Diversification of Crested Wheatgrass Stands in Utah

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Great Basin Native Plant Selection & Increase Project

Brigham Young University Founded 1875 Provo, Utah

Great Basin Restoratoin Project

U.S. Department of the Interior Bureau of Land Management

Rocky Mountain Research Station

NRCS Natural Resources Conservation Service

Utah Division of Wildlife Resources

Background

1998-1999 Study "Increasing Native Diversity of Cheatgrass Dominated Rangelands Through Assisted Succession"

Cox and Anderson; JRM 2004, 57:203-210

Question: Will native species establish better in a perennial or annual monoculture?

Answer: It is easier to establish native vegetation in crested wheatgrass as opposed to cheatgrass.

Background

Assisted Succession Steps:

1. “Capture” the site with crested wheatgrass
2. Reduce crested wheatgrass (mechanical or herbicide)
3. Reseed the site with natives

The Goal

To determine effective ways to diversify crested wheatgrass seedings while minimizing weed invasion.

Three questions:

1. **Which treatment (chemical vs. mechanical) best controls crested wheatgrass?**
2. **Does crested wheatgrass control followed by seeding native species promote or inhibit weed invasion?**
3. **Do wheatgrass control methods affect native plant revegetation success?**

The Hope:

The Fear:

Site Location

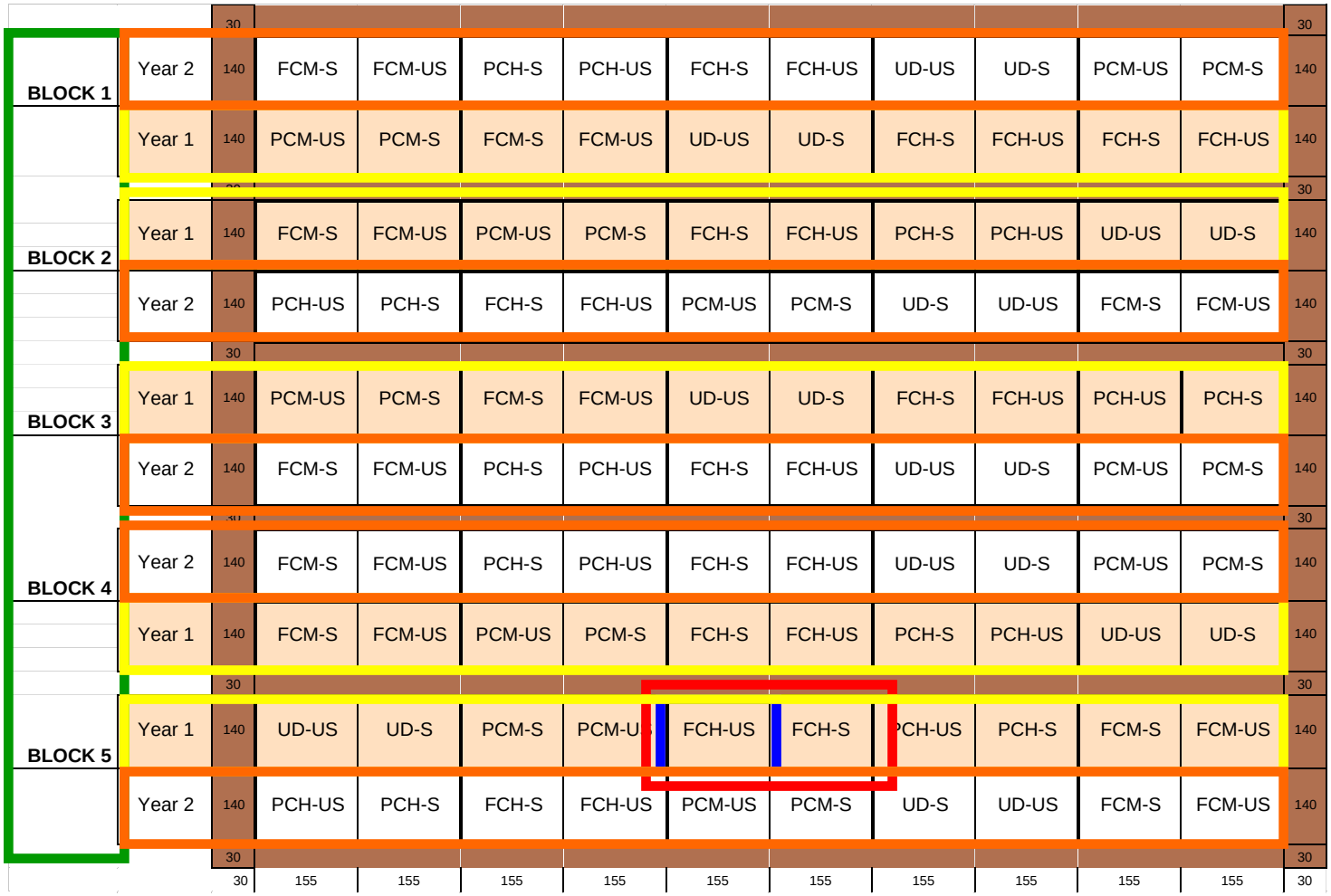
Site Description

Skull Valley

- 1525m (5000’)
- 200 – 254mm (8 – 10”)
- Medburn fine sandy loam

Lookout Pass

- 1676m (5500’)
- 254 – 305mm (10 – 12”)
- Taylorsflat loam



Randomize Block Split Plot Design

Blocks = 5

Year 1 = 2005

Year 2 = 2006

Main Plot: 1 acre (0.4 ha)

PCM = 1-way disk

FCM = 2-way disk

PCH = 1.1 L/ha Roundup Original Max

FCH = 3.2 L/ha Roundup Original Max

UD = Undisturbed (no treatment)

Sub Plot: ½ acre (0.2 ha)

S = Seeded

US = Unseeded

Timeline

Treatment Implementation:

Herbicide: May 2005, 2006

2-way disking: June 2005, 2006

Data Collection:

June 2006: Year 1 plots

May 2007: Year 1 and 2 plots

May 2008: Year 1 and 2 plots

Herbicide Treatment

Roundup Original Max

PCH – 1.1 L/ha

FCH – 3.2 L/ha

Mechanical Treatments

PCM – 1 way disk

FCM – 2 way disk

Drill Configuration

Truax Rough Rider

Drill Configuration

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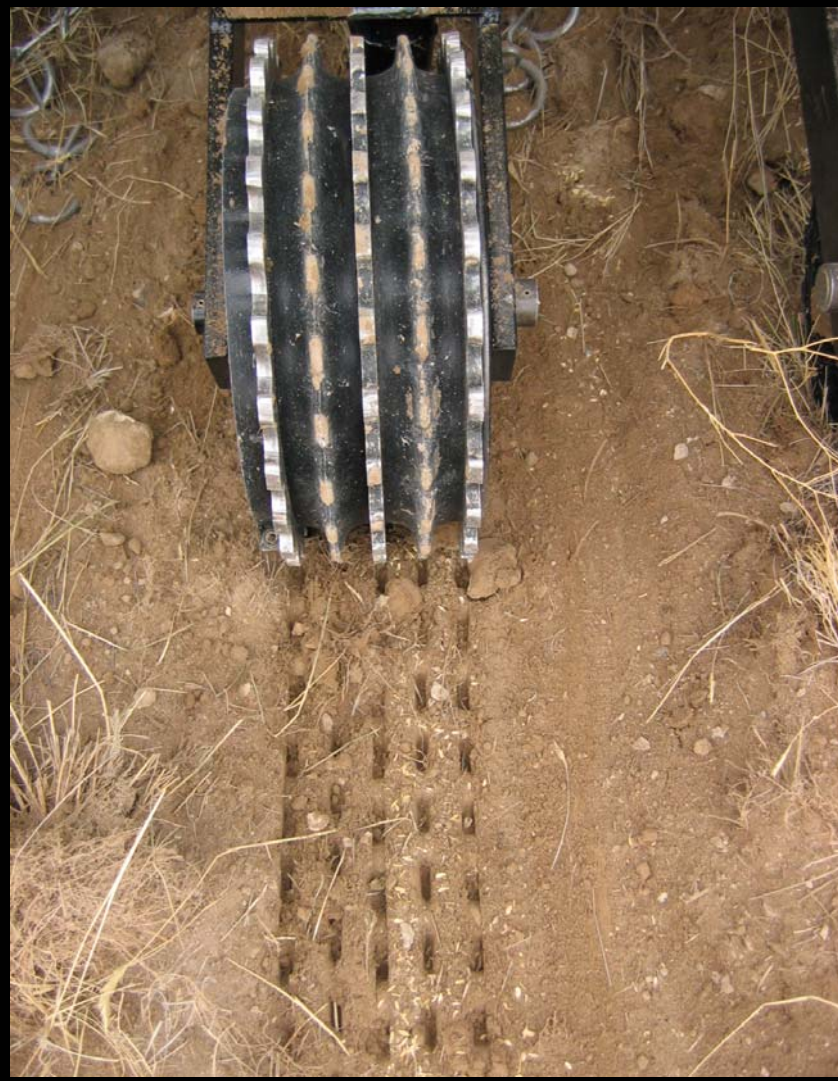
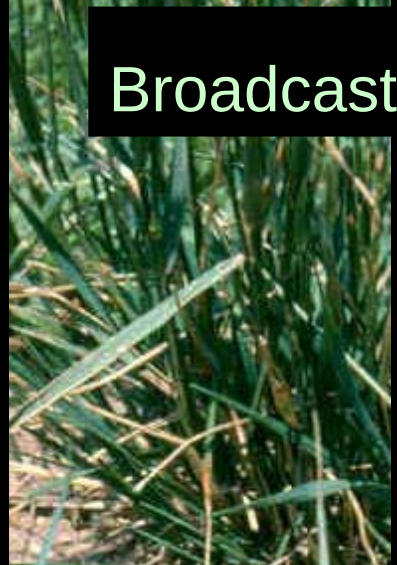


Drill Configuration



Seed Mix

Species		PLS kg/ha	Bulk kg/ha
Bluebunch wheatgrass - 'Anatone'		3.36	3.54
Squirreltail - 'Sanpete'		2.24	3.16
Indian ricegrass - 'Nezpar'		2.24	2.39
Fourwing saltbush		1.12	3.90
Lewis flax - 'Appar'		0.84	0.93
Munroe globemallow		0.56	0.94
	Total	10.36	14.86
Sandberg bluegrass		0.84	1.06
White stemmed rabbitbrush		0.28	0.84
Wyoming big sagebrush		0.22	1.05
Yarrow - 'Eagle'		0.22	0.27
	Total	1.56	3.22

Drilled

Broadcast

Seed Mix

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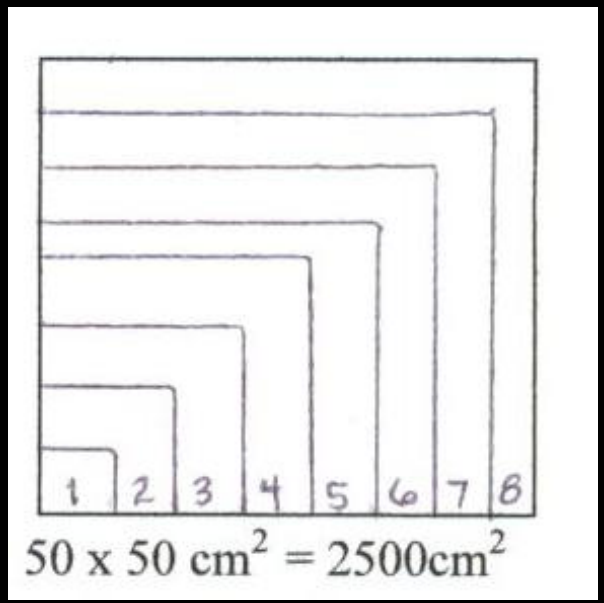
0.25 m^2 quadrat

- Density: all species
- Modified Duabenmire Cover class: crested wheatgrass, cheatgrass, residual grass



Cover Class	Cover	Midpoints
1	0-1%	0.5
2	1-5%	3
3	5-15%	10
4	15-25%	20
5	25-50%	37.5
6	50-75%	62.5
7	75-95%	85
8	95-100%	97.5

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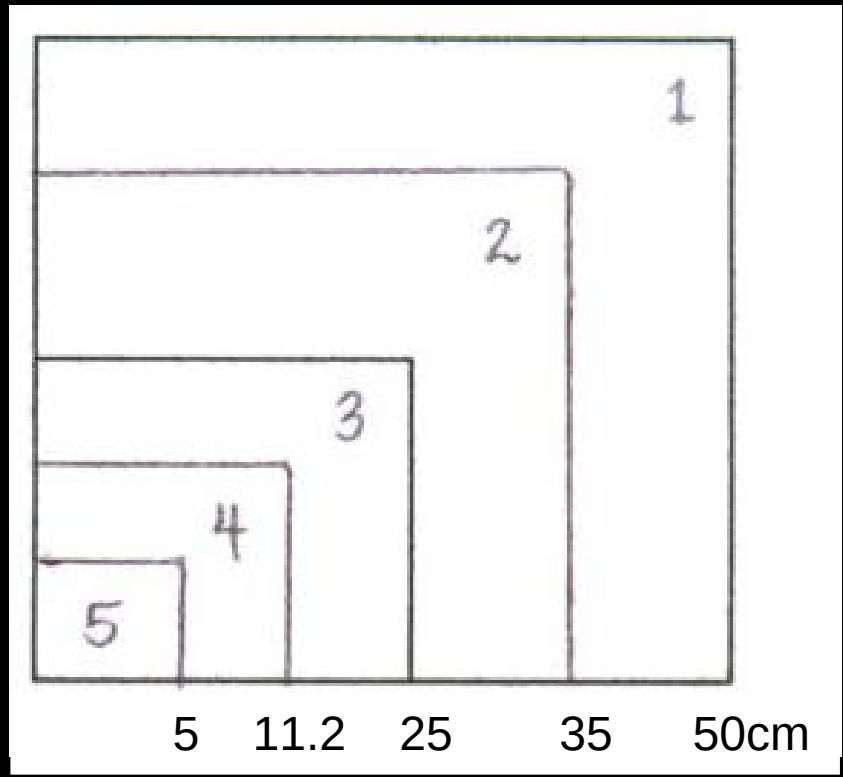

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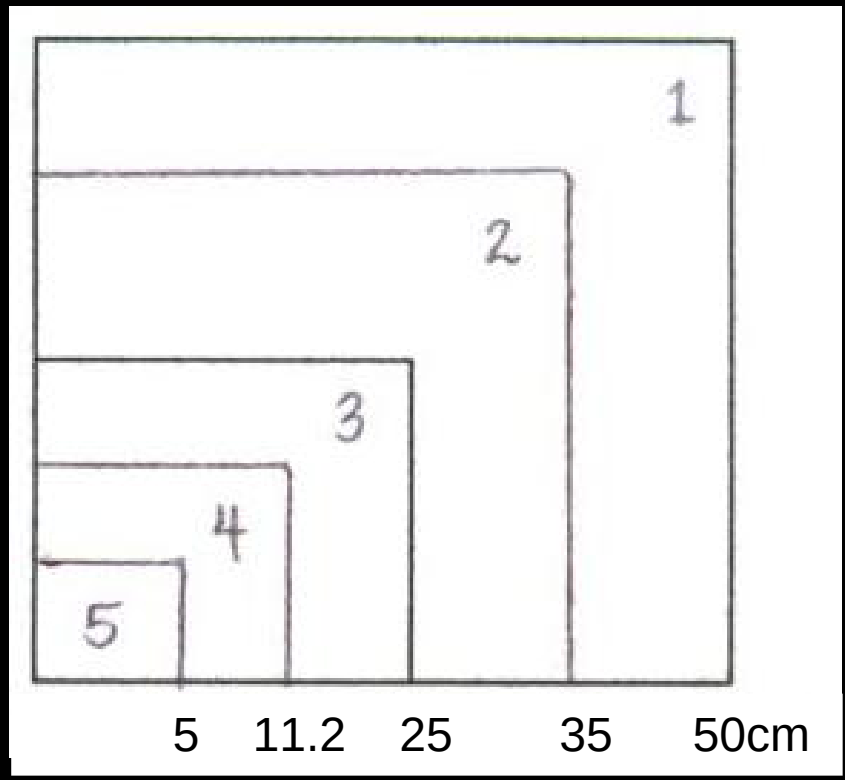
$P < 0.05$



Results

1. Which treatment best controls crested wheatgrass?

1st year response data

Mature Crested Wheatgrass Cover

	Lookout Pass		Skull Valley	
Treatment	Year 1 read 2006	Year 2 read 2007	Year 1 read 2006	Year 2 read 2007
UD	**14.26**	**6.18**	**14.25**	**7.32**
FCM	5.71 *	3.23	3.94 *	1.21 *
PCM	8.10 *	3.09	6.47 *	2.69 *
FCH	5.16 *	7.64	11.09	4.45
PCH	12.12	13.51 *	15.44	10.55

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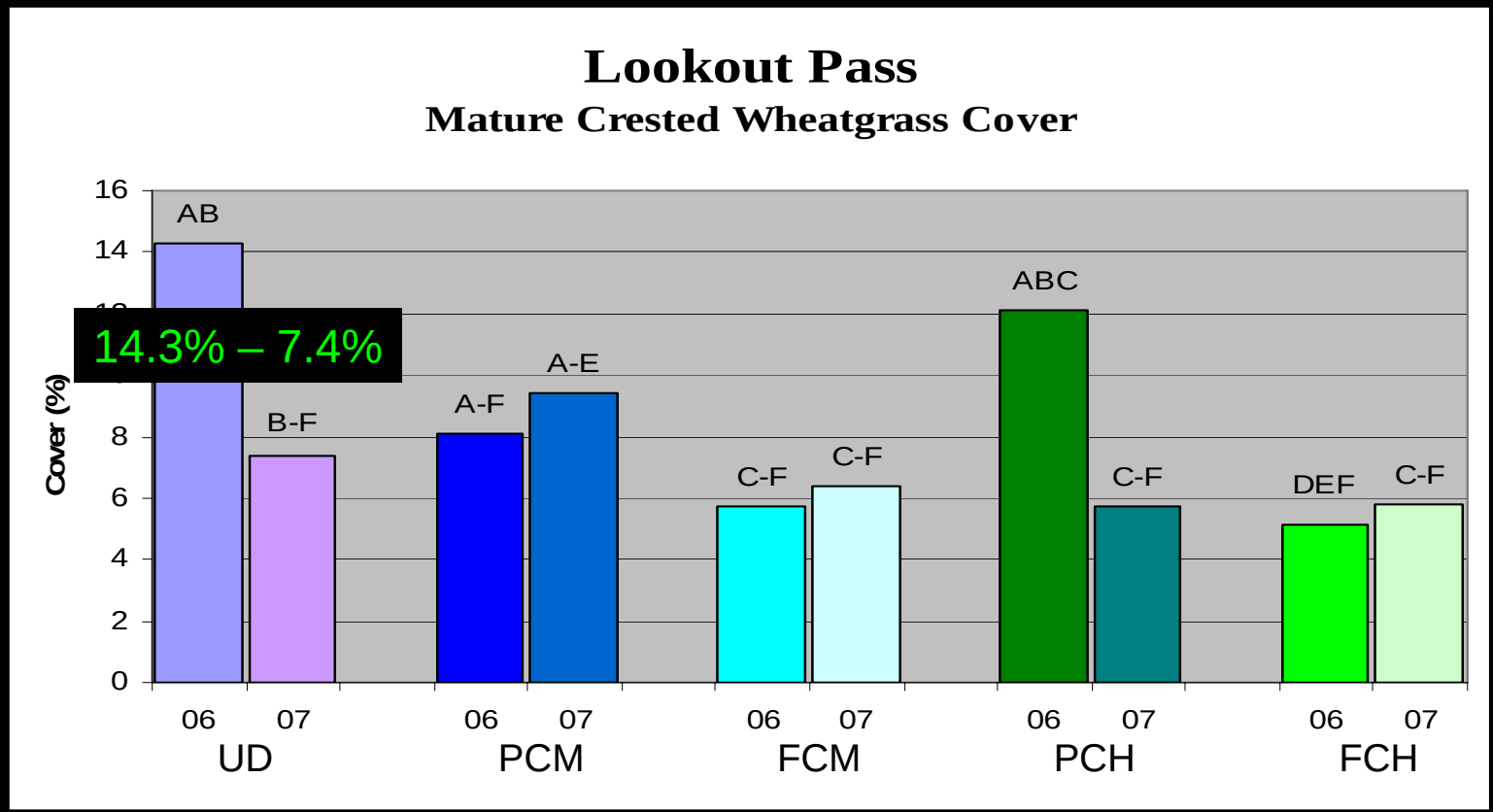

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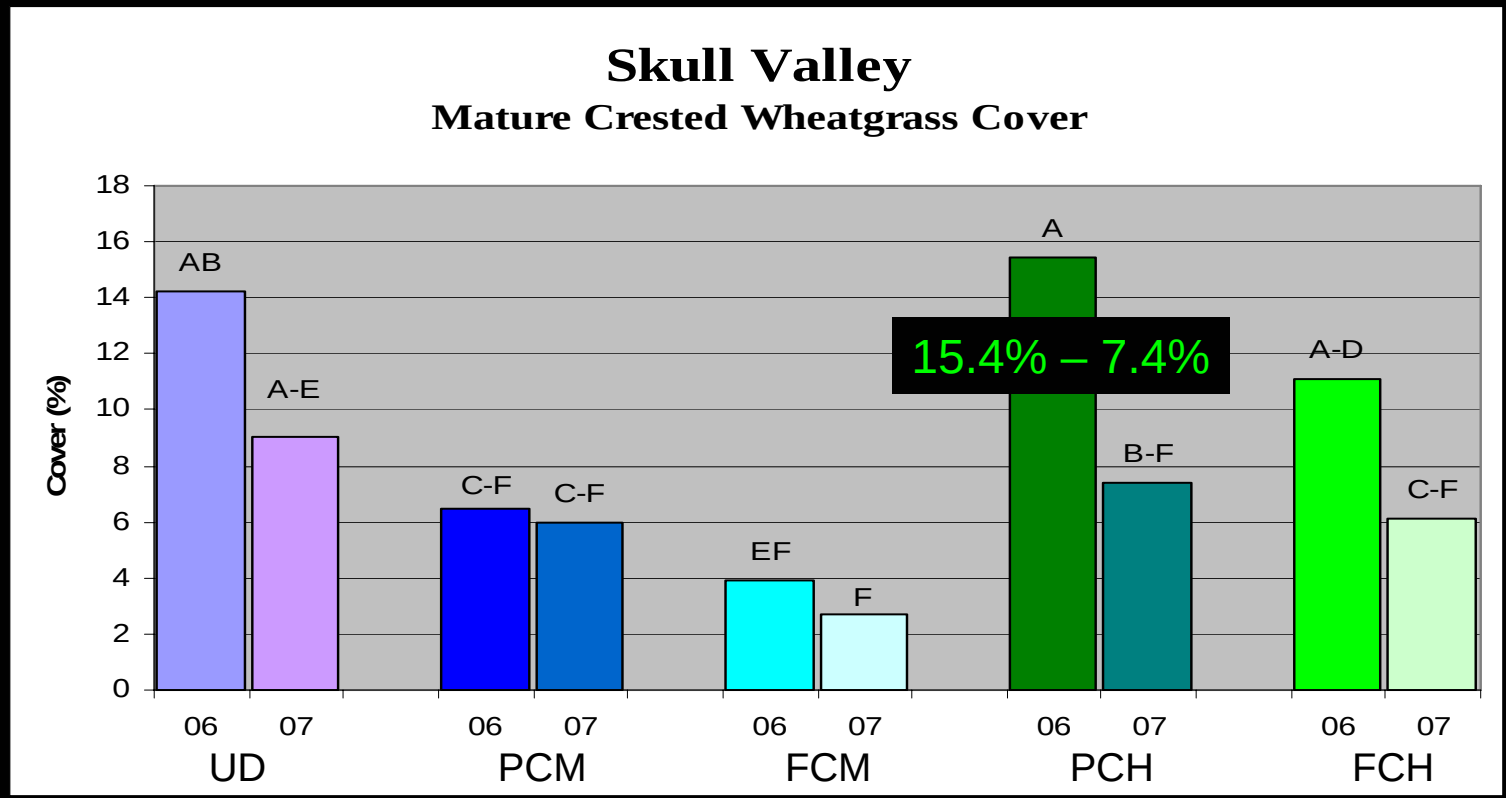
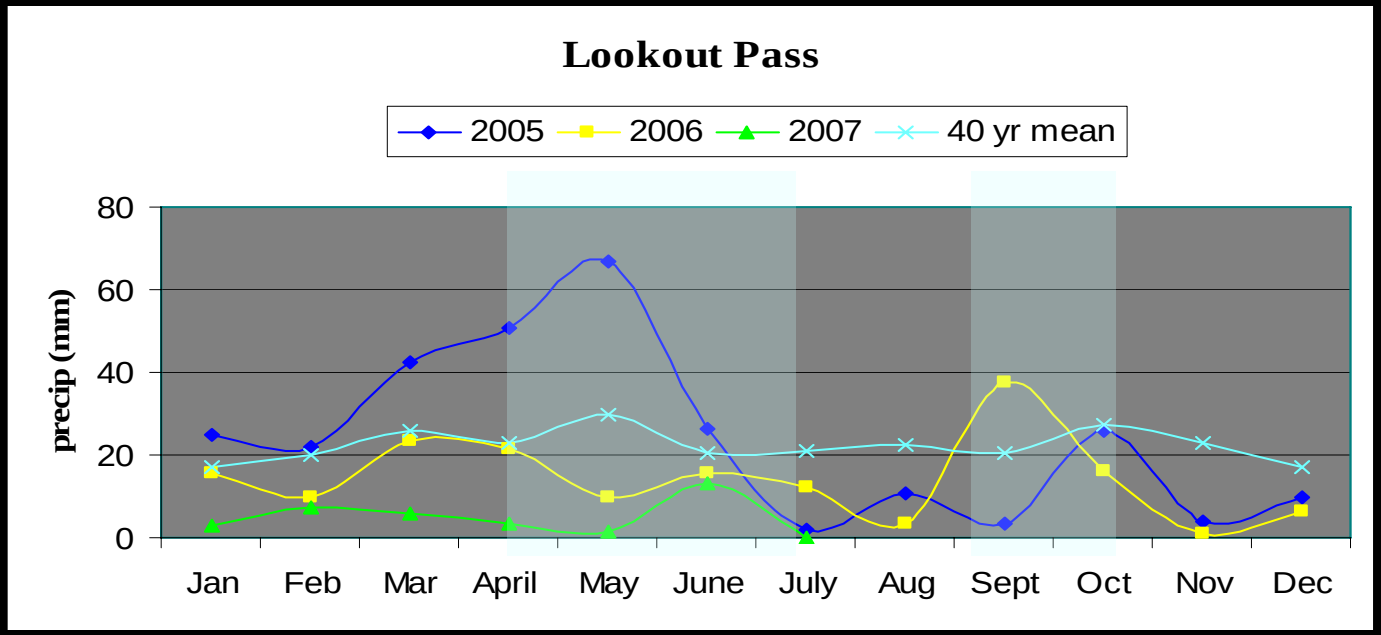
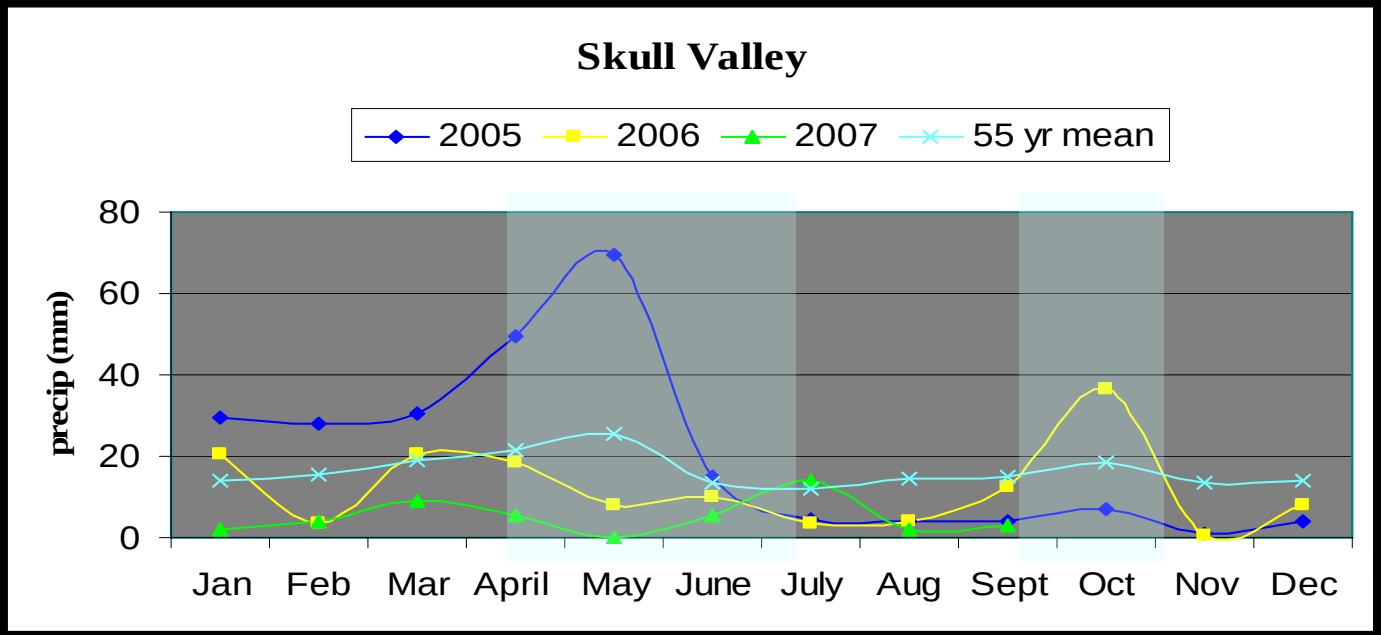


Precipitation Data





Results

1. Which treatment best controls crested wheatgrass?

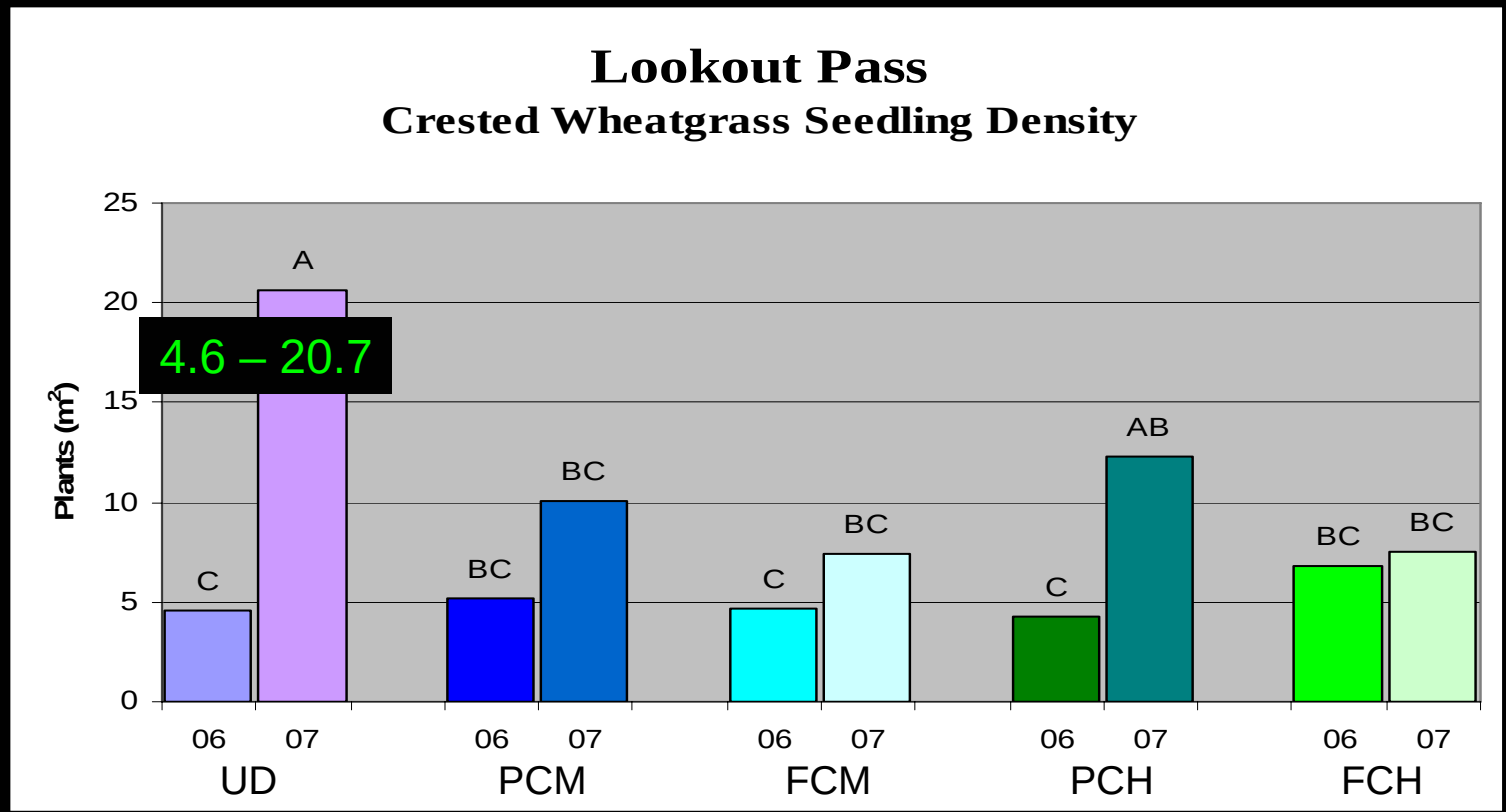
1st year response data
Crested Wheatgrass Seedling Density

	Lookout Pass		Skull Valley	
	Year 1 read 2006	Year 2 read 2007	Year 1 read 2006	Year 2 read 2007
Density (m^2)	5.12 (C)	11.59 (A)	5.48 (C)	7.40 (B)

Results

1. Which treatment best controls crested wheatgrass?

Repeated Measurements



The Bad News

- Crested wheatgrass is very difficult to kill

The Good News

- Crested wheatgrass is very difficult to kill

Results

2. Does crested wheatgrass control followed by seeding native species promote or inhibit weed invasion?

1st year response data

Cheatgrass Density

	Lookout Pass		Skull Valley	
Treatment	Year 1 read 2006	Year 2 read 2007	Year 1 read 2006	Year 2 read 2007
UD	0.57	1.27	33.58	153.67
FCM	2.0	0.1	34.71	62.24
PCM	.20	.85	36.75	85.64
FCH	0.31	5.84	10.39 *	109.8
PCH	0.24	3.41	8.95 *	72.47

0.9 plants per m^2

2.4 plants per m^2

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FCM	2.09	0.77	[illegible]	
PCM	1.20	0.85	[illegible]6.75	85.64
FCH	0.31	5.84	10.39 *	109.8
PCH	0.24	3.41	8.95 *	72.47

24.9 plants per m^2

96.8 plants per m^2

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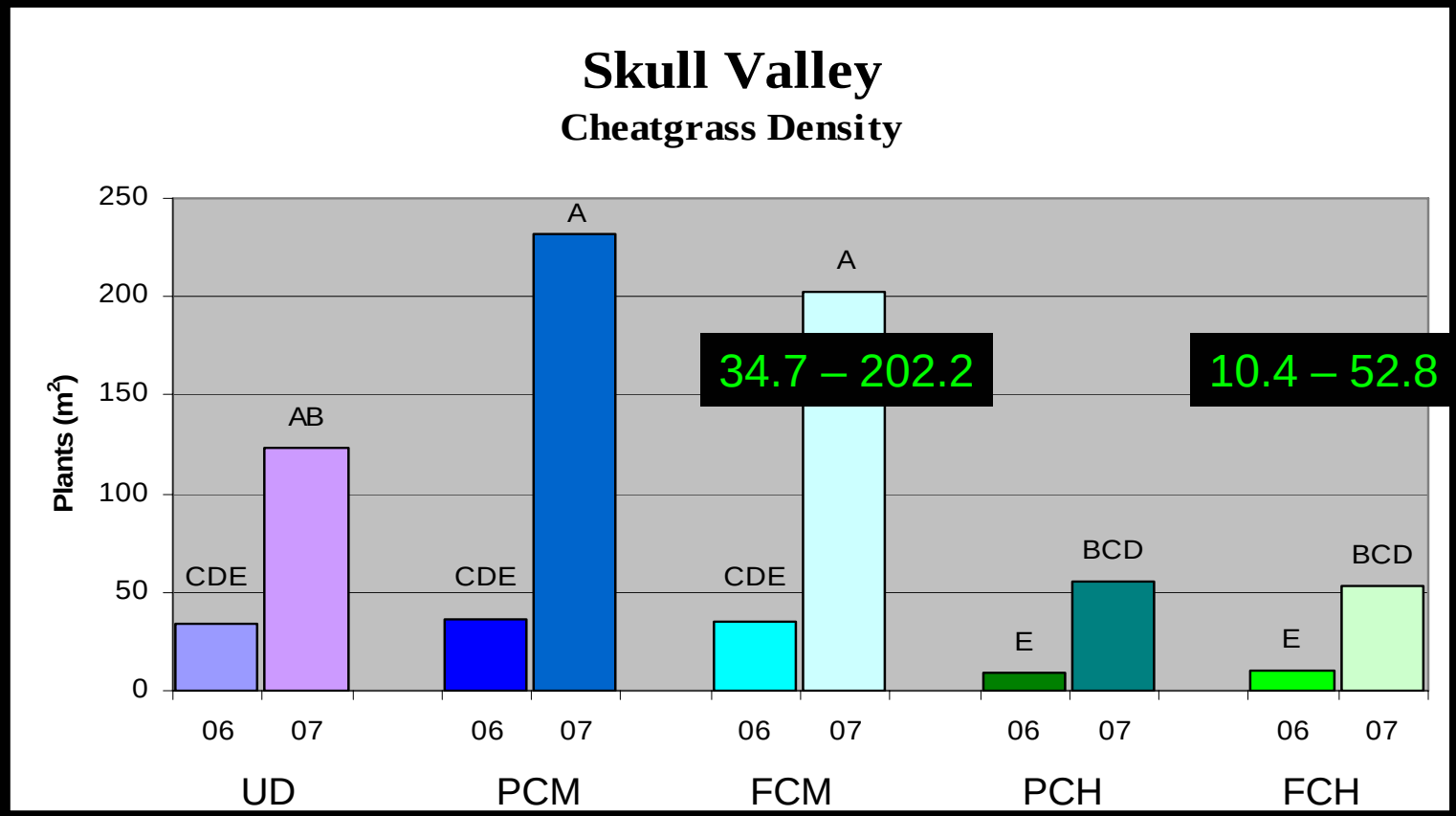

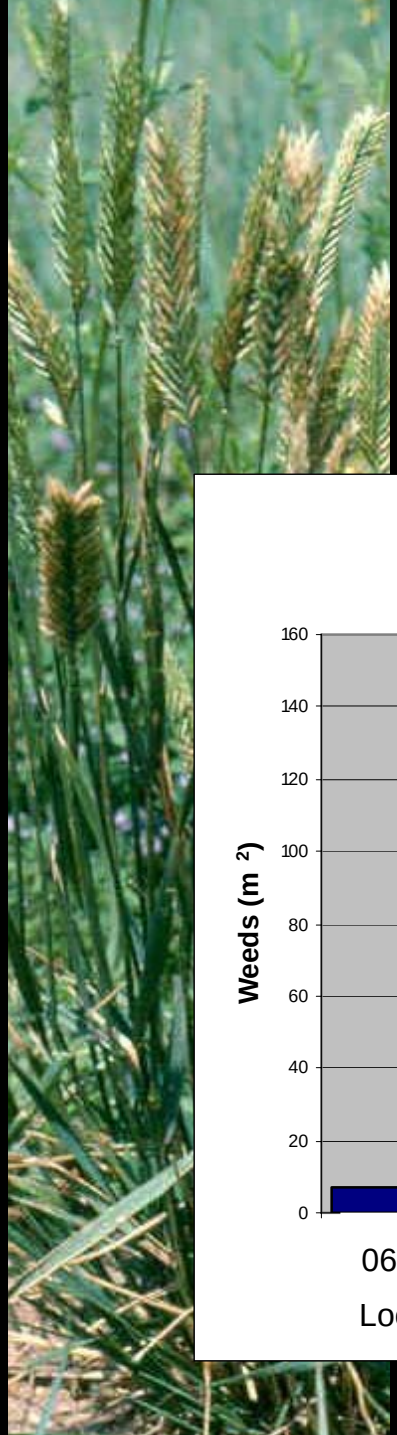

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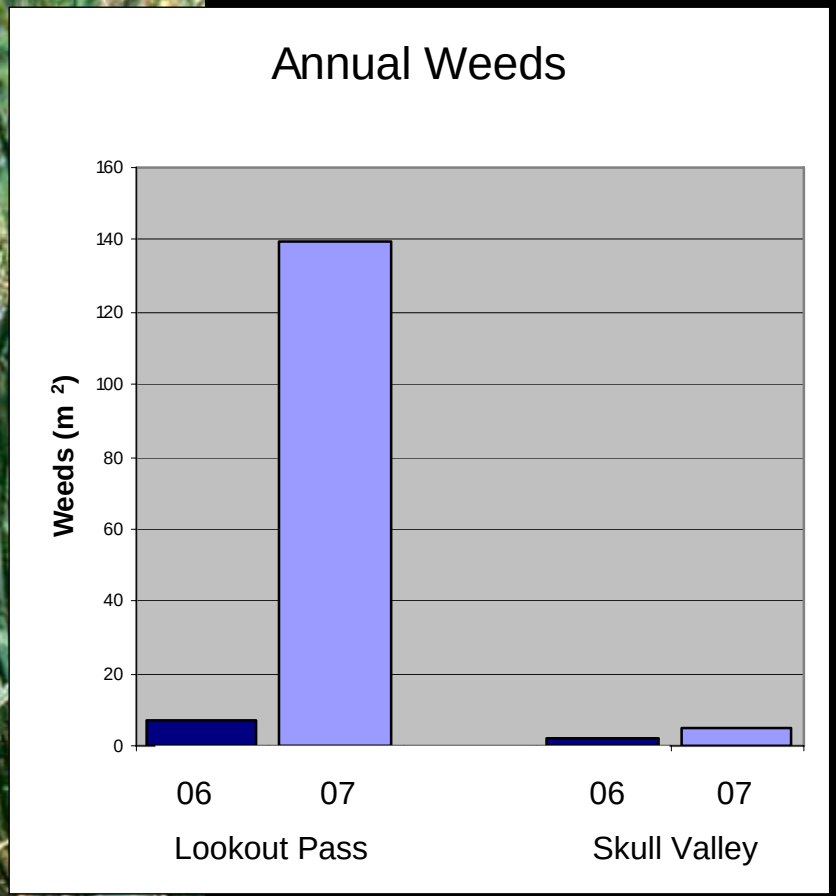

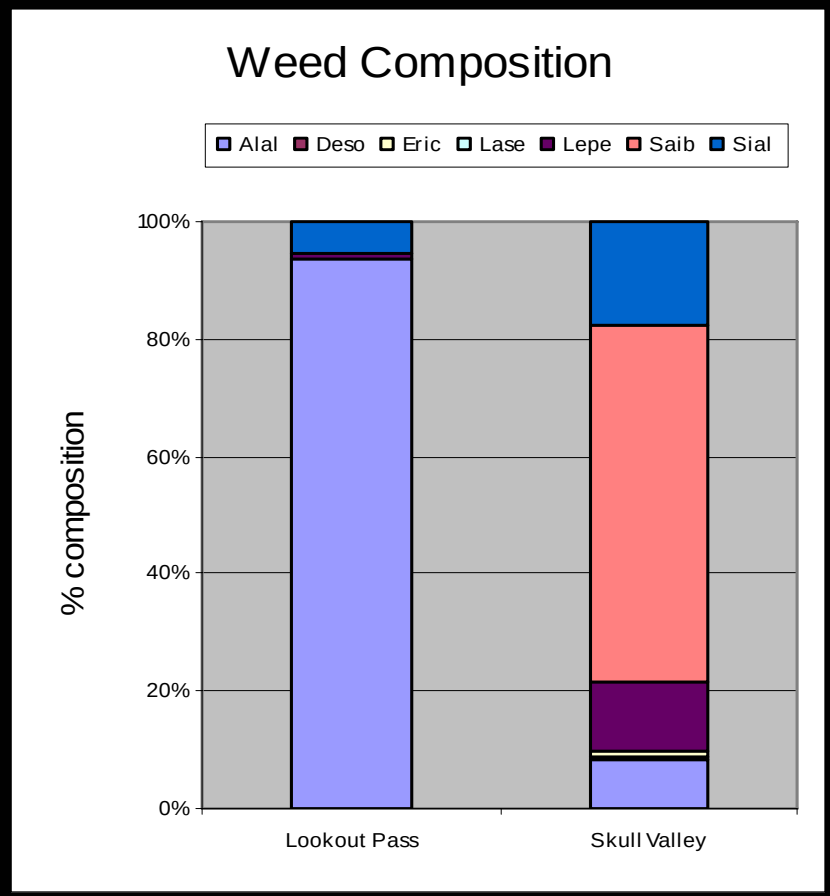

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3. Do wheatgrass control methods affect native plant revegetation success?

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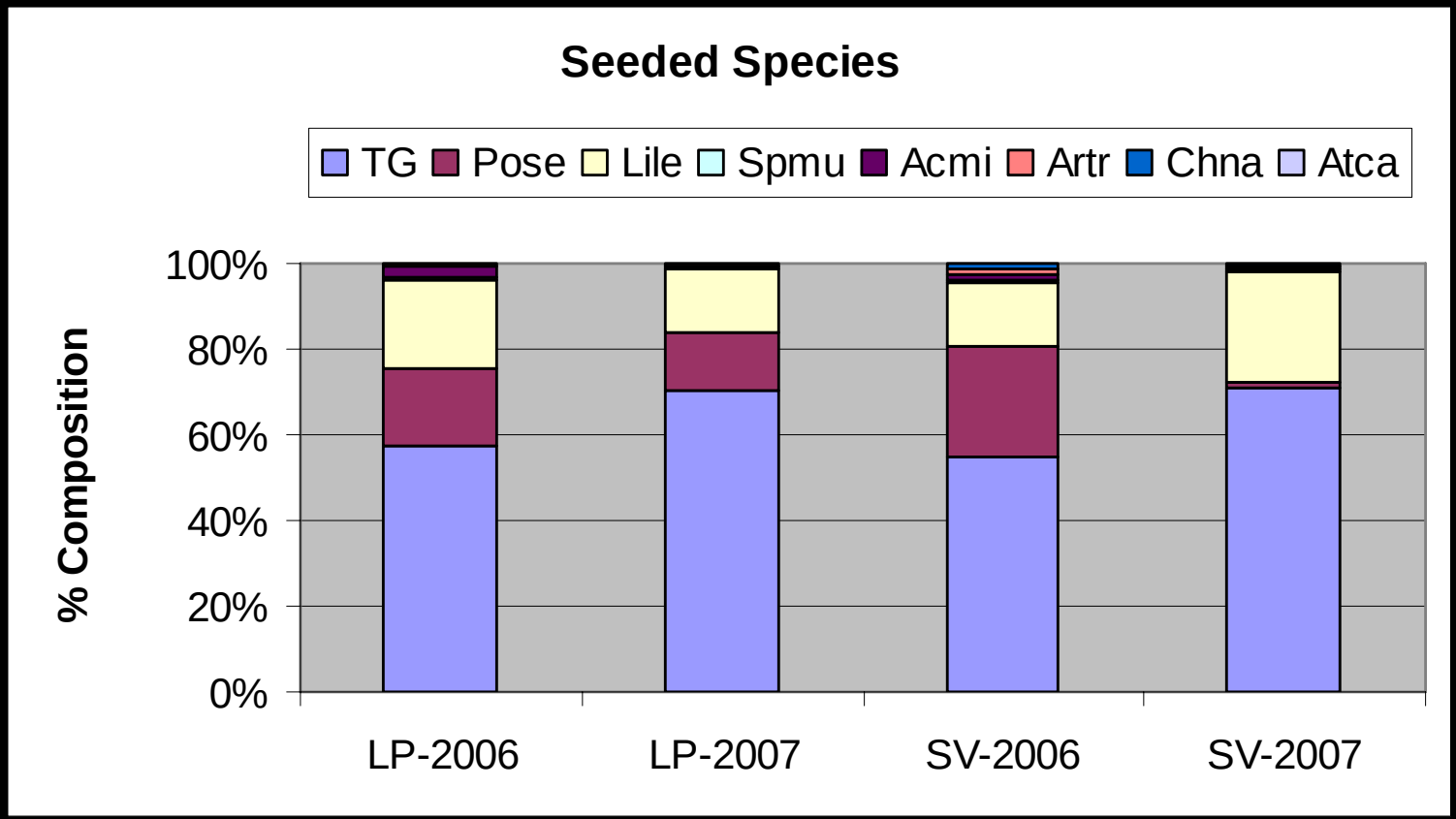
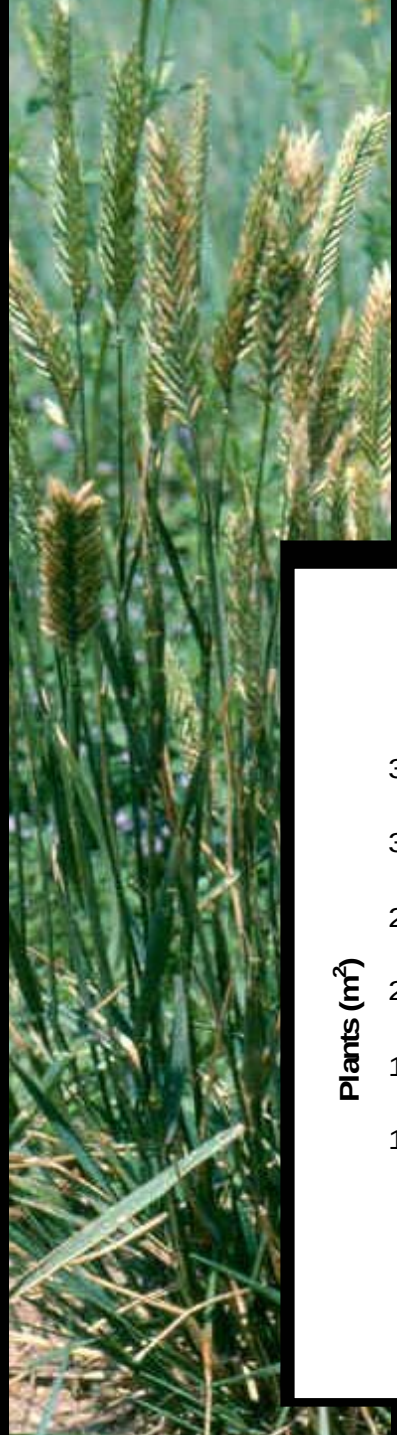
1st year response data
Seeded Species Density





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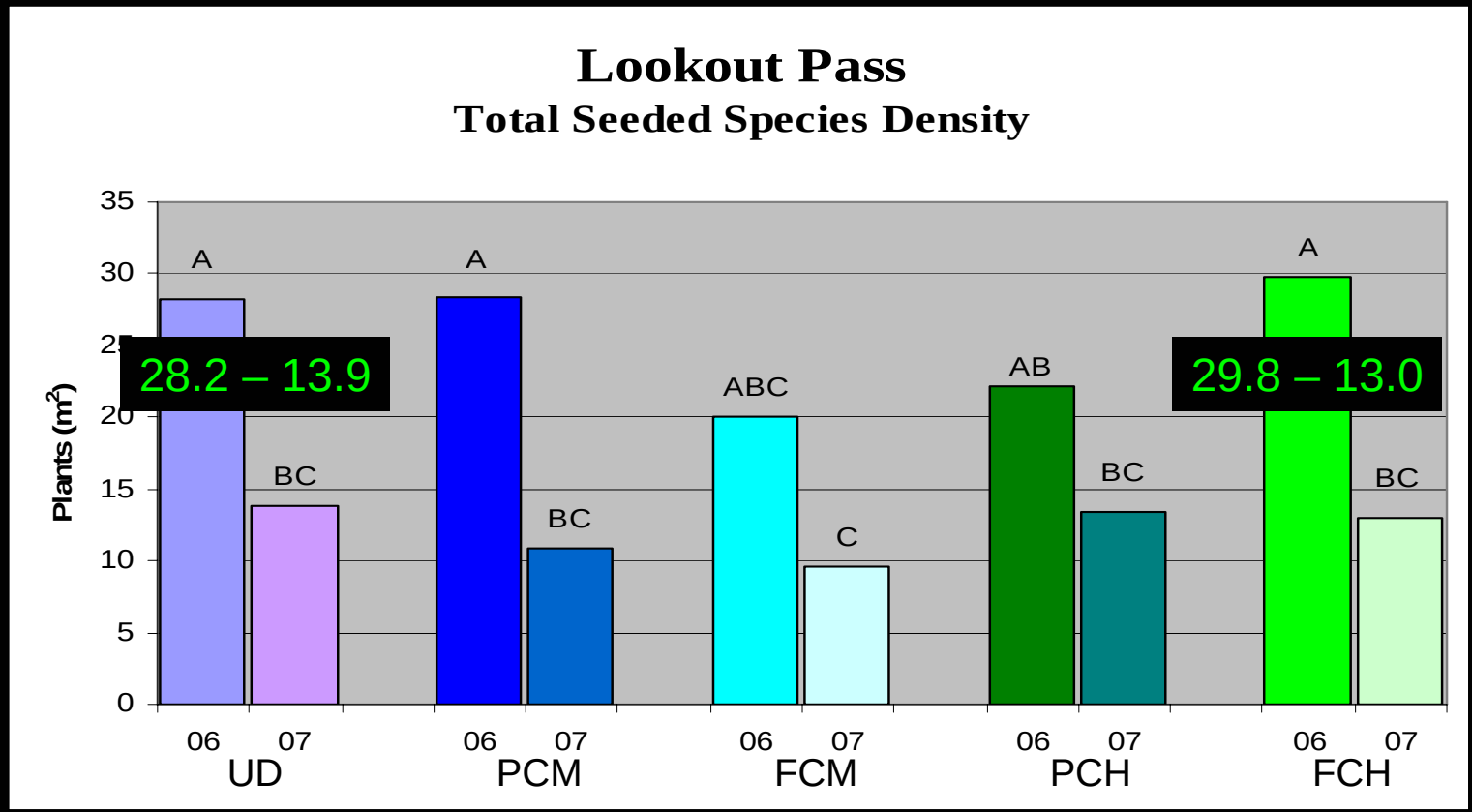

Summary

1. Which treatment best controls crested wheatgrass?

- Mechanical treatments
- Crested wheatgrass seedling density increased in each treatment between 2006 and 2007

2. How does wheatgrass control followed by native revegetation affect weed invasion?

- Cheatgrass density was significantly higher in mechanical plots versus herbicide plots

3. Do wheatgrass control methods affect native plant revegetation success?

- Treatments had no affect on seeded seedling emergence
- Mortality was not specific to grasses, forbs, or shrubs between 2006 and 2007

Reality: