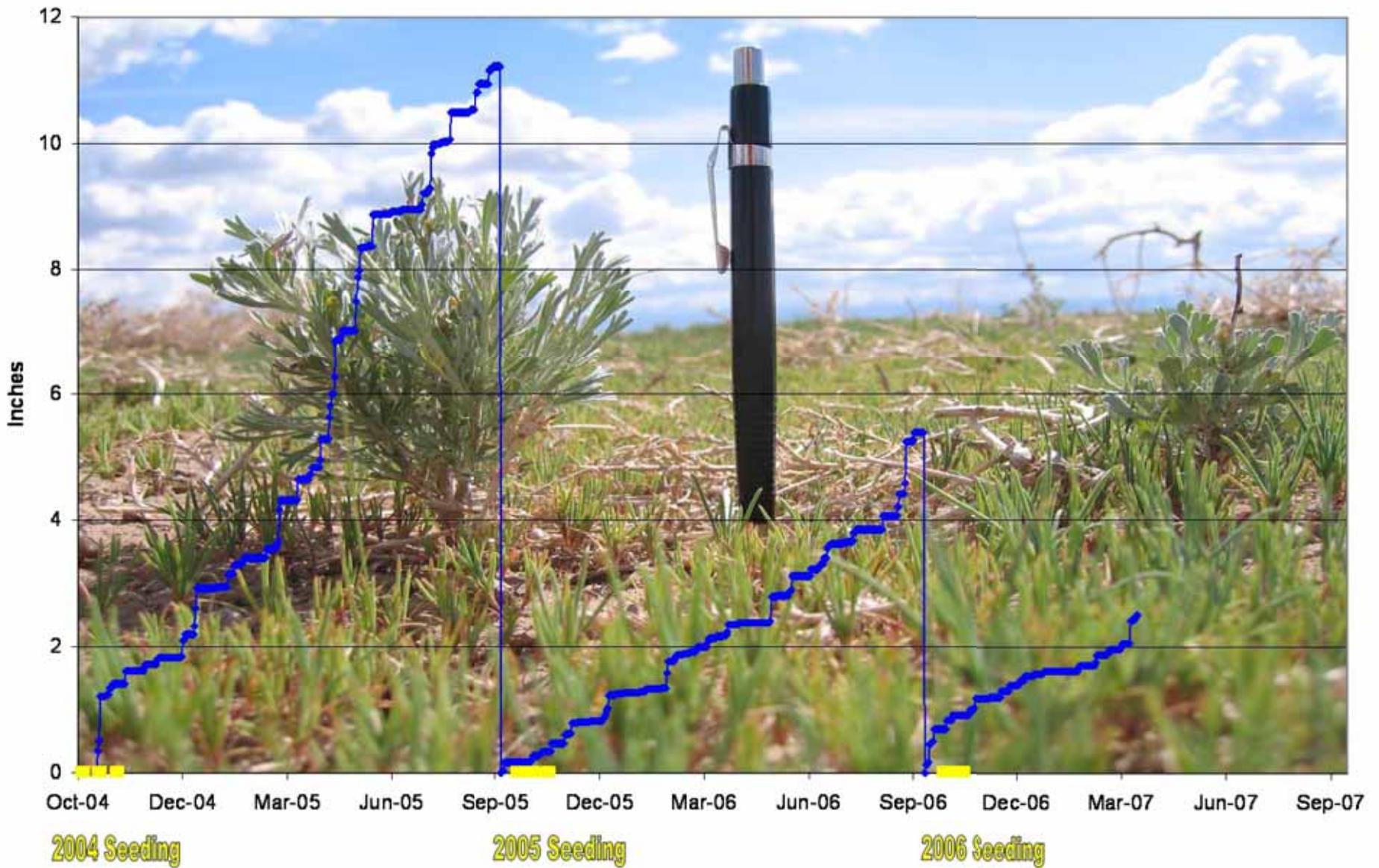
Cumulative Inches of Precipitation

Annually - Oct 1 through Sept 30

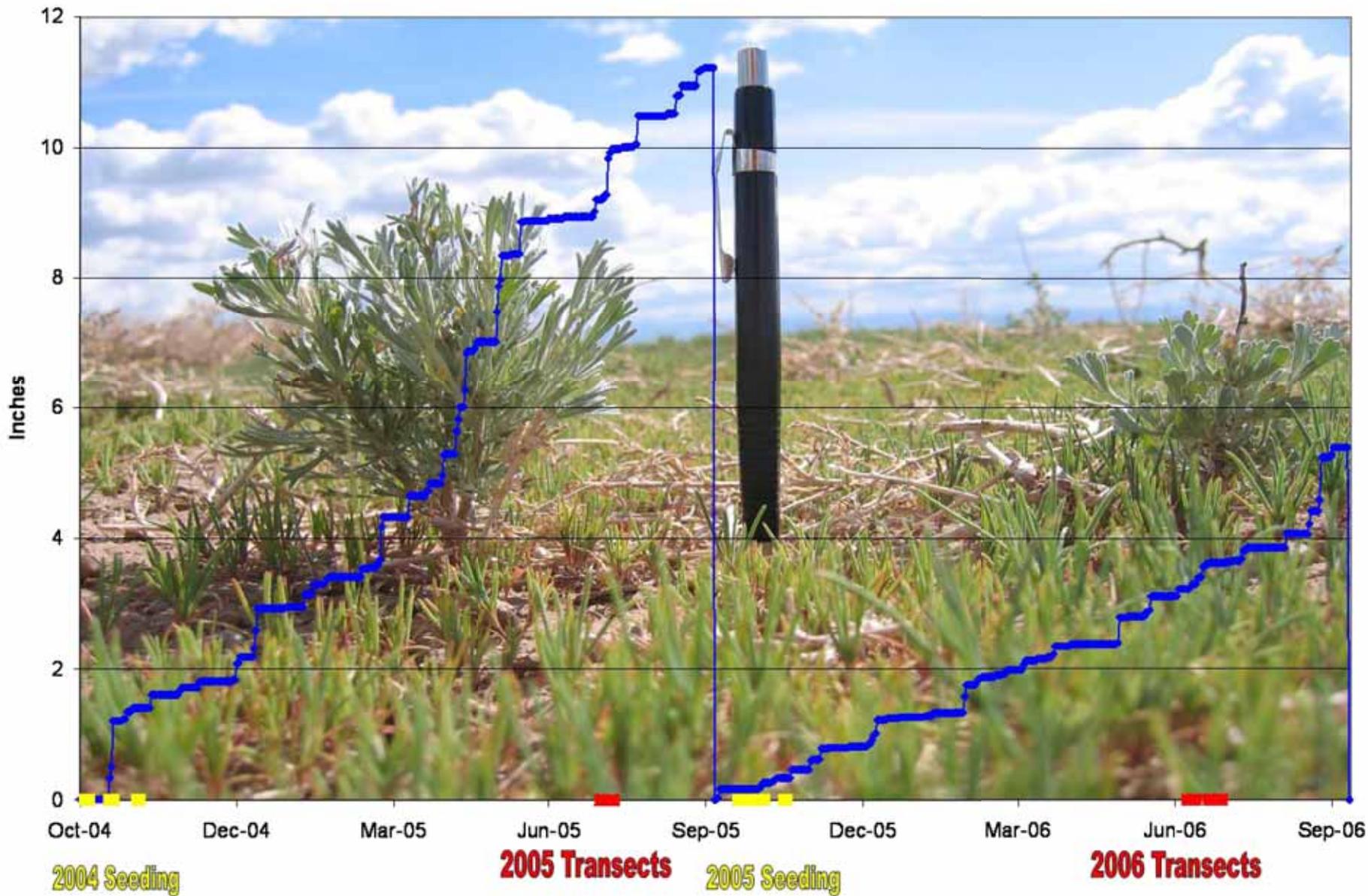
Big Piney Station Pinedale Station



Cumulative Inches of Precipitation
Annually - Oct 1 through Sept 30
Big Piney Station, WY



Cumulative Inches of Precipitation
Annually - Oct 1 through Sept 30
Big Piney Station, WY



2004-05

Good Precipitation Year

- Reclaimed Pit Locations seeded in 2004 all did well, with only one exception.
 - Mesa 6-28: dry, fluffy topsoil; seeded too soon after topsoil applied (Truax site w/ amendments)

2004-05

Good Precipitation Year



- **Overseed Locations not as successful**
 - Existing grasses obscured visual monitoring
 - No quantitative monitoring done until 2006

2005-06

Poor Precipitation Year

- Reclaimed Pit Locations seeded in 2005 did NOT do well, with 3 exceptions
- Locations seeded in 2004 continued to do well

2005-06

Poor Precipitation Year

- Overseed Locations not great, but somewhat better than anticipated
 - Data complicated by previous shrub/forb seeding



A note about transects:

➤ 2005 transects:

- 200 ft line transects

- random where space permitted on hydroseeded sites
- diagonal across seed rows on Truax-seeded sites
- % shrub canopy measured along line, tallied by shrub species

- 50cm square quadrants

- 20 quadrants per transect
- placed on alternate sides of line in even spacing

A note about transects:

- 2005 transects – Quadrant measurements:
 - % Composition – estimated dry mass wt; ranking of 70%, 20% or 10%
 - Basal Ground Cover Point Intercept – leading outside corner of each quadrant used as point intercept (based on 20 points per transect)
 - Nearest Sage Height w/in 5 ft radius of point intercept

A note about transects:

➤ 2006 transects:

- 100 meter or 60 meter transects on new sites
- Maintained 200ft transects on 2005 sites for comparison
- Added Belt Transects
 - continuous 1 meter (3 ft used with 200ft transects) belt along total transect length
 - Species Density/Diversity - all species of interest counted; tabulated by species, calculated # plants/meter²
 - Overseed sites – counted only forbs/shrubs

FALL 2004 SEEDING

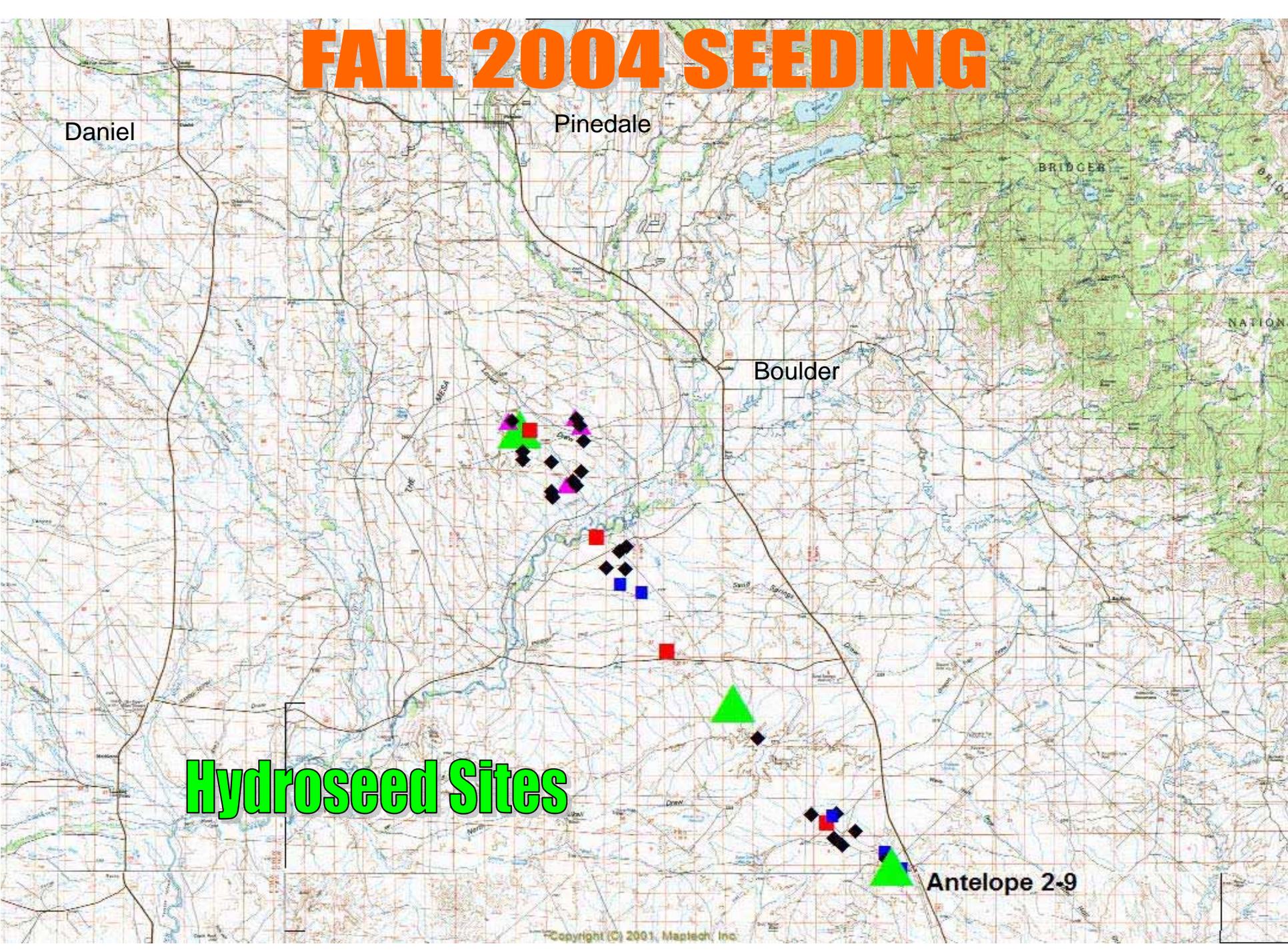
Daniel

Pinedale

Boulder

Hydroseed Sites

Antelope 2-9



Date:	7/27/2005
Transect Name:	Ant 2-9-05
Transect Length (ft):	200
Observers:	Carr, Dale

Basal Ground Cover Point Intercept	
Grass	
Forb	5%
Shrub	
Bare Ground	85%
Gravel	
Rock	
Litter	
Woody Litter	10%
Cryptogam	

	Mean (cm)	Std Dev.
Sage Ht w/in 5 ft radius (excl. no-sage points):	6.1	1.7
Sage Ht w/in 5 ft radius (incl. all points):	5.5	2.5
Total % canopy:	0.46%	

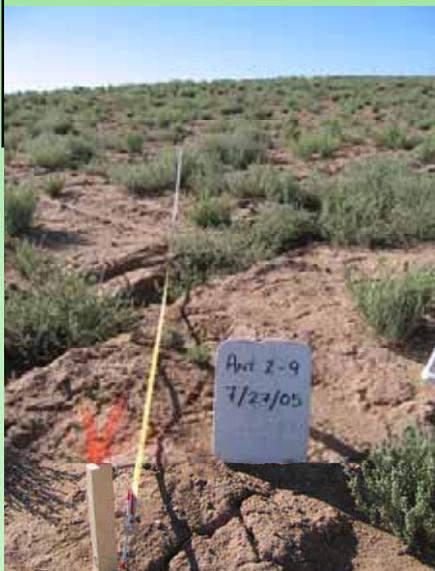
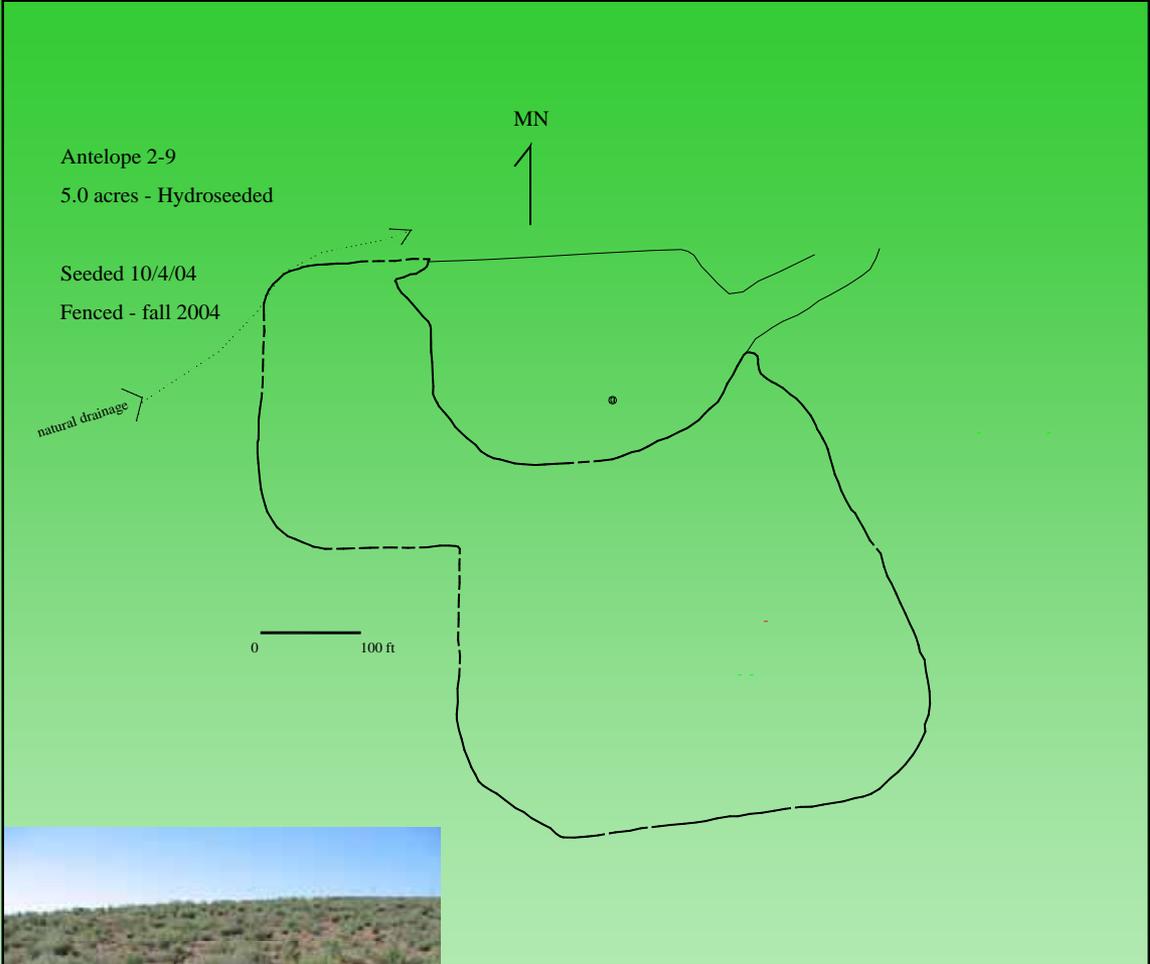
Species	% Composition
Undesirable forbs	70.6
Sage	10.6
Ricegrass	6.1
Lupine	5.6
Yarrow	3.9
Winter Fat	1.7
Sandberg Bluegrass	1.1
Penstemon	0.6
Clover	0.0

Weeds (undesirable forbs):

- Kochia
- Russian Thistle
- Netseed lambsquarter
- halogeton

Also present:

Comments:
 random transect
 sage has been browsed
 animal scat: 2



Date:	7/5/2006
Transect Name:	Ant 2-9-06
Transect Length (ft):	200
Transect Length (m):	
Observers:	RSC

Antelope 2-9

Antelope 2-9-06 Transect

5 acres – Hydroseeded

Seeded 2004; "A" blend amendments

Fenced

Basal Ground Cover	
Point Intercept	
Grass	
Forb	30%
Shrub	5%
Bare Ground	55%
Gravel	
Rock	
Litter	10%
Woody Litter	
Cryptogam	

Mean HI (cm) w/in 5 ft radius (excl. no shrub points):	
Sage	6.5
Std Dev.	1.9
Sample Size (n)	
Mean Vol. (cm ³) w/in 5 ft radius (excl. no shrub points):	
Sage	640
Std Dev.	492.0
Sample Size (n)	
% canopy:	0.94%



Species	% Composition	Density ^a
		Pft/m ²
Undesirable forbs	72.0	
Sage	21.0	1.40
Sandberg Bluegrass	1.0	0.13
Winter Fat	4.5	0.070
4-wing Saltbush		
Yarrow	0.5	0.230
Penstemon		
Lupine		
Ricegrass	0.5	0.020
Fringed Sage		
Globemallow		
Cryptantha sp.		0.020
Unknown grass		0.090
Unknown forb	0.5	0.040

^a Belt based summary

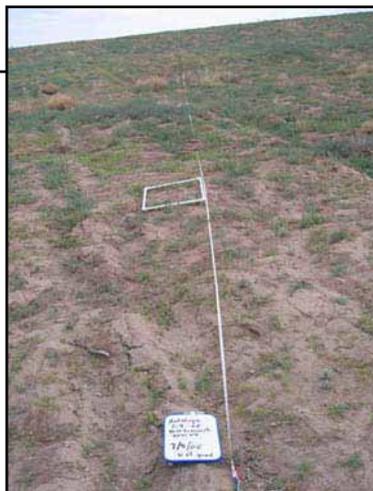
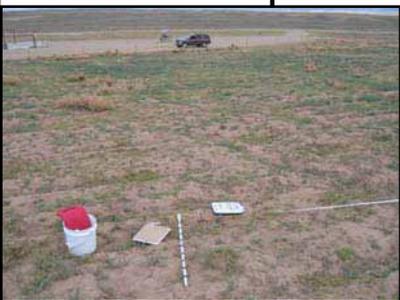
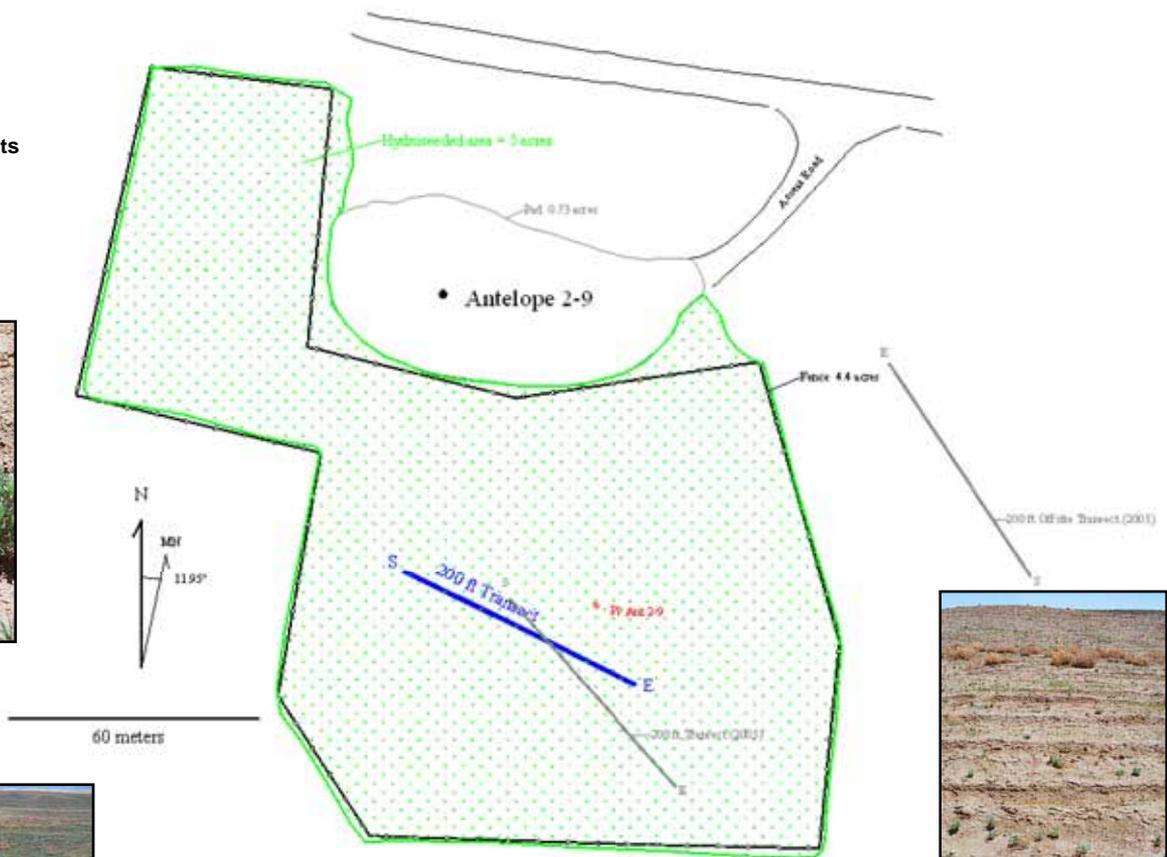
% of seeded species present:		50%			
Total pfts/m ² of all seeded species:		1.80			
% of Quadrants containing scat:	Rabbit	Ground Squirrel	Sage Grouse	Antelope	Cow
	85%	10%	15%	10%	

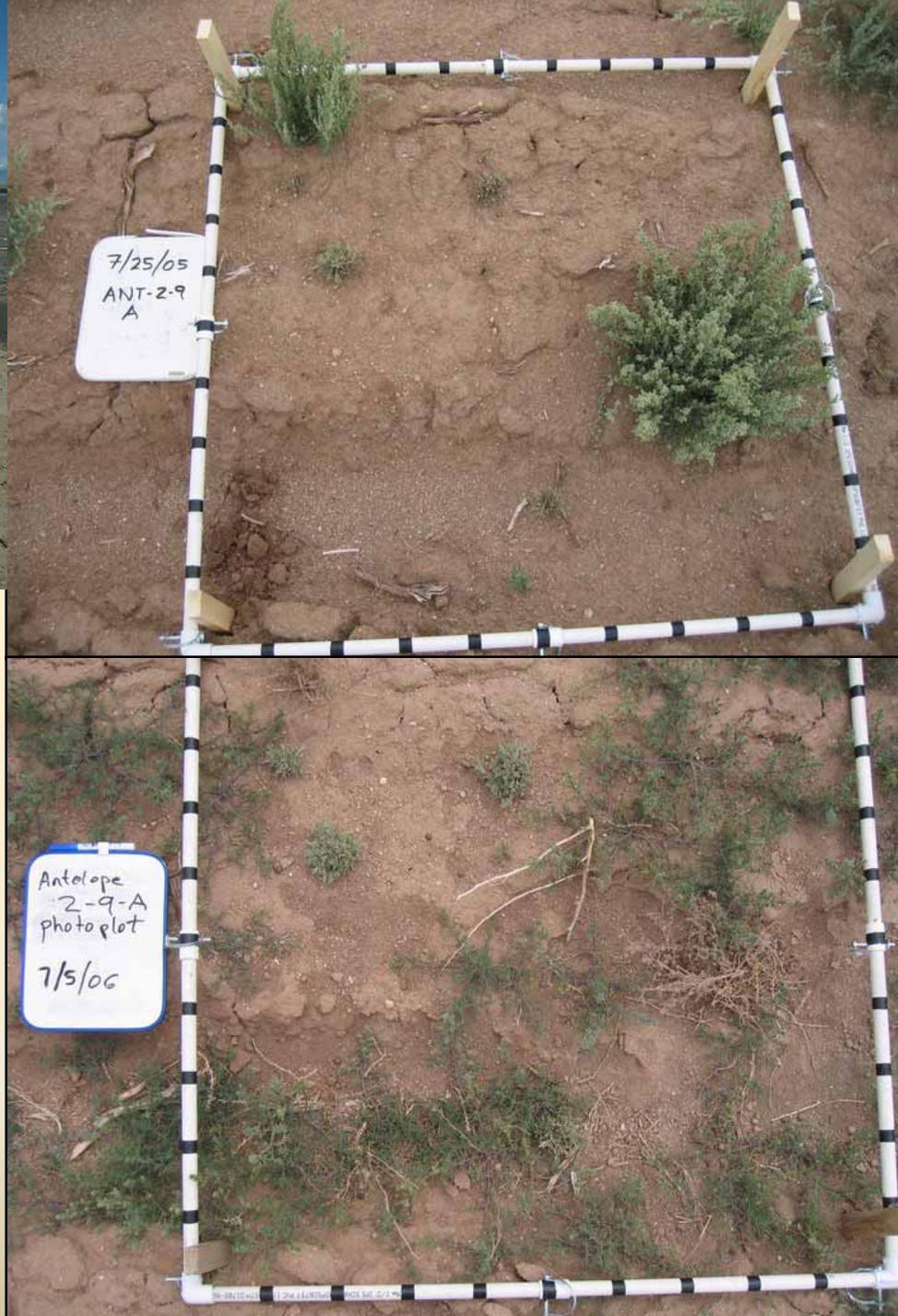
Weeds (undesirable forbs):

Kochia
Russian Thistle
Netseed lambquarter
halogeton

Comments:

sage has been browsed





View to South



Photo Plot
Antelope 2-9 A
2005

View to West



View to East



View to North



7/25/05 photos

View to South



Photo Plot
Antelope 2-9
2006

View to West



View to East



View to North



7/5/06 photos

FALL 2004 SEEDING

Daniel

Pinedale

Boulder

Mesa 6-28

Riverside 2-14

New Fork 13-32

Rainbow 11-31

Truax Drill Seed Sites

FALL 2004 SEEDING

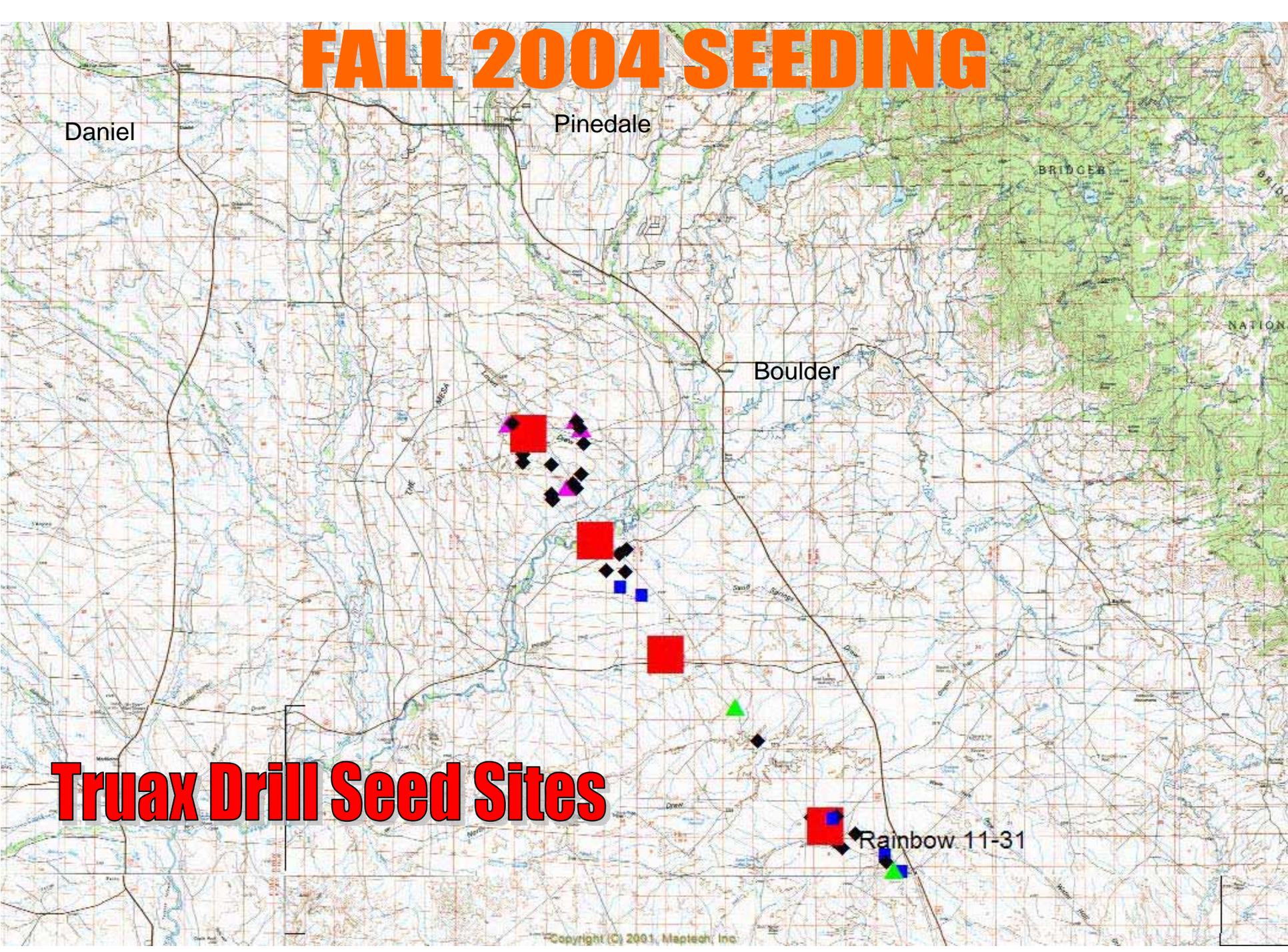
Daniel

Pinedale

Boulder

Truax Drill Seed Sites

Rainbow 11-31



Date:	7/27/2005
Transect Name:	Rainbow 11-31-05
Transect Length (ft):	200
Observers:	Dale, Carr

Basal Ground Cover Point Intercept	
Grass	5%
Forb	5%
Shrub	
Bare Ground	90%
Gravel	
Rock	
Litter	
Woody Litter	
Cryptogam	

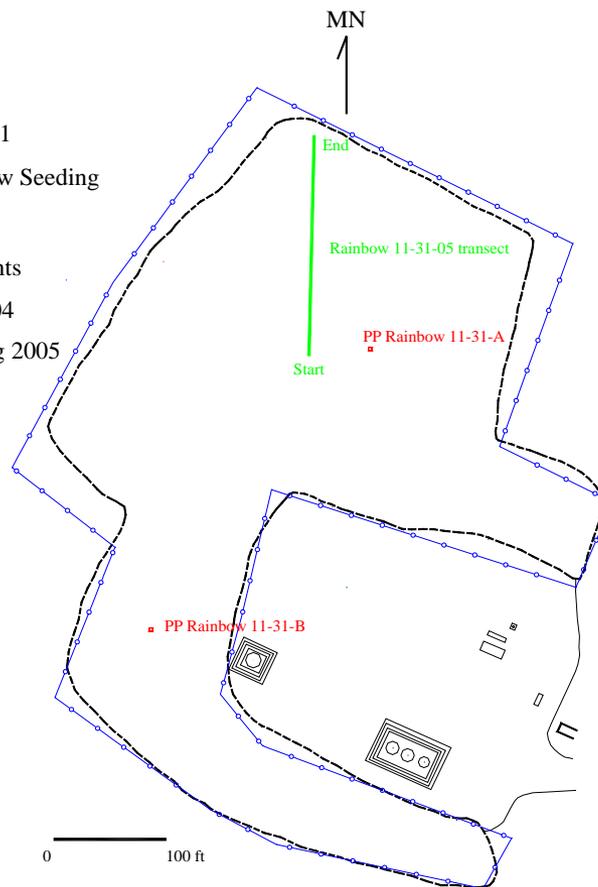
	Mean (cm)	Std Dev.
Sage Ht w/in 5 ft radius (excl. no-sage points):	3.7	1.0
Sage Ht w/in 5 ft radius (incl. all points):	3.7	1.0
Total % canopy:	0.69%	

Species	% Composition
Undesirable forbs	52.1
Sandberg Bluegrass	21.6
Sage	12.1
Ricegrass	10.5
Unkn. forb 2	2.1
Lupine	0.5
Unkn. forb 1	0.5
Four-wing saltbush	0.5
Yarrow	0.0

Weeds:

Also present:

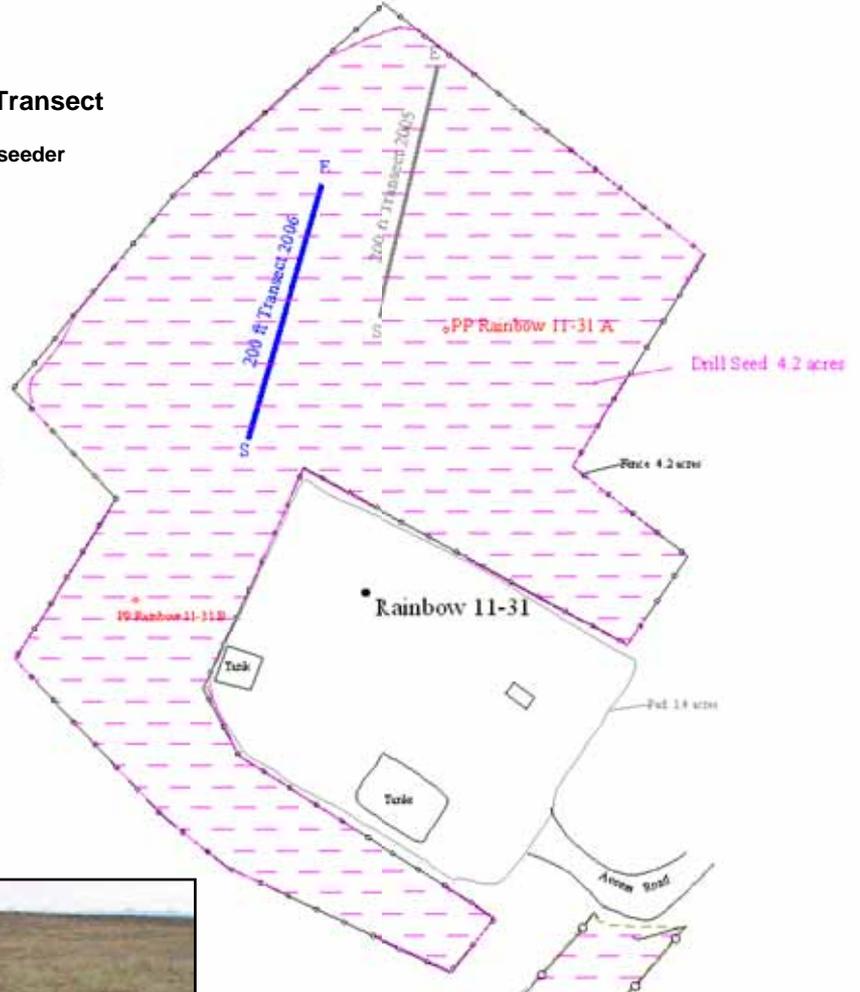
- Rainbow 11-31
- 3.9 acres - New Seeding
- Truax
- No amendments
- Seeded 10/6/04
- Fenced Spring 2005



Date:	7/5/2006
Transect Name:	Rainbow 11-31-06
Transect Length (ft):	200
Transect Length (m):	
Observers:	RSC
Basal Ground Cover Point Intercept	
Grass	15%
Forb	
Shrub	
Bare Ground	60%
Gravel	
Rock	
Litter	20%
Woody Litter	5%
Cryptogam	



Rainbow 11-31
Rainbow 11-31-06 Transect
 4.2 acres – Truax drill seeder
 Seeded 2004
 Fenced



	Sage	4-wing Saltbush
Mean Ht (cm) w/in 5 ft radius (excl. no shrub points):	8.5	10.59
Std Dev:	3.0	4.15
Sample Size (n)	20	11
Mean Vol. (cm³) w/in 5 ft radius (excl. no shrub points):		
Std Dev:	552.5	2198.0
Sample Size (n)	20	11



% canopy: 2.71%	
Species	% Composition
Undesirable forbs	23.0
Sage	40.0
Sandberg Bluegrass	10.5
Winter Fat	
4-wing Saltbush	1.0
Yarrow	2.0
Penstemon	
Lupine	
Ricegrass	23.5
Fringed Sage	
Globe-mallow	
Cryptantha sp.	
Unknown forbs	
Squirreltail	

* Belt transect summary

% of seeded species present: 70%					
Total pits/m ² of all seeded species: 19.0					
	Rabbit	Ground Squirrel	Sage Grouse	Antelope	Cow
% of Quadrants containing scat:	100%		15%		

Weeds (undesirable forbs):
 Halogeton
 Russian Thistle
 Netseed

Comments:
 All sages and majority of 4-wings measured were browsed



2005



2006

Rainbow
11-31



Any Conclusions?

Too early - only 2 seasons; one good, one poor

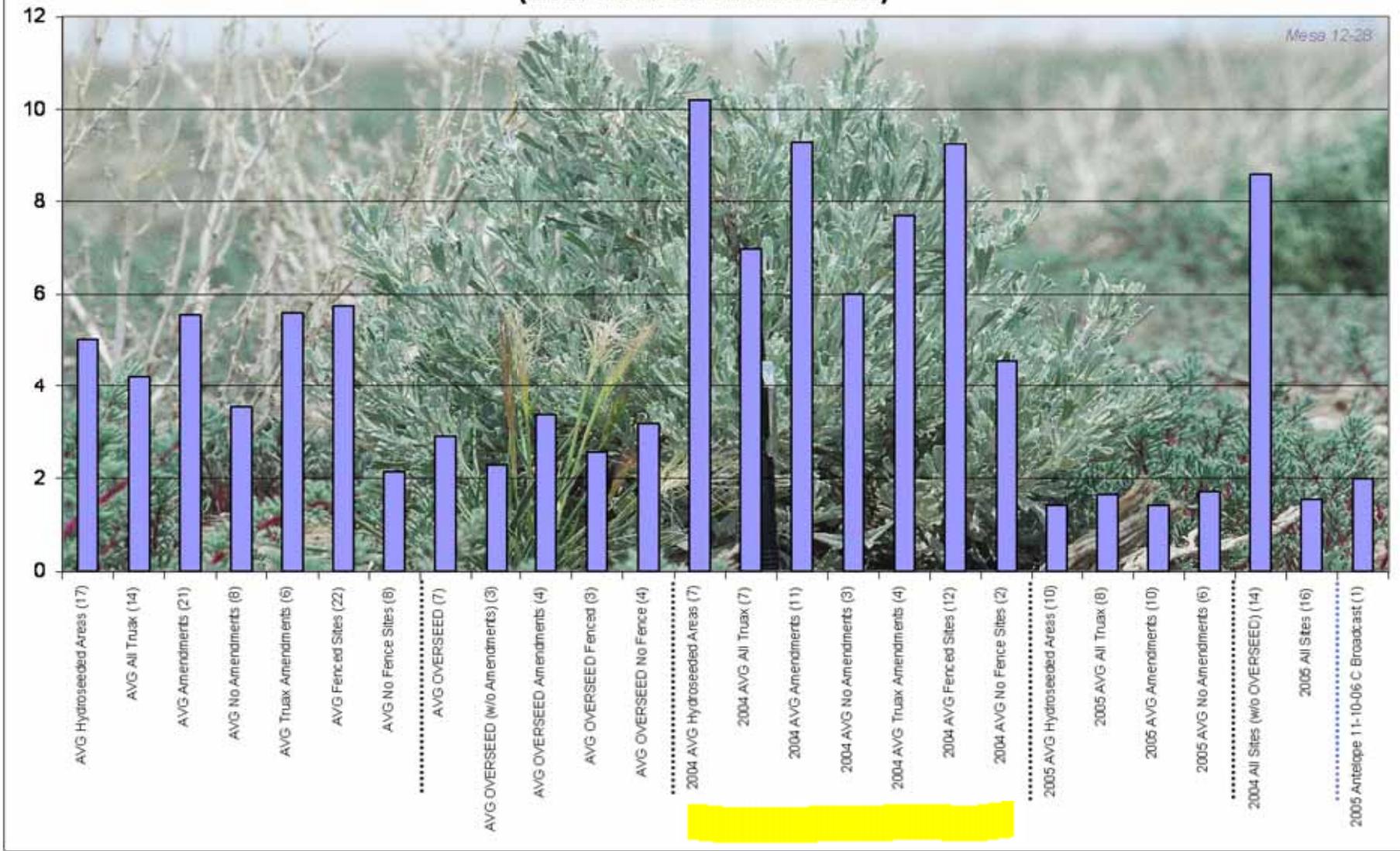
HOWEVER - a few observations:

1. 2005 and 2006 transects – average sage height appears to be approximately 50% taller on amended vs. non-amended sites on 2004 seeded locations.
 - Keep in mind data based on 20 points per transect
 - Data confused in 2006 transects by:
 - poor precipitation year
 - grazing – antelope, rabbits(?), etc.

2006 Transect Data

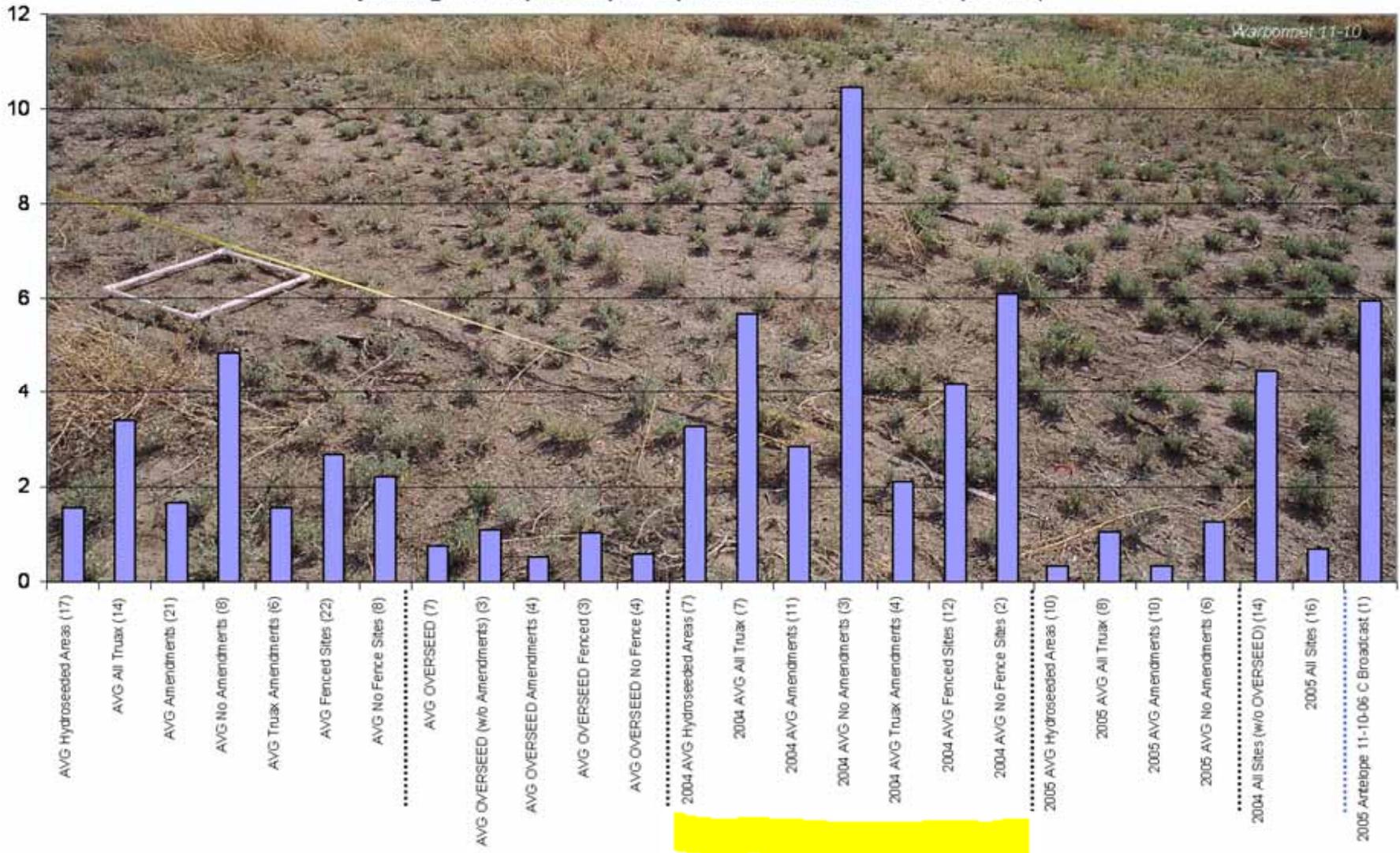
Sage
(Mean Ht. in cm w/in 5ft radius)

Mesa 12-28



2. 2005 transects – average Seeded Species Density appears less on hydroseeded sites than drill-seeded sites.

Seeded Species Density - 2006 Belt Transect Data (average total plants per square meter of seeded species)

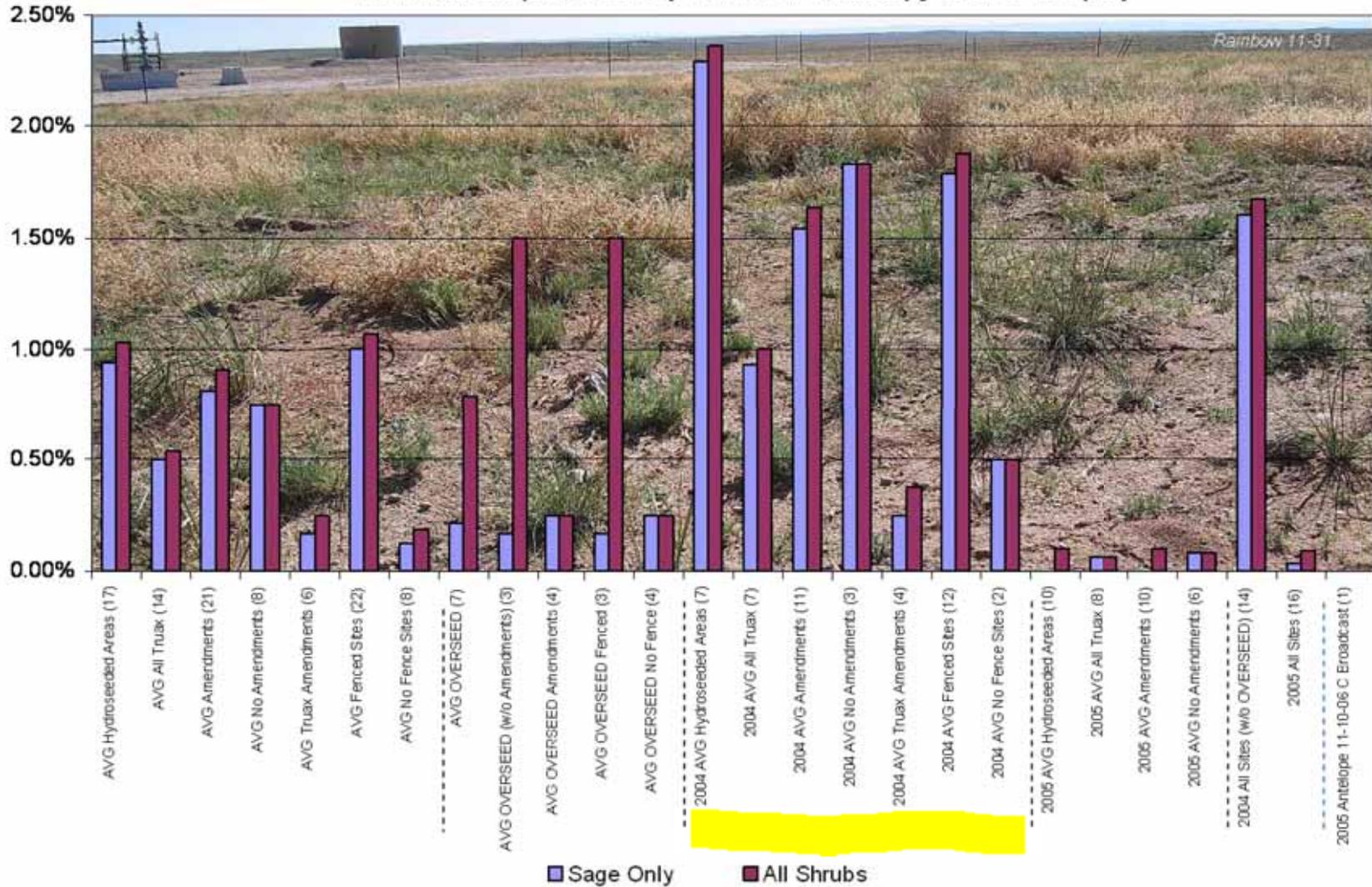


3. Average Basal Ground Cover (Point Intercept % Cover for Sage and Shrubs only) appears higher on hydroseeded sites than drill-seeded sites.

- data based on 200 pts calculated from % canopy data

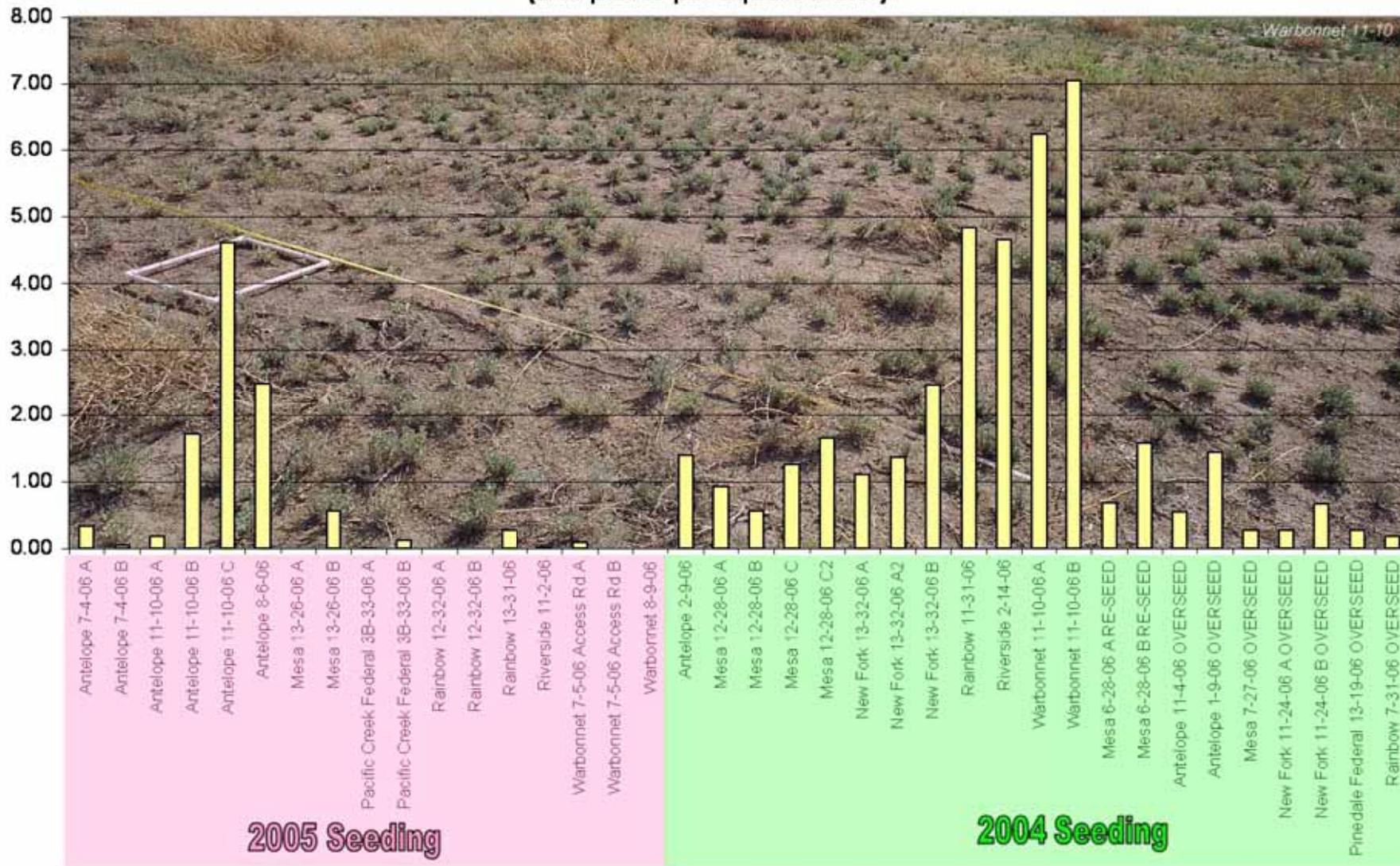
Basal Ground Cover

Point Intercept % Cover (calc. from % canopy notes - 200pts)



4. The highest sage density occurs on one hydroseed site – Warbonnet 11-10.

Sage Density - 2006 Belt Transect Data (# of plants per square meter)



5. 2005 vs. 2006 transect data from 2004-seeded locations show:

- decrease in bare ground
- increase in Basal Ground Cover for sage and shrubs
- increase in average sage height, and
- increase in % canopy

TRANSECT DATA COMPARISON: 2004 AND 2005 TRANSECTS

Transect Name:	Antelope 2-9-05 Hydroseeded	Antelope 2-9-06 Hydroseeded	Mesa 12-28-05 A Hydroseeded	Mesa 12-28-06 A Hydroseeded	Mesa 12-28-05 B Hydroseeded	Mesa 12-28-06 B Hydroseeded	Mesa 12-28-05 C Hydroseeded	Mesa 12-28-06 C Hydroseeded	Waibornet 11-10-05 A Hydroseeded	Waibornet 11-10-06 A Hydroseeded	Waibornet 11-10-05 B Hydroseeded	Waibornet 11-10-06 B Hydroseeded	Mesa 6-28-05 A Truak (amendments added)	Mesa 6-28-06 A Truak (amendments added)	Mesa 6-28-05 B Truak (amendments added)	Mesa 6-28-06 B Truak (amendments added)	New Fork 13-30-05 A Truak (amendments added)	New Fork 13-30-06 A Truak (amendments added)	New Fork 13-30-05 B Truak (amendments added)	New Fork 13-30-06 B Truak (amendments added)	Rainbow 11-31-05 Truak (no amendments)	Rainbow 11-31-06 Truak (no amendments)	Riverwide 2-14-05 Truak (no amendments)	Riverwide 2-14-06 Truak (no amendments)
Date:	7/27/2005	7/6/2006	7/29/2005	8/09/2006	7/29/2005	8/30/2006	7/29/2005	8/30/2006	7/27/2005	7/12/2006	7/27/2005	7/12/2006	7/28/2005	6/30/2006	7/28/2005	7/12/2006	7/27/2005	7/12/2006	7/12/2006	7/28/2005	7/12/2006	7/27/2005	7/28/2005	7/15/2006
Transect Length (ft):	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Transect Length (m):												60							60					
Observer:	RSC,OD	RSC	RSC	RSC,AD	RSC	RSC,LC	RSC	RSC,LC	DDRSC	PEM,LC	RSC	RSC	RSC	RSC,LC	RSC	RSC,PEM	RSC	PEM,LC	RSC	RSC	PEM,LC	DDRSC	RSC	RSC,LC
Basal Ground Cover Point Intercept (20 pts)																								
Grass																								
Forb	5%	30%		5%	10%	20%	5%	10%	25%	15%	20%	10%	25%	20%	10%	30%	10%	10%	10%	20%		5%	15%	10%
Shrub		5%		5%						10%												5%		
Woody Litter	85%	55%	90%	50%	75%	50%	85%	60%	75%	30%	50%	30%	60%	40%	80%	25%	75%	65%	55%	70%	65%	90%	60%	85%
Rock			5%	10%	10%	10%	5%	10%					10%	15%	5%		5%						5%	
Litter		10%		20%	5%	15%		10%		45%	25%	50%	5%	10%				25%	30%	10%	35%		20%	5%
Woody Litter	10%		5%	10%		5%	5%	10%			5%	10%		10%	5%		10%					5%		
Cryptogam																								
Calc from %Canopy noted:																								
	6.00%	1.00%	2.00%	1.50%	0.50%	1.00%	1.50%	2.00%	0.00%	3.00%	1.00%	4.50%	0.00%	0.00%	0.00%	0.50%	0.00%	0.00%	0.50%	0.00%	1.50%	0.50%	3.50%	0.50%
	6.00%	1.50%	2.00%	1.50%	0.50%	1.00%	1.50%	2.00%	0.00%	3.00%	1.00%	4.50%	0.00%	0.00%	0.00%	0.50%	0.00%	0.50%	0.50%	0.00%	1.50%	0.50%	3.50%	1.00%
Mean (cm)																								
Sage ht w/in 5 ft radius (excl. no sage points)	6.1	6.5	7.0	10.7	9.6	11.7	9.3	13.3	6.5	8.1	9.0	8.1	6.4	4.3	8.0	5.2	6.4	11.3	10	5.8	5.8	3.7	8.5	3.7
Sage ht w/in 5 ft radius (incl. all points)	5.5	6.5	5.2	9.6	8.7	8.8	8.9	12.6	6.5	8.1	9.0	8.1	4.2	4.1	3.0	4.2	6.4	10.7	10	5.8	5.8	3.7	8.5	3.7
	0.46%	0.94%	0.75%	0.72%	0.26%	0.71%	2.05%	1.79%	1.28%	2.94%	0.92%	3.37%	0.10%	0.00%	0.00%	0.11%	0.11%	1.26%	0.97%	0.67%	1.26%	0.69%	2.71%	0.90%
Species																								
% Comp.																								
Undesirable forbs	70.6	72.0	58.5	66.5	54.0	89.0	66.3	67.5	50.0	40.5	51.0	38.0	84.5	90.5	90.5	85.5	90.0	75.5	57.0	77.0	78.5	52.1	23.0	63.5
Unknown forbs		0.5	36.0		41.5		12.1		0.5		0.0		4.5	2.0	3.0	1.5		0.5	0.5	3.5		2.6		1.5
Sage	10.6	21.0	8.5	25.5	1.5	0.5	12.6	26.5	7.5	34.0	9.5	40.0	0.5	0.5	7.0	1.6	1.6	19.5	37.0	9.5	14.5	12.1	40.0	13.5
Sandberg Bluegrass	1.1	1.0	1.0	0.5	0.0	0.5	0.5	0.5	0.0	0.5			5.5	0.5	0.5	1.0	3.2	1.0	2.5	2.0	2.5	21.6	10.5	0.5
Winter Fat	1.7	4.5							3.5		1.0				2.0		3.2	1.5	1.0	1.5	1.0			0.5
Yarrow	3.9	0.5	0.0	0.5	0.5				0.0		1.0	4.0	1.0			1.5	1.6		1.0			0.0	2.0	2.0
Penstemon	0.6		0.0										1.5											
Lupine	5.6																					0.5		
Ricegrass	6.1	0.5	1.5	1.5		0.5	5.8	2.0					2.0	2.5	0.5		0.5		1.0	4.0		10.5	23.5	4.5
Four-wing saltbush																				0.5				5.5
Fringed sage																						0.5	1.0	1.0
Clover	0.0																							
Wheatgrass								0.5									0.5							
Green Foxtail			0.5		1.0		1.1																	
Bottlebrush Squirreltail		2.0	4.5	1.5	0.5	0.5	3.0																	
Alysum			1.0			0.0			37.5	24.0	34.5	17.0	0.5	3.0	1.0	3.0		2.0			3.5			13.0
Cryptantha sp.														1.5										
Unknown mustard									0.5		3.0									2.0				
Aster																	0.5							
Unkn. mat-form. forb																								1.0
Rabbitbrush									0.5	1.0		1.0												
Unknown grass							1.1																	
Totals	100.2	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.1	100.0	100.0	100.0	99.9	100.0	100.0	100.0

Seeded species
Hydroseeded Location

6. Weeds (of the right sort) are our friends...

- shade for shrub/forb seedlings
- protection from grazing by antelope
- trap snow

SNOW CATCHERS





snow catchers

7. Drill seeding into snow – the “exceptions” to the poor results of the Fall 2005 seeding:

- Antelope 8-6 and Rainbow 13-31
- Seeded late November, 2005, with Truax Flex II drill – into light snow cover

FALL 2005 SEEDING

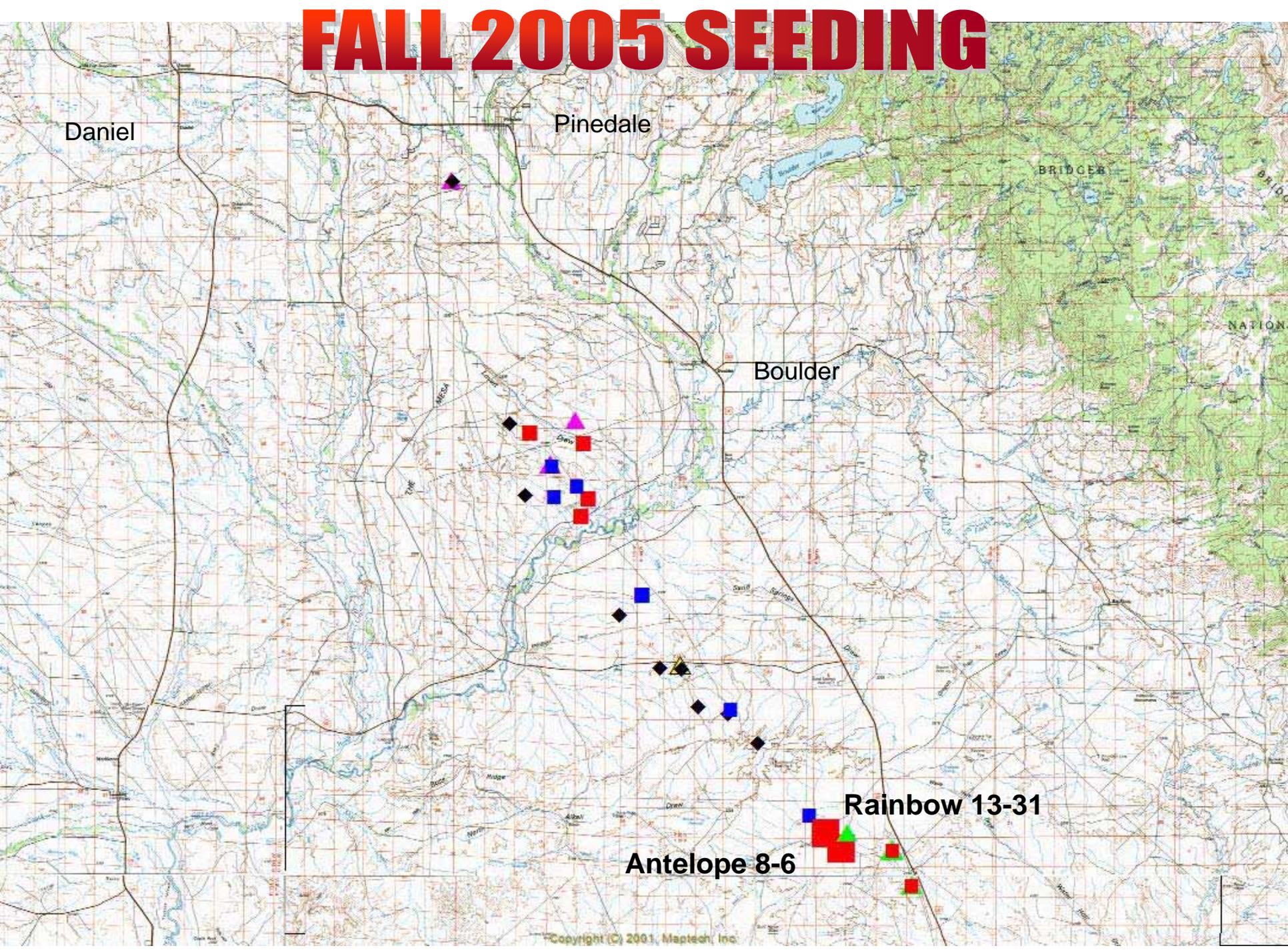
Daniel

Pinedale

Boulder

Rainbow 13-31

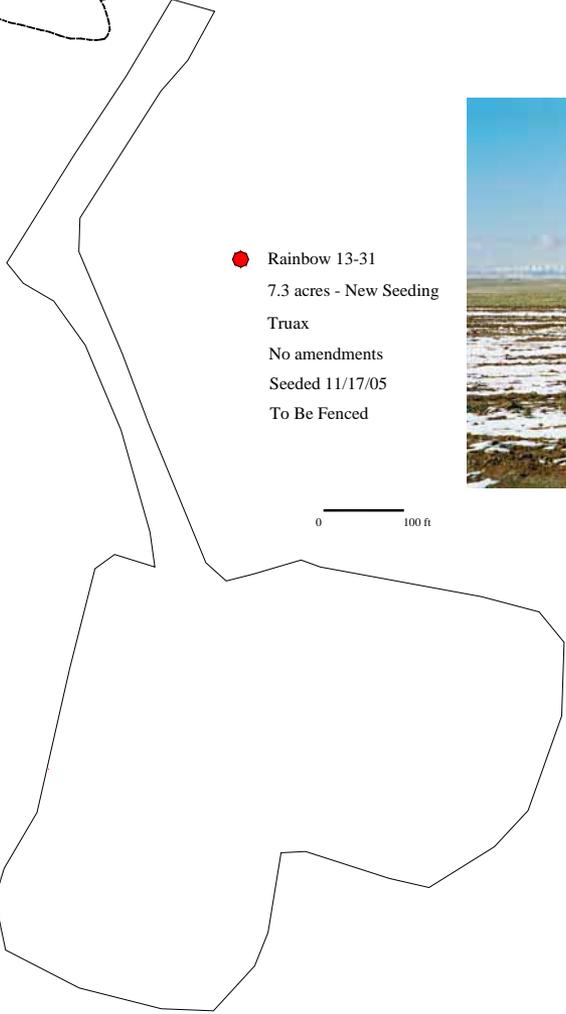
Antelope 8-6



0 100 ft



MN
↑



● Rainbow 13-31
7.3 acres - New Seeding
Truax
No amendments
Seeded 11/17/05
To Be Fenced

0 100 ft

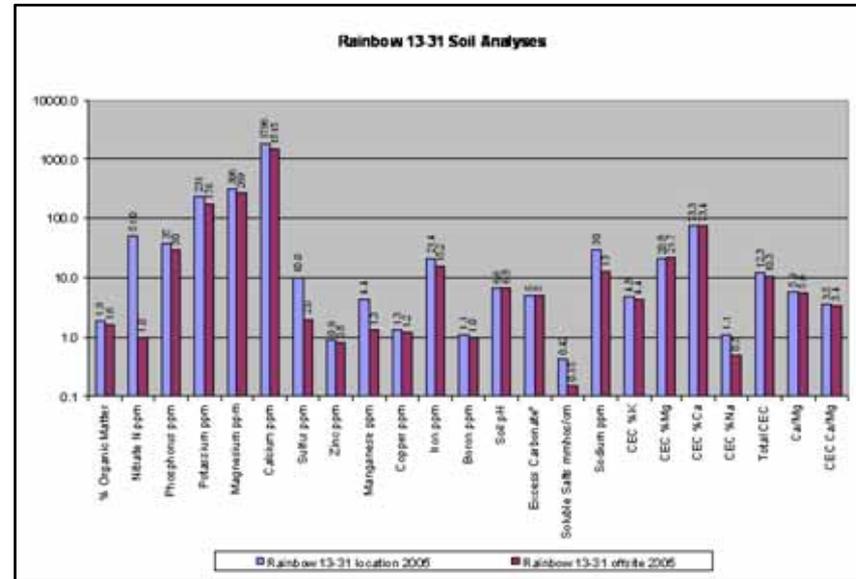


Rainbow 13-31



Shell Habitat Seed Mix (SH)				
Species	MAcre	Seedlb	Seedsf 12'	% Seeds
Indian Ricegrass, Rimrock	1.00	141,000	3.24	4.68
Four-winged Saltbush	0.50	52,000	0.60	0.88
Otobemallow, Scarlet	0.03	500,000	0.34	0.50
Sandberg Bluegrass	1.00	925,000	21.24	30.71
Lupine, Robinson L. polyphyllus	1.00	13,000	0.30	0.43
Winterfat	1.00	56,700	1.30	1.88
Yarrow, white N. American	0.05	2,770,000	3.18	4.60
Penstemon Proctorii	0.05	4,400,000	5.05	7.30
W.Y. Big Sagebrush	0.50	2,500,000	28.70	41.50
Fringed Sagewort	0.05	4,536,000	5.21	7.53
	5.18		69.15	100.00

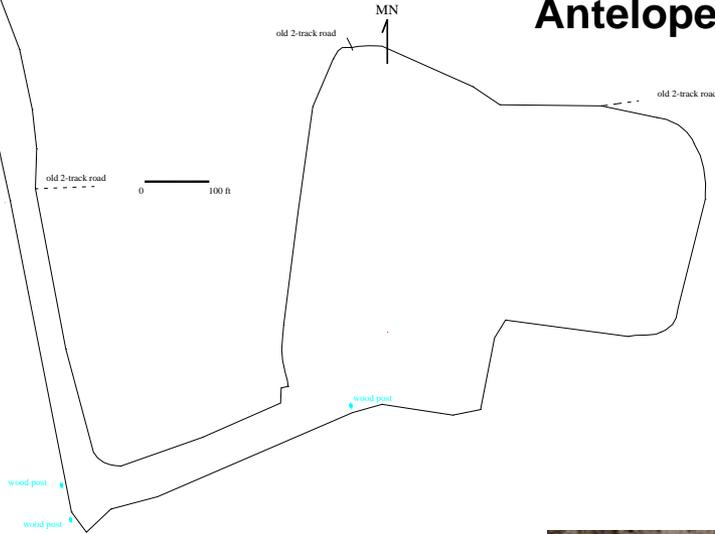
 Truax Range Drill Surface Seed Box (Fluffy Box = Middle Box)
 Truax Range Drill 1/4 Inch Deep Seed Box (Small Seed Box = Front Box)
 Truax Range Drill 1 Inch Deep Seed Box (Grass "Cool Season" Box = Back Box)





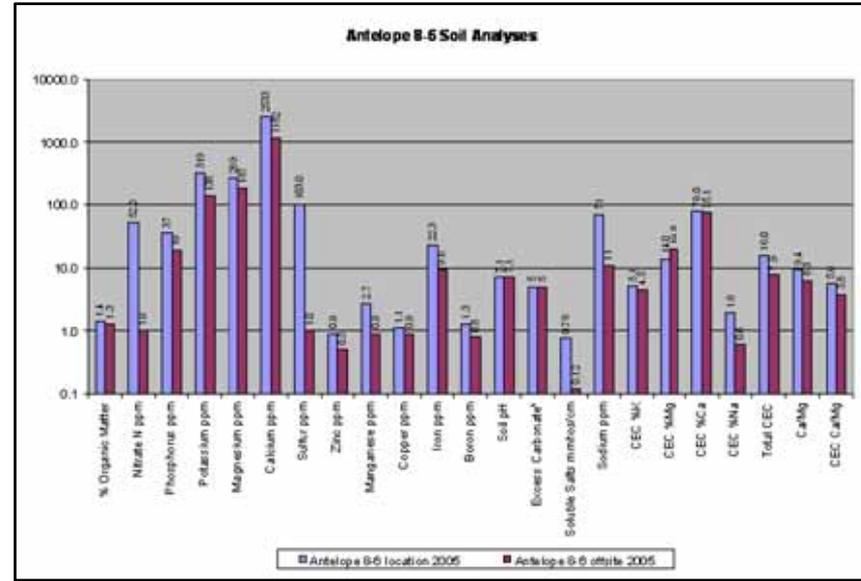
● Antelope 8-6
 8.9 acres - Truax Drill Seeding
 Seeded 11/17/05
 No amendments
 To Be Fenced

Antelope 8-6



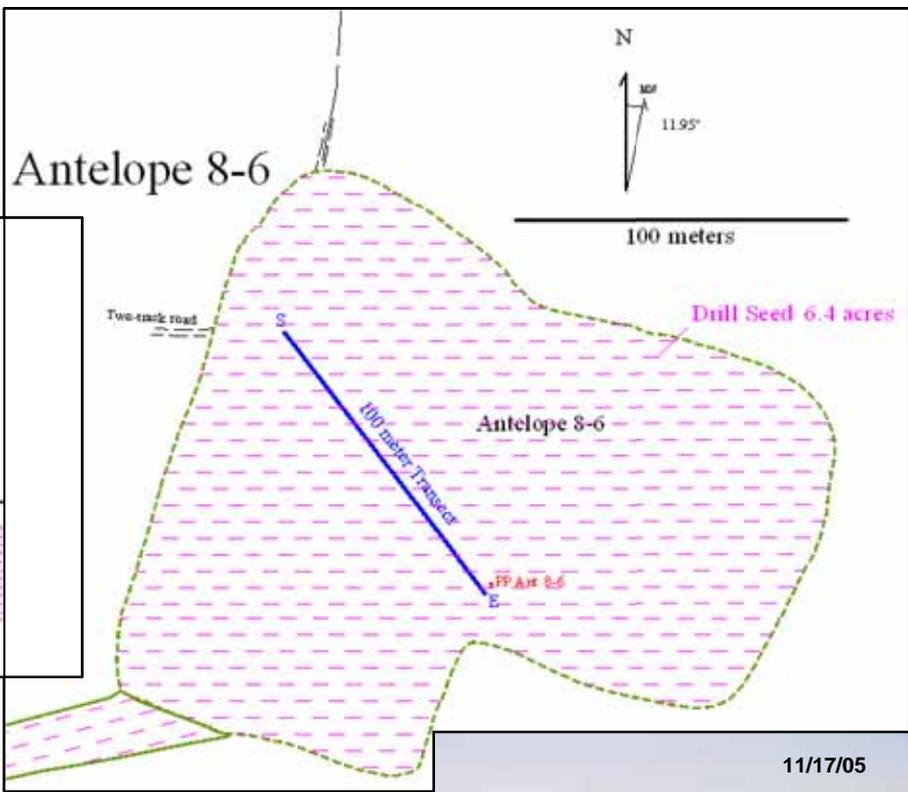
Shell Habitat Seed Mix (SH)				
Species	#/Acres	Seeds/lb	Seeds/100	% Seeds
Indian Ricegrass, Rimrock	1.00	141,000	3.24	4.68
Four-winged Saltbrush	0.50	52,000	0.90	0.88
Globe-mallow, Scarlet	0.03	500,000	0.34	0.90
Sandbara Ricegrass	1.00	925,000	21.24	30.71
Lupine, Robinson L. ash-hedge	1.00	13,000	0.30	0.48
Winterfat	1.00	86,700	1.30	1.88
Yarrow, white N. American	0.05	2,770,000	3.18	4.60
Penstemon Procerus	0.05	4,400,000	6.05	7.30
WY Big Sagebrush	0.50	2,500,000	28.70	41.50
Fringed Sagewort	0.05	4,530,000	5.21	7.53
	5.18		69.15	100.00

Truax Range Drill Surface Seed Box (Fully Box = Middle Box)
 Truax Range Drill 1/4 Inch Deep Seed Box (Small Seed Box = Front Box)
 Truax Range Drill 1 Inch Deep Seed Box (Grass "Cool Season" Box = Back Box)



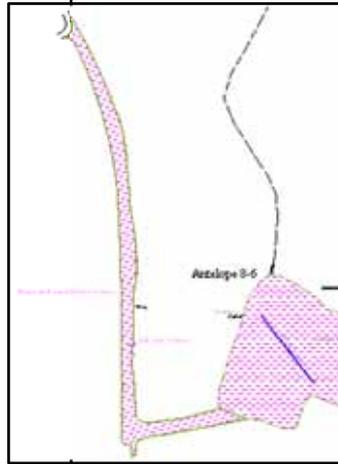
Date: 7/14/2006
 Transect Name: Antelope 8-6-06
 Transect Length (ft):
 Transect Length (m): 100
 Observers: RSC, LBC

Antelope 8-6
 Antelope 8-6-06 Transect
 8.8 acres – Truax drill seeder
 Seeded 2005, in snow
 No Fence



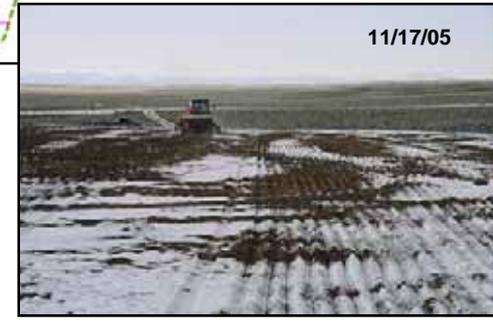
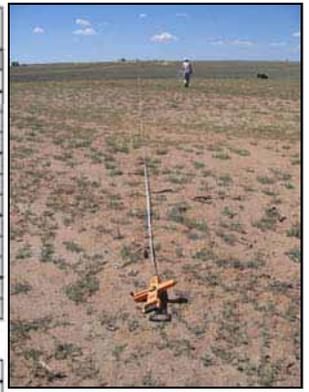
Basal Ground Cover Point Intercept	
Grass	
Forb	
Shrub	
Bare Ground	90%
Gravel	
Rock	
Litter	5%
Woody Litter	5%
Cryptogam	

	Sage	Winterfat	Fringed Sage
Mean Ht (cm) w/in 5 ft radius (excl. no shrub points):		3.9	1.5
Std Dev:	0.9	18.7	-
Sample Size (n)	17	20	1
	Sage	Winterfat	Fringed Sage
Mean Vol. (cm ³) w/in 5 ft radius (excl. no shrub points):	5.3	50.4	3
Std Dev:	7.9	57.8	-
Sample Size (n)	17	20	1



Species	% Composition	Density* Pits/m ²
Undesirable forbs	85.5	
Sage	5.0	
Sandberg Bluegrass		
Winter Fat	9.0	1.110
4-wing Saltbush		0.030
Yarrow		0.03
Penstemon		
Lupine	0.5	0.060
Ricegrass		0.020
Fringed Sage		0.010
Globe mallow		
Alyssum		0.020
Vetch		0.010

* Belt transects summary



% of seeded species present:	
Total pits/m ² of all seeded species:	
% of Quadrants containing scat:	30%

	Rabbit	Ground Squirrel	Sage Grouse	Antelope	Cow

Weeds (undesirable forbs):
 Russian Thistle
 Netseed - rare

Also present:
 Little stinging bees

Comments:
 some winterfat has been browsed (50% of recorded WF shrubs)



RECLAIMED PIT LOCATIONS

% of Locations Where Seeded Species Found (regardless of abundance) - Sorted on 2005 Data		
Seeded Species	2005 (7)	2006 (18)
Sage	100%	95%
Sandberg BG	100%	58%
Yarrow	100%	79%
Indian Ricegrass	88%	95%
Winterfat	83%	95%
4 Wing SB	63%	79%
Penstemon	50%	26%
Lupine	38%	53%
Fringed Sage		42%
Globemallow		26%

% of Locations Where Seeded Species Found (regardless of abundance) - Sorted on 2006 Data		
Seeded Species	2005 (7)	2006 (18)
Indian Ricegrass	88%	95%
Sage	100%	95%
Winterfat	83%	95%
4 Wing SB	63%	79%
Yarrow	100%	79%
Sandberg BG	100%	58%
Lupine	38%	53%
Fringed Sage	25%	42%
Globemallow	13%	
Penstemon	50%	

OVERSEED LOCATIONS

% of Locations Where 2004 Seeded Species Found (regardless of abundance)		
Seeded Species		2006 (6)
Sage		
4 Wing SB		67%
Globemallow		17%
Fringed Sage		0%
Indian Ricegrass		0%
Lupine		0%
Penstemon		0%
Sandberg BG		0%

RECLAIMED PIT LOCATIONS - HYDROSEEDING ONLY

% of Locations Where Seeded Species Found (regardless of abundance) - Sorted on 2005 Data		
Seeded Species	2005 (3)	2006 (8)
Indian Ricegrass	100%	88%
Sage	100%	88%
Sandberg BG	100%	63%
Winterfat	100%	100%
Yarrow	100%	75%
Penstemon	67%	75%
4 Wing SB	33%	75%
Lupine	33%	20%
Fringed Sage		13%
Globemallow		25%

% of Locations Where Seeded Species Found (regardless of abundance) - Sorted on 2006 Data		
Seeded Species	2005 (3)	2006 (8)
Winterfat	100%	100%
Indian Ricegrass	100%	88%
Sage	100%	88%
4 Wing SB	33%	75%
Penstemon	67%	75%
Yarrow	100%	75%
Sandberg BG	100%	63%
Globemallow	0%	
Lupine	33%	
Fringed Sage	0%	

RECLAIMED PIT LOCATIONS - TRUAX DRILL SEEDING ONLY

% of Locations Where Seeded Species Found (regardless of abundance) - Sorted on 2005 Data		
Seeded Species	2005 (4)	2006 (10)
4 Wing SB	100%	90%
Indian Ricegrass	100%	100%
Sage	100%	100%
Sandberg BG	100%	60%
Winterfat	100%	100%
Yarrow	100%	90%
Penstemon	75%	90%
Lupine	50%	80%
Fringed Sage	25%	60%
Globemallow	0%	30%

% of Locations Where Seeded Species Found (regardless of abundance) - Sorted on 2006 Data		
Seeded Species	2005 (4)	2006 (10)
Indian Ricegrass	100%	100%
Sage	100%	100%
Winterfat	100%	100%
4 Wing SB	100%	90%
Penstemon	75%	90%
Yarrow	100%	90%
Lupine	50%	80%
Fringed Sage	25%	60%
Sandberg BG	100%	60%
Globemallow	0%	30%

What Now?

Under consideration:

- Increase lupines and other forbs(?)
- Only slight increase in bunch grasses, if any
- Seed sages as late as possible in season
- Consider changes in seed mix for anticipated drought conditions?
- Fencing is critical for couple of years
- “Mini snow fences” for maximizing snow/moisture entrapment on sites?

What Now?

Under consideration:

- “Cultivate” Topsoil Piles
 - Flatter, broader topsoil stockpiles
 - Seed first season with grasses/forbs(?) that will help maintain soil microbial viability until needed for interim/final reclamation.

What Now?

Under consideration:

- Rain Dancing Classes.

END

Participants

- BLM - Pinedale Field Office
- BLM – Vale, OR Field Office
- Shell Rocky Mountain Production Co.
- C-M Environmental Group, Inc.
- John Steinbacher – Summit Associates
- Quattro Environmental
- Wind River Seed LLC
- Mountain West Hydroseeding
- CDL Habitat LLC