2006 Annual Technical Report

Upper Colorado Environmental Plant Center

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Upper Colorado Environmental Plant Center

Established primarily as a means to identify, increase and introduce superior plant materials for identified conservation uses, Upper Colorado Environmental Plant Center (UCEPC) has played a vital role in revegetating disturbances in the inter-mountain west. Owned and operated by the Douglas Creek and White River Conservation Districts, UCEPC has had, since its inception in 1975, the specific charge and primary responsibility for collecting, evaluating, testing, selecting and producing quality plant species for the Upper Colorado River Basin. Superior materials, upon research completion, are then increased, released and made available to the public where they are utilized for a variety of conservation purposes.

UCEPC, at 6,500 feet in elevation, is unique in that it is the highest elevation center within the Plant Materials system. A vital need was identified over 25 years ago within NRCS and among many NRCS customers for plant materials and associated technology for high elevation uses.

The Center was also strategically placed near the world's largest deposit of oil-bearing shales, and within an area rich in other mineral deposits. The area is also home to the world's largest concentration of mule deer and elk, which made for considerable interest in providing quality plant materials for revegetation uses related to energy extraction activities.

Much of the research and development of plant materials from agronomic, arable land is provided primarily by the Agricultural Research Service and University Experiments Stations and Extension Services. As a result, the focus of the UCEPC Plant Materials Program is on plant material development for conservation uses on high elevation disturbances, rangeland, wildlife habitat and riparian corridors. There is, however, a certain degree of overlap in the utility a material may provide. For example, many of the grass species developed in the plant materials program for use in rangeland enhancement have been used on thousands of acres of agricultural ground through federal programs such as the Conservation Reserve Program (CRP). Other programs, such as the Buffer Initiative Program, Environmental Quality Incentives Program and Wildlife Habitat Improvement Program may utilize UCEPC developed materials. These programs have been initiated to reduce soil loss and improve water quality while providing concurrent benefits to livestock, wildlife and humans.

Because of the multitudes of existing problems, which can be alleviated, with the use of properly selected plant materials, the direction of the plant materials program and prioritization of projects and materials undertaken by UCEPC is largely provided by the Technical Advisory Committee. This committee is made up of State

Conservationists, State Resource Conservationists and other representatives of state and federal agencies, universities and private industry. Key, too, to this process and the operation of UCEPC are local conservation districts, and NRCS Field Office and district employees. From individual districts, plant materials, which can aid in solving conservation problems are identified and collected. These materials are then provided to UCEPC for testing and evaluating against the same or comparable materials prior to seed increase or release. It is within this framework that the best materials are made available for the identified conservation use on the area they were developed for and by the users who will benefit from their inclusion in seedings or plantings.

Presently, there are many plant species and projects at UCEPC, which our Technical Advisory committee has identified as providing substantial benefit for resource conservation. These projects fall into one of five identified High Priority Areas listed below:

- Revegetation of high altitude and disturbed land
- Increased productivity of rangeland and pastures
- Improved water quality
- Wildlife habitat enhancement
- Use of native plants in xeriscape and horticulture

These projects include years of evaluations at numerous testing locations, small seed increase fields, and the production of foundation quality seed of materials released for use by the public. The plant materials, which are developed as a result of the projects encompassed by these priority areas, will provide direct and indirect benefit to the resources of Colorado and to those who call Colorado "Home" for many years to come.

Research projects utilizing plant materials developed by UCEPC have ranged in scope from channel restoration and stabilization to roadside revegetation and from enhancement of mule deer winter range to phytoremediation of heavy metal runoff from mine spoils. Range, water and soil resources have been and will continue to be conserved and improved with UCEPC products. Reclamation and revegetation of utility and transmission corridors and natural and man induced surface disturbances are more successful as a result of research and products developed for those purposes, and livestock and wildlife forage and habitat are improved by the plant materials program and the many entities which assist in and cooperate with our mission.

For information about Upper Colorado Environmental Plant Center or any of its products or services, including specific information about plants, please contact us at (970) 878-5003.

Project 08A207
Project Report-2005
By: Steve Parr and Manuel Rosales

Advanced Evaluation of *Koeleria macrantha* Prairie Junegrass

OBJECTIVE

To develop and release an accession of *Koeleria macrantha* for conservation use from a composite selection of superior Northwest Colorado ecotypes

INTRODUCTION

Koeleria macrantha (prairie Junegrass) is a perennial, cool-season bunchgrass that is widely distributed throughout the United States. According to Hitchcock, 1935, its range extends from Ontario to British Columbia, south to Delaware, Missouri, California, and Mexico. The species is also widely distributed in the temperate regions of the old world. In the Central Rocky Mountains, it is commonly found as a component of prairies, open woods, mountain parks, sagebrush, and mountain brush communities. It is found in elevations ranging from below 4,000 feet to over 11,000 feet. The species provides good forage for both livestock and grazing wildlife species, and fair forage for browsing species of wildlife. *Koeleria macrantha* is usually sparsely distributed and is generally not found as the dominant range species in a particular stand. Because of this, its importance as forage to both wildlife and livestock may be more related to its abundance than its preference.

Prairie Junegrass also responds well after fire and studies have found positive effects to plant size and seed head abundance following fire. Other studies show it has increased in abundance after prolonged drought conditions and man induced surface disturbances. Although prairie Junegrass has a number of characteristics that make it an attractive product for inclusion in seed mixtures for revegetation, there is only one released variety, **Barkoel**, which is from the Netherlands. There is no release from the United States. This may be a factor in whether the species is recommended in mixtures. Because of the potential benefit to native ranges, prairie Junegrass has been a product under selection at the Upper Colorado Environmental Plant Center (UCEPC) since 1984.

MATERIALS

Forty accessions of *Koeleria macrantha* were planted as a fall seeding, Project 08I115, on August 23, 1985. Due to poor establishment of this planting, a **spring planting**, Project 08I152, was established on June 12, 1986. Because of insufficient seed, only 32 accessions of the original 40 were included in Project 08I152. In addition, 19 International collections were included in Project 08I152, bringing its total number of accessions up to 51. In 1988, Projects 08I115 and 08I152 were combined into a single project designated as 08I115.

In 1991 Dr. Jack Carlson, who was at the time the Northwestern Regional Plant Materials Specialist for the SCS, recommended that a composite of the best strains from the Central

Highlands of Turkey (PI-204451, PI-206274, PI-383672, PI-383673, and PI-383674), be made. In addition, Dr. Carlson recommended that a second composite be put together that consisted of the best performing strains from Northwestern Colorado. At that time, Northwest Colorado accessions 9024197, 9024421, and 9039787 were recommended.

In 1993, Dr. Gary Noller, UCEPC Senior Scientist, determined the top three Northwest Colorado and the top three Turkish Central Highlands accessions for the project. Dr. Noller recommended that accessions PI-383672, PI-383673, and PI-204451 be chosen from the Turkish Ecotypes. In addition, Dr. Noller recommended that accessions 9024197, 9039786, and 9039787 be chosen to represent the Northwest Colorado ecotypes. Accession 9024197 is from Rio Blanco County, while accession 9039786 and 9039787 are from Routt County.

During the summer of 1994, the UCEPC established separate crossing nurseries for the Northwest Colorado and Central Turkish Highland Accessions in UCEPC. The nurseries were established with vegetative culms transplanted from UCEPC Field 21 onto 3-foot centers. Each nursery was laid out in a Randomized Complete Block design and included three replications. Each genotype is represented within a given replication seven times. The Northwest Colorado crossing block represents Project 08A207 while the Turkish Central Highlands crossing block represents Project 08A208. Dr. Tom Jones, ARS, Logan, Utah pointed out that *K. macrantha* cross-pollinates and is self-incompatible. Upon cross-pollination, seed borne on each individual representing one of the three accessions will be considered a half-sib family (one parent known, one parent unknown).

METHODS FOR PRODUCT DEVELOPMENT

The original project methodology was to utilize genotypic recurrent selection only for the establishment of an F1 nursery. The original parental plants, 63 in all, were to provide the seed source for 63 F1 type plants, replicated three times, to produce an F1 nursery with 189 plants.

Each of the F1 plants was to be maintained as a separate line and eventually used to create an F2 nursery. The F1 seed, F2 seed and Parental seed would be compared and a subsequent release be initiated based on the results.

In 1996, seed was collected and harvested by individual plant, but was not identified as to which plant or accession. In 1997-2000, seed was harvested and identified for parental determination. In 2001-2003, the seed from the crossing block was bulk harvested. Because a recurrent selection process would take an additional three to five years to establish and compare seed production results, it was determined by UCEPC to go forward with a release of prairie Junegrass based on results of advanced evaluations.

On July 16, 2002, blended seed from the 2001 harvest was used to seed one acre of prairie Junegrass in Field 11 at UCEPC. Seed density was targeted at 30 seeds per linear foot and the

seeding was completed with a hand pushed Planet Junior. A poor to weak stand was noted until late fall, when a good stand was finally evident.

Since 2004 to present, the crossing block has been hand –harvested by accession number.

RESULTS

The following results are summarized by year:

1997-1999

Individual plant harvests were conducted with reference to accession from years 1997-1999. Harvest results from accession 1 (9024197) from Rio Blanco County and accessions 2 (9039786) and accession 3 (9039787) from Routt County are provided below.

Year	Accession 1	Accession 2	Accession 3	Total
1997	209	240	225	674
1998	653	710	581	1944
1999	174	237	255	666
Totals	1036	1187	1061	

Analysis of variance statistics were run for the randomized complete block design of this study. Although there is an apparent accessional difference, the difference is not significant at the 5% level. Of the 63 parental plants, there is mortality in ten. Of the remaining 53 plants, 16 are contributing very little to the seed gene pool simply because of the poor stature of the parental plants. Thirty- seven superior plants will be used for cross-pollination with harvested seed being used to test against the blended seed increase field.

Year- 2001

The Hege combine was used to harvest the entire block on July 11. The clean seed amount resulted in 461 grams.

Year- 2002

On July 18 the Hege combine was again used to harvest the entire block, but only 19 grams were harvested.

Year- 2003

The entire plot was hand harvested on July 15 and 2.5 pounds of clean seed resulted.

Year- 2004

Nine inferior plants out of the 44 remaining plants in the crossing block were clipped to prevent crossing with superior desirable parents. Plants were clipped May 17. Plants were monitored throughout the growing season for re-growth but no new heads were formed in the clipped

plants. However, about 12 inches of new leaf growth was measured from May 17 to June 15. On July 7, the 35 desirable parent plants in the crossing block were hand harvested and bulked. Three pounds of unclean seed yield 1.7 pounds of cleaned seed.

Year- 2005

On May 13, the nine inferior plants (due to short height and vigor) were clipped to prevent crossing with superior parental plants. All plants were just starting to head out. In June 7, the nine clipped plants were starting to head out again, so they were clipped a second time. The clipped plants were measured for re-growth with an average re-growth of 16 inches. On July 12, the superior plants were hand-harvested by accession. The results are presented in the following table:

Entry No.	Accession No.	No. Plants per Accession	Total bulk seed yield per accession	Collection Site Colorado
1	9024197	10	163 grams	Rio Blanco County
2	9039786	13	181 grams	Routt County
3	9039787	12	187 grams	Routt County

Year- 2006

On 2006, the superior plants of each accession were hand-harvested Inferior plants of each accession were hand clipped (May 18) prior to anthesis to prevent crossing with superior plants. Superior plants were harvested on July 3. Results are presented in the following table:

Entry No.	Accession No.	No. Plants per Accession	Total bulk seed yield per accession	Collection Site Colorado
1	9024197	10	181 grams	Rio Blanco County
2	9039786	13	242 grams	Routt County
3	9039787	12	171 grams	Routt County

CONCLUSION

A plant materials release (selected class) from a composite of the three accessions is being planned for the year 2007.

Project 08A209
Project Report-2006
By: Steve Parr

Non-Irrigated Production of Three Smooth Brome Grasses

ABSTRACT

Smooth brome grass *Bromus inermis* has been utilized for the conversion of non-irrigated cropland to non-irrigated hayland and improvement of existing non-irrigated hayland throughout the intermountain west. This study was conducted to determine which of three varieties of smooth brome would produce the largest quantity of harvestable biomass for domestic livestock feed in a mountain valley setting of the intermountain west. This study compared the production of 'Manchar', 'Liso', and 'Lincoln' varieties of smooth brome grass under non-irrigated conditions.

INTRODUCTION

During the past several decades many thousands of acres of smooth brome grass have been seeded into non-irrigated situations for hay production in the intermountain west. With the pending release of 'Liso' smooth brome grass, the question arises as to how it will produce in relation to traditional releases of smooth brome grass. The purpose of this study and paper is to review which variety of smooth brome grass will produce the maximum annual harvestable biomass over a realistic stand life of seven to ten years.

MATERIALS AND METHODS

This study was conducted at Upper Colorado Environmental Plant Center, six miles southeast of Meeker, Colorado. Environmental factors at test site are: 16.19″ of annual precipitation, 6500 ft elevation, north facing slope of 3%, growing season of 100 days. This comparison test was conducted on a work loam (fine, montmorillonitic typic argiborolls) which had been fallow for multiple years providing a fine relative weed free seed bed. A total of 18 plots in a random format were developed. Each plot was developed utilizing five 6-ft long rows on 1-ft centers. In return, each plot had border rows consisting of equal parts of each variety on a PLS basis. Planting was conducted utilizing a Planet Junior brand hand planter placing the seed at 1/2″ depth.

The site preparation began on July 1, 1997, and the plots were planted on July 10, 1997. The plots were then irrigated utilizing a “hand” move sprinkle system. The plots were irrigated to field capacity to replicate early spring conditions that are found in the White River Valley. Once field capacity was reached, three weeks later, the sprinkler pipe was removed and no additional irrigation was used during the scope of this study. The results of the 2003 evaluation showed a trend for production by accession to favor those products that spread laterally. Both 'Lincoln' and 'Manchar' had higher plot productivity than the 'Liso' material which was noted to remain more centered along the planted row with much less lateral spread. For evaluations in 2004, ocular assessments were made on the percent spread from the center line of the seeded rows. The three interior rows of each plot were evaluated. A less aggressive, spreading type of smooth

brome may be more productive through time than a vigorous spreading type. In addition, smooth brome has come under some scrutiny as being an aggressive, non-native that has the ability to out-compete native vegetation and spread beyond planted locations. Environmental considerations may strongly favor 'Liso' over more aggressive, spreading selections.

In 2005, productivity was evaluated on a relative scale to help determine the effects of the non-spreading nature of 'Liso' compared to the more aggressively spreading 'Lincoln' and 'Manchar' varieties. Other vegetative characteristics were noted to help identify the unique attributes of each of the selections.

RESULTS

Results are listed in Table 1 for percent cover, number of discernible rows and number of seed heads by plot and product.

Evaluation of
Three Smooth Bromes

Plot #	Percent Cover	Number of Discernible Rows	Number of Seed Heads	Product
1	85	0	0	'Manchar'
2	65	3	4	'Liso'
3	95	0	0	'Lincoln'
4	73	3	2	'Manchar'
5	90	0	0	'Lincoln'
6	80	1	0	'Liso'
7	95	0	0	'Lincoln'
8	70	1 w/parts of 2	1	'Liso'
9	90	0	0	'Manchar'
10	90	0	0	'Manchar'
11	77	3	6	'Liso'
12	95	0	0	'Lincoln'
13	70	3	5	'Liso'
14	80	0	4	'Manchar'
15	95	0	2	'Lincoln'
16	76	3	11	'Liso'
17	85	0	2	'Lincoln'
18	95	0	0	'Manchar'

Table 1

Project 08A209
Project Report-2005
By: Steve Parr

Analysis of variance was conducted for each of the dependent variables; cover, rows, and seed heads. Statistically, there was significant difference in each of these variables by cultivar. However, only the percent cover exhibited normal distribution as 'Liso' displayed the least amount of cover, 'Lincoln', the most cover while 'Manchar' was intermediate. The number of seed heads and the number of rows were also statistically significant among the cultivars, but their distribution is not normal. Rows were either apparent or not visible, so there was not normal distribution. Seed head numbers were a reflection of cover and row visibility. The greater the percent cover, the fewer the number of seed heads.

Listed below are the results of the comparisons of each of the variables with the three cultivars in the study. The analysis of variance for cover is presented after the variable comparisons.

Descriptive Statistics for cultivar = 'Lincoln'

Variable	N	Mean	SD	Minimum	Maximum
Cover	6	92.500	4.1833	85.000	95.000
Heads	6	0.6667	1.0328	0.0000	2.0000
Rows	6	0.0000	0.0000	0.0000	0.0000

Descriptive Statistics for cultivar = 'Liso'

Variable	N	Mean	SD	Minimum	Maximum
Cover	6	73.000	5.5857	65.000	80.000
Heads	6	4.5000	3.9370	0.0000	11.000
Rows	6	2.5000	0.8367	1.0000	3.0000

Descriptive Statistics for cultivar = 'Manchar'

Variable	N	Mean	SD	Minimum	Maximum
Cover	6	85.500	7.9687	73.000	95.000
Heads	6	1.0000	1.6733	0.0000	4.0000
Rows	6	0.5000	1.2247	0.0000	3.0000

Randomized Complete Block AOV Table for cover

Source	DF	SS	MS	F	P
Rep	5	99.33	19.867		
Cultivar	2	1171.00	585.500	12.68	0.0018
Error	10	461.67	46.167		
Total	17	1732.00			
Grand Mean	83.667	CV 8.12			

Tukey's 1 Degree of Freedom Test for Non-Additivity

Source	DF	SS	MS	F	P
Non-Additivity	1	0.959	0.9590	0.02	0.8941
Remainder	9	460.708	51.1897		
Relative Efficiency, RCB 0.79					

Project 08A209
Project Report-2005
By: Steve Parr

Means of Cover for Cultivar

Cultivar	**Mean**
'Lincoln'	92.500
'Liso'	73.000
'Manchar'	85.500
Observations per Mean	6
Standard Error of a Mean	2.7739
Std Error (Diff of 2 Means)	3.9229

CONCLUSIONS

'Lincoln' smooth brome is a very aggressive, rhizomatous sod-forming product. It is suspected that plots were clipped in 2003 at the beginning of lateral movement of 'Lincoln' and 'Manchar' from the planted row. 'Liso', from previous observations, has less lateral spread or movement from its planted row than either 'Manchar' or 'Lincoln'. Because there was "more material to clip" in the 'Manchar' and 'Lincoln' plots from lateral movement of those materials relative to the lack of a spreading tendency exhibited by 'Liso', they produced more forage biomass in 2003 than 'Liso'. Evaluations in 2004 and again in 2005 confirmed the higher biomass production from the lateral spreading products compared to 'Liso'. In 2006, vigor was higher for 'Liso' based on the number of seed heads, 27 compared to six for 'Manchar' and four for 'Lincoln'.

'Lincoln' may still be the most productive smooth brome, in terms of biomass, while 'Liso', since 2003, has become the least productive, although no data was collected for biomass in 2006. Ocular observations in 2005 also identified six out of six plots of 'Liso' by the vegetative characteristic of "very curly leaves". Four of six plots of each 'Manchar' and 'Lincoln' were also identified by leaf shape morphology. Plots 1 and 4 seemed to be a mixture of leaf shapes. No notations were made for leaf shape for plots 3 and 5. In 2006, 5 of 6 'Liso' plots were identified because of the non-spreading nature, or lateral "row migration" as compared to the other two cultivars. Plot 6 is the most difficult to distinguish as 'Liso'. The southwest portion of the study is also the most heavily vegetated because prevailing winds deposit more snow in this section of the study than elsewhere. The increased moisture has increased the lateral spread of 'Liso', which is not unexpected. This experimental error also shows up as non-additivity in Tukey's Test for seed head numbers especially. There is one 'Liso' plot with 11 seed heads while the next highest number is six. As a result, there is not normal distribution of seed head numbers. There are additional vegetative differences in 'Manchar' and 'Lincoln'. 'Lincoln' has more upright leaf growth while 'Manchar' exhibits less of that characteristic.

The notion that a less aggressively spreading smooth brome may, in the long term, be more compatible with a mixed planting of other grasses and/or legumes in a hay or pasture planting has merit. However, after nine years of data and observations, 'Liso' has never been more productive than 'Lincoln', and has been less productive than 'Manchar' since 2003. Since the source of seed for 'Liso' has been difficult to obtain, efforts to collect seed from the established project will be done so that further studies can be conducted.

Project 08A210 (COPMC-T-9801-WL, COPMC-T-9802-WL, COPMC-T-9803-WL)
Maybell Bitterbrush
December – 2006
By: Dr. Gary L. Noller

Maybell Bitterbrush Project with Colorado Division of Wildlife

INTRODUCTION

The project contains three studies: COPMC-T-9801 bitterbrush re-establishment by drilling; COPMC-T-9802 bitterbrush re-establishment, caching vs. live transplants; and COPMC-T-9803 bitterbrush re-establishment with transplants in rows. On November 1, 2006, two of the three bitterbrush studies were evaluated. The evaluation involved examining tubling plants of antelope bitterbrush *Purshia tridentata* in rows and plots. The one caching plot with seedlings (Replication 1, plot 7) has been found each year from 1999 to 2006. Drilled rows (COPMC-T-9801) were **not examined** in 2006, since live plants have not been found. Additional information on methods of planting can be found in progress reports for 1998 and 1999.

In general, the conditions and plant growth within the exclosure appeared to be good. However, grasses, especially needle-and-thread did not have as much growth as was present in 2005. As a result, bitterbrush plants were easier to find in 2006. Small bitterbrush plants were flagged to help locate them for future evaluations. The exclosure fence is still in need of repair and does not prevent animals from entering the exclosure. Some rodent activity was noted in 2006. Two white-tailed jack rabbits were observed inside the exclosure.

RESULTS

Tubling plants in rows and plots were examined on November 1, 2006. In addition, the one cache (Replication 1, plot 7) that was found each year from 1999 to 2006 was also evaluated. Soil inside the exclosure was moist to a depth of 22 inches, and was not examined to a greater depth. The average height and width for plants in **rows** was determined by measuring all plants in the first four rows. The average height for plants in **plots** was determined by measuring all plants where herbicide or no herbicide was used. Many bitterbrush plants inside the exclosure had been browsed, but the use did not appear to be very recent.

COPMC-T-9801-WL

Drilled plots – (4.5 and 9.0 ft. row spacing)**:**
This study was **not evaluated** in 2006.

COPMC-T-9802-WL

Caching:
Plots for caching and tubling (plug) plants had 36 planting sites per plot. Only one cache (Replication 1, plot 7) had plants on November 1, 2006. The one cache results in 0.3% re-establishment for caching. Since the one cache was in the herbicide (glyphosate to reduce competition) plot, this averages 0.7% re-establishment when herbicide is used to reduce competition. The plant in this cache measured only 10.0 cm tall and 25.0 cm wide. Based on

this project, caching is **not** a **successfu**l method for re-establishing antelope bitterbrush on this site. Caching plots where plants had not been found in the past were not examined.

Tubling plants in plots:
Height and width measurements from all plots where **herbicide** was used averaged 31.1 cm by 53.5 cm, respectively. The one plant in the plots where **no herbicide** was used measured 22.0 cm in height and 55.0 cm in width. Survival in plots where **herbicide** was used was 34.7% in 1999, 30.6% in 2000, 25.7% in 2001, 25.0 % in 2002, 24.3% in 2003 and 2004, and 23.6% in 2005 and 2006 (Table 1). Survival in plots where **no herbicide** was used was 13.9% in 1999, 9.0% in 2000, 4.9% in 2001, 1.4% in 2002, and 0.7% in 2003, 2004, 2005 and 2006. Survival for bitterbrush plants in plots did not change in 2006 for the **herbicide** or **no herbicide** treatments. Planting tubling bitterbrush plants in plots when **herbicide** is used is a **successful** method of re-establishing antelope bitterbrush. In 2006, 50.0% of the plants were found, that were present in 1999. **Herbicide** is important in the initial **establishment** of bitterbrush tublings (50 plants with herbicide and 20 plants with no herbicide in 1999, Table 1), but also in the **persistence** of tublings (34 of 50 plants, 68.0%, were still alive in 2006 when herbicide was used vs. only 1 of the 20 plants, 5.0% was still alive in 2006 when no herbicide was applied). Survival of bitterbrush tublings in plots appears to be relatively stable three years (2002) after planting (Figure 1). This study indicates that if a bitterbrush tubling can survive for three years, its chances of long term survival are good. It would also suggest, methods that improve the chances of survival for the first three years will be important for long term survival.

COPMC-T-9803-WL
Tubling plants in rows:
Eighteen rows of tubling antelope bitterbrush plants (716 planting sites) were examined for survival on November 1, 2006. Plants in rows averaged a height of 29.6 cm and a width of 51.5 cm. It should be noted that rows were treated with **herbicide** to reduce competition before planting. Survival in rows was 21.1% (151 plants) in 1999, 18.2% (130 plants) in 2000, 17.0% (122 plants) in 2001, 16.5% (118 plants) in 2002, 15.8% (113 plants) in 2003, 16.1% (115 plants) in 2004, and 15.9 % (114 plants) in 2005 and 2006 (Table 2). Survival for tubling plants in rows did not change in 2006 from 2005. In 2006, 75.5% of the plants were found, that were present in 1999. This is a **successful** method of re-establishing antelope bitterbrush on this site. Survival of bitterbrush tublings in rows also appears to be relatively stable three years (2002) after planting (Figures 2 and 3). This study indicates that if a bitterbrush tubling can survive for the first three years, its chances of long term survival are good. It also suggests that methods that improve the chances for survival for the first three years will be important for long term survival.

OBSERVATIONS AND CONCLUSIONS

1. The project was evaluated on November 1, 2006, for antelope bitterbrush re-establishment.

2. Seeding (both drilling and caching) was done on October 21, 1998.

3. Antelope bitterbrush tublings were planted in plots and rows on May 6, 1999.

4. Seeding (both drilling and caching) were **not successful** methods for re-establishing antelope bitterbrush on this site at this time. Drilled plots were **not examined** in 2005.

5. Survival of antelope bitterbrush tublings on November 1, 2006, in **plots** averaged 12.2% on this site. (23.6% when herbicide was used and 0.7% with no herbicide.) This is a **successfu**l method for re-establishing antelope bitterbrush on this site at this time.

6. In **plots**, 50.0% of the plants that were observed in 1999 were found again in 2006.

7. Planting antelope bitterbrush tublings in **rows** was a **successful** method of re-establishing bitterbrush and resulted in a 15.9% survival recorded on November 1, 2006.

8. In **rows**, 75.4% of the plants that were observed in 1999 were found again in 2006.

9. **Herbicide** was important for the **establishment** of bitterbrush tubling (See Table 1, 1999), and for the **persistence** of the tublings over time (See Table 1, 1999 to 2006).

10. Width measurements of bitterbrush plants were included in the report for 2006.

11. Survival of tubling plants in plots and rows did not change for 2005 to 2006.

12. Survival of bitterbrush tublings in plots and rows did not change substantially after the first three years (2002) of the study.

13. Methods that will improve survival for the first three years will be important for the long term survival of bitterbrush tublings.

Project 08A210 (COPMC-T-9801-WL, COPMC-T-9802-WL, COPMC-T-9803-WL)
Maybell Bitterbrush
December – 2006
By: Dr. Gary L. Noller

Table 1. A listing of the number of plants found in plots treated with herbicide, no herbicide, and the total of both, from 1999 through 2006. Percent survival is also listed.

TUBLING PLANTS IN PLOTS

Date		**Number of Plants**	**% Survival**
May 9**,** 1999	(Planted)	288	-
November 10, 1999	(all plants)	70	24.3
	Herbicide	50	34.7
	No herbicide	20	13.9
September 26, 2000	(all plants)	57	19.8
	Herbicide	44	30.6
	No herbicide	13	9.0
November 7, 2001	(all plants)	44	15.3
	Herbicide	37	25.7
	No herbicide	7	4.9
October 4, 2002	(all plants)	38	13.2
	Herbicide	36	25.0
	No herbicide	2	1.4
October 9, 2003	(all plants)	36	12.5
	Herbicide	35	24.3
	No herbicide	1	0.7
October 13, 2004	(all plants)	36	12.5
	Herbicide	35	24.3
	No herbicide	1	0.7
November 2, 2005	(all plants)	35	12.2
	Herbicide	34	23.6
	No Herbicide	1	0.7
November 1, 2006	(all plants)	35	12.2
	Herbicide	34	23.6
	No Herbicide	1	0.7

Table 2. A listing of the number of plants found in rows from 1999 to 2006. Percent survival is also listed.

TUBLING PLANTS IN ROWS

Date	Number of Plants	% Survival
May 6, 1999 (Planted)	716	-
November 10, 1999	151	21.1
September 26, 2000	130	18.2
November 7, 2001	122	17.0
October 4, 2002	118	16.5
October 9, 2003	113	15.8
October 13, 2004	115	16.1
November 2, 2005	114	15.9
November 1, 2006	114	15.9

Project 08A210 (COPMC-T-9801-WL, COPMC-T-9802-WL, COPMC-T-9803-WL)
Maybell Bitterbrush
December – 2006
By: Dr. Gary L. Noller

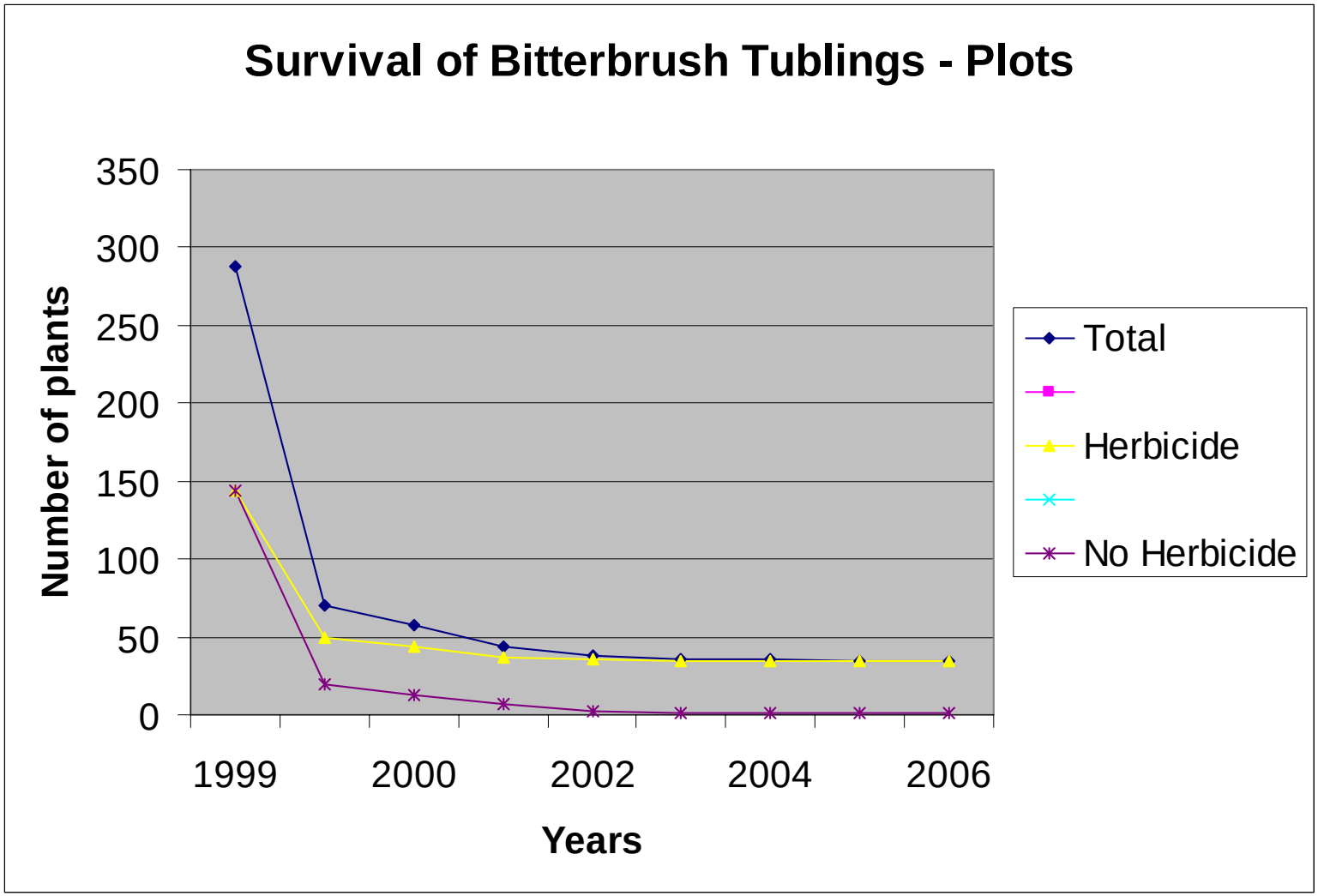

Fig. 1.
Survival of bitterbrush tublings in plots is shown. Bitterbrush tublings are shown as total plants (with and without herbicide), tublings with no herbicide, and tublings that had herbicide (Roundup Ultra at 2 quarts/Ac in a four foot strip prior to planting) to reduce competition. The figure shows that survival, three years after planting (2002), is relatively stable to 2006.

Project 08A210 (COPMC-T-9801-WL, COPMC-T-9802-WL, COPMC-T-9803-WL)
Maybell Bitterbrush
December – 2006
By: Dr. Gary L. Noller

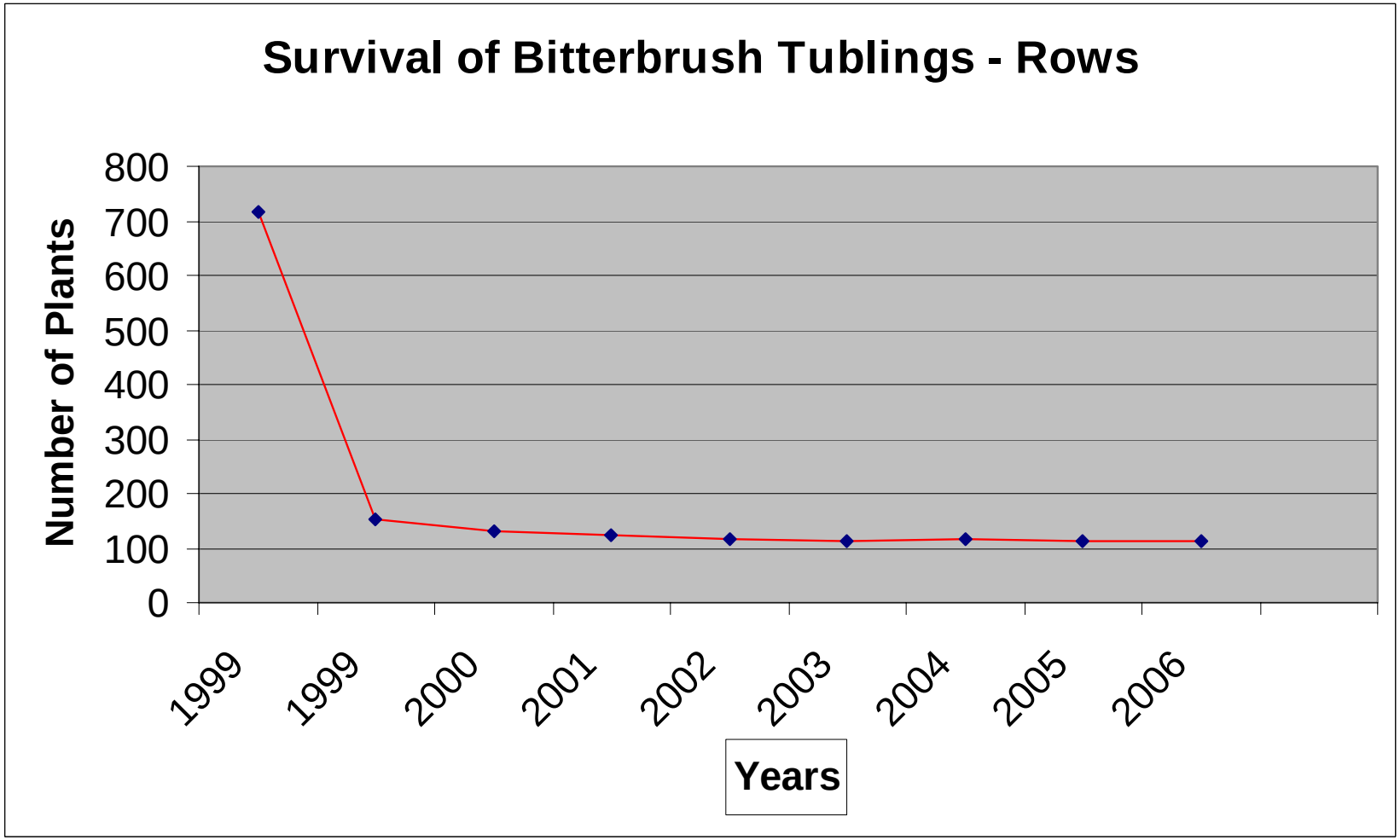

Fig. 2.
Survival of bitterbrush tublings in rows. Herbicide was applied to all rows to reduce competition. Survival three years after planting (2002), has remained relatively stable to present.

Project 08A210 (COPMC-T-9801-WL, COPMC-T-9802-WL, COPMC-T-9803-WL)
Maybell Bitterbrush
December – 2006
By: Dr. Gary L. Noller

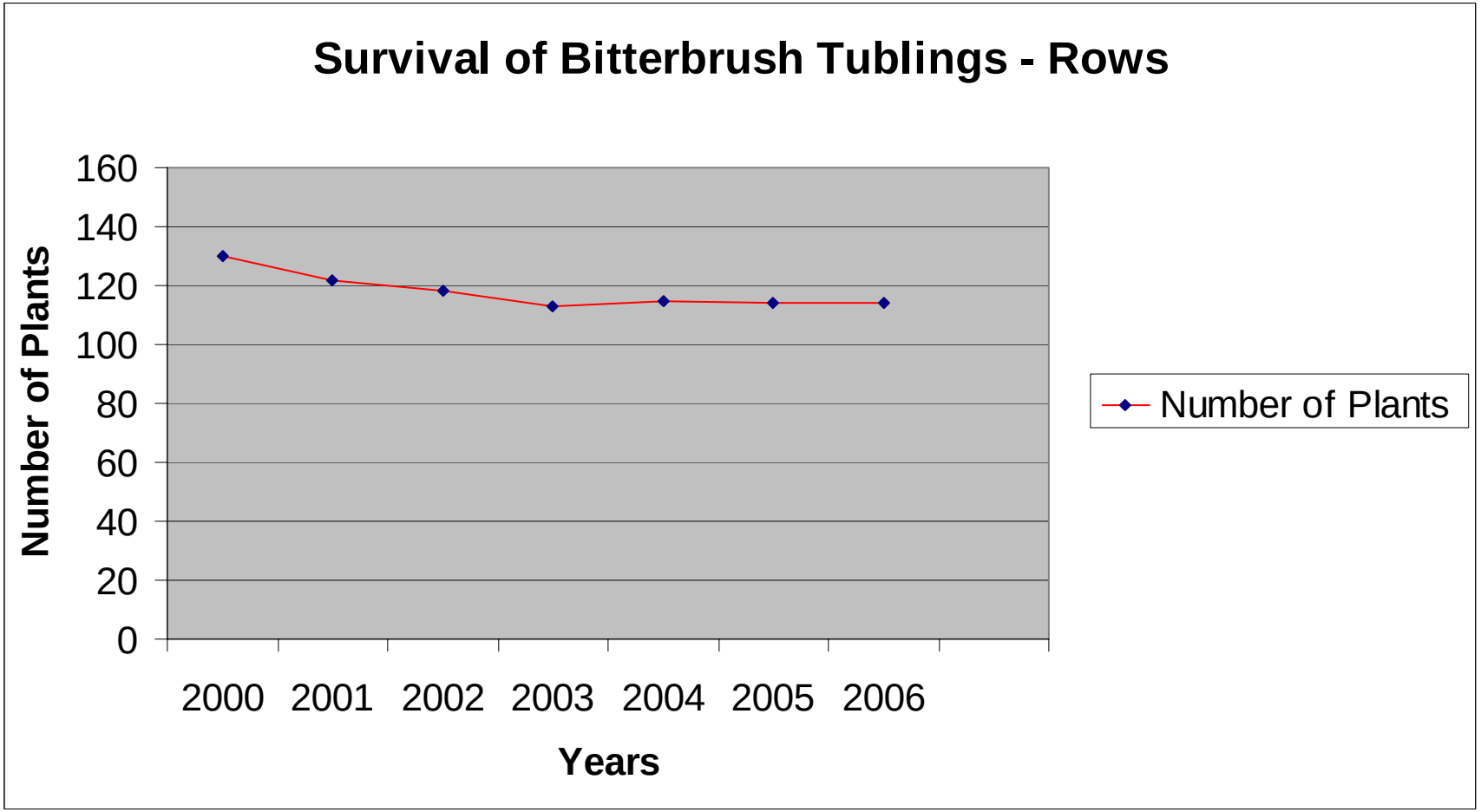

Fig. 3.
This figure is an attempt to emphasize the changes in survival from the fall of 1999 to 2002. And to show that survival was relatively stable from 2002 to 2006.

Project 08A213
Progress Report – 2006
By: Steve Parr

Willow Planting at an Alkaline Site

INTRODUCTION

With the increased interest in riparian improvement projects and national programs such as WHIP and EQIP, Upper Colorado Environmental Plant Center planted multiple willow species in three separate locations during the spring and summer of 2000. Each of the species planted was collected from the Center's willow cutting block, which included 13 species of native willows. Materials were collected as 24″ hardwood cuttings in February and March of 2000 and held in suspended dormancy in a cold storage/bare root facility until the time of planting. Plantings were done at sites of varying elevations and stream characteristics.

The planting into an ephemeral stream's incised channel was done at an elevation of 6100 feet into alluvial soils with some alkaline characteristics. This planting was designed for species adaptability to heavy, alkaline soils, but also to re-establish woody riparian species into an ephemeral stream which is largely devoid of such materials. Extensive erosion of deep soils had created very deeply cut, steep sided channels, with little stability. Adapted woody plants are needed to aid in channel stabilization and to improve stream system dynamics of perennial and ephemeral steams.

The White River, along with 13 of Colorado's 15 major river drainages and other rivers in the Intermountain West, has had a recent but serious problem with whirling disease. This disease is thought to be one of the causes of trout population reductions. The disease has been identified as an ailment affecting trout development prior to bone ossification. In essence, there is very little natural recruitment of young trout into adult populations in streams affected with the amoeba spores responsible for transmitting the disease. The whirling disease parasite has a two-host lifecycle that includes trout and a bottom, muddy sediment dwelling tubifex worm. The tubifex worm is found in shallow, sunny stream sites underlain with fine sediments. Efforts to reduce soil sedimentation and water temperatures and increase oxygen water content may prove beneficial to trout recruitment. Both of these stream conditions can be altered with proper selection and establishment of streamside woody riparian species.

OBJECTIVE

The objectives of this planting are to (1) determine if willow cuttings can be successfully established in Jordan Gulch, an ephemeral stream, and (2)ascertain which species and which accession within each specie is more site adapted to an alkaline, moist sodic planting; and (3) compare five-year site success with other willow planting sites.

Project No. 08A213
Progress Report – 2006
By: Steve Parr

METHODS

Two plantings were conducted on August 22, 2000, on lower Strawberry Creek west of Meeker, Colorado, on the property of Bill and Phyllis Lake. One planting will compare three accessions of *Salix lutea*, yellow willow, to each other while a second planting will compare three accessions of *Salix exigua*, coyote willow, to one another. In addition, one accession of coyote willow, 9070981, is a wild land collection from near the Plant Center rather than the other products which are nursery grown. The yellow willow planting is located north of the designated landmark; a road crossing in the gulch. The coyote willow planting is south of the road crossing.

Yellow Willow Planting

The yellow willow planting was done with Replication I starting just north of the road crossing. The planting consists of four replications of three accessions. Each replicated accession was planted with five entries across or perpendicular to stream flow. The two-foot cuttings were placed as deeply as soil would allow such that two to three buds were above ground. The cuttings were also planted at a slanted, downstream angle to help prevent debris from hanging up on the cuttings and washing them out. In all, each accession is represented 20 times in the planting. The plot layout is presented in Figure 1.

Figure 1.

N

Replication IV	834	x	x	x	x	x
	819	x	x	x	x	x
	835	x	x	x	x	x
Replication III	835	x	x	x	x	x
	834	x	x	x	x	x
	819	x	x	x	x	x
Replication II	819	x	x	x	x	x
	835	x	x	x	x	x
	834	x	x	x	x	x
Replication I	819	x	x	x	x	x
	834	x	x	x	x	x
	835	x	x	x	x	x

Road Crossing

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Coyote Willow Planting

The coyote willow planting was done in much the same fashion, but with Replication I starting just south of the road crossing and continuing southward through the last entry in Replication IV. The planting, as mentioned, has four replications of three accessions, but each accession is entered eight times per replicated plot, or a total of 32 times within the planting. Cuttings were planted perpendicular to stream flow and with similar depths and angles as described for the yellow willow planting. The plot layout is presented in Figure 2.

Figure 2.

N

Road Crossing

Replication I	830	x	x	x	x	x	x	x	x
	981	x	x	x	x	x	x	x	x
	831	x	x	x	x	x	x	x	x
Replication II	830	x	x	x	x	x	x	x	x
	831	x	x	x	x	x	x	x	x
	981	x	x	x	x	x	x	x	x
Replication III	981	x	x	x	x	x	x	x	x
	831	x	x	x	x	x	x	x	x
	830	x	x	x	x	x	x	x	x
Replication IV	981	x	x	x	x	x	x	x	x
	830	x	x	x	x	x	x	x	x
	831	x	x	x	x	x	x	x	x

Results from these plantings will help satisfy stated objectives. Survival, new growth, and vigor will be monitored for five years to determine species/site suitability, and to provide confidence in recommendations for area buffer projects.

Project No. 08A213
Progress Report – 2006
By: Steve Parr

RESULTS

On September 25, 2002, evaluations were conducted to determine success of the project to date. The evaluations of two species, represented by six accessions, were conducted on Jordan Gulch, a tributary of the White River. Of the original planted materials, only three rows of yellow willow were identified in the yellow willow planting. While no original coyote willow rows were identified, numerous coyote willows were found growing where few existed when the planting occurred in August of 2000. Several theories about the "missing willow cuttings" center around large rainstorm events depositing sediment over the cuttings or washing the cuttings out. One row of yellow willows, two plants, was also noted in the coyote willow planting. These plants, however, were in a row and are thought to have been planted in the wrong location.

The project was next evaluated in September of 2003. An excerpt from the 2003 report identifies the prolific willow growth. "None of the planted yellow willow rows were identified, but individual plants were persisting. However, no identification as to accession could be determined from observations. The results to date of the coyote willow planting are also difficult to interpret, but for different reasons. Coyote willows are now filling in the planted area (the bottom of a wash) to such an extent that planted willows cannot be detected from new growth. New growth is likely from vegetative growth and seed because the percent cover from willows has gone from only planted accessions at less than 5% cover to over 20% from the planted area upstream to a cross-fence and downstream approximately 30 yards from the estimated last planted location. The upstream migration is fairly clearly divided at the fence, which is also the location of a junction of two ephemeral stream channels. This upstream migration will be closely monitored through time. The downstream migration is less clearly defined. Some migration may be a result of the planting, while other willows may be coming in naturally".

Six years after planting, willows persist upstream and downstream of the planting location. However, only coyote willows were observed, but they are present along the stream channel approximately 300 feet below the previously mentioned benchmark location for the planting. Willow presence downstream terminates just upstream from a pipeline installed and seeded in 2005. Willow migration upstream is about 200 feet. Through this entire reach, no yellow willows were found. However, the coyote willow component is quite well represented, albeit without recognition to individual collections. There does appear to be a reduction in the total willow density since the evaluation done in 2003. Trapped sediment from the planting has made a very suitable site for a robust herbaceous vegetative component, and has raised the incised channel approximately 50 inches vertically. This increased herbaceous component has likely competed with willow expansion perpendicular to channel flow. There now exists vegetation from bank to bank with approximately 70% cover.

CONCLUSION

This observed species shift has been both dramatic and rapid. In 2000, the year of the planting, the site was largely devoid of woody vegetation, and had limited locations of herbaceous clumps along the undefined channel. Two years after planting, the 2002 evaluation revealed identifiable planted rows of both yellow willow and coyote willow, but still little herbaceous component within the incised channel.

Three years after planting, the willow growth and migration up and down the channel was impressive and unexpected. Willows were over six feet in height and well represented in the channel. Both species were identified, but individual accessions were not. Too much growth and expansion had occurred to locate, with certainty, the original planted stock. An herbaceous component was noted, but was minor in its presence.

Just six years after the willows were installed in Jordan Gulch, a fully vegetated channel bottom with a well defined "green line" of willows was observed.

Two of the objectives have partially been met while the third offers an opportunity for additional plantings. The first objective is to determine whether willow cuttings can be established on lower Jordan Gulch. Evaluations two, three, and six years after planting indicate that willows can be successfully established as cuttings and both persist and expand beyond the location of their planting. Portions of the second objective have also been met. Both yellow willow and coyote willow were established as cuttings and appeared to be healthy and vigorous in the early years following planting. However, during the shift from woody riparian stock to a more heavily vegetated herbaceous component, yellow willow died out. In addition, the identity of which accessions persisted is not possible without extensive effort. Coyote willow, as a species, is well suited to this site when compared to yellow willow. An additional planting site has been identified for a future study that will be used to compare the same objectives contained in this study, the third of which was to use this planting as a benchmark for planting comparisons.

The willow planting in an ephemeral stream has been successful in reducing erosion, trapping sediment, increasing herbaceous cover, and for determining that coyote willow is well suited for use in stream channel improvement projects in similar sites.

Project 08S078Z
Report-2006
By: Manuel Rosales and Gary Noller

Seed increase of 9021438 Saskatoon Serviceberry

OBJECTIVE

To produce seed for additional testing and release of the accession 9021438.

INTRODUCTION

Saskatoon serviceberry *Amelanchier alnifolia* is a native shrub found in the Northern Great Plains and northern Rocky Mountains. It is deciduous with numerous erect stems and gray to brown bark. Twigs are dark gray to reddish brown. Leaves are alternate, ovate with dentate margins. Flowers are a showy white and the fruit is a small, juice red to purple pome. The flowers and fruits are born in terminal clusters. Each fruit can contain from four to ten seeds, some of which might be unfertile. The shrub is a relatively slow growing, long lived plant that can reproduce by seed or root sprouts. Vegetative reproduction by sprouting is most common. Seeds are dormant and require cold moist stratification to break dormancy. Viability of seeds is good and it has been reported to remain viable for ten years or more. Accession 9021438 was collected in 1975 from Long's Ridge near Parachute Creek in Garfield County, Colorado, at an elevation of about 8100 feet. It has good vigor, foliage production, survival, with an upright growth form and almost no root sprouts. It has had light use by wildlife on the plant center. The accession has the potential for use with critical area stabilization, mined land reclamation, range and wildlife habitat improvement plantings, as a living snow fence and in xeriscape plantings.

EXPERIMENTAL DESIGN

This study is a non –replicated test.

MATERIALS & METHODS

Accession 9021438 is a selection from the original nursery planted at the center in August 8, 1977. The accession was selected as a superior performer among 14 different accessions of serviceberry.

On May 19, 1984, the accession was planted in field 3 on the Plant Center. Tubling (container-grown) plants were transplanted by hand and spaced 15 feet apart in one row. Two of the tublings died and were replaced in 1986. The planting receives no supplemental water.

RESULTS

The planting was evaluated from 1985 to 1992. Information from these evaluations can be found on the reports for these years. Seed has been collected from the project since 1993 and is listed in the following table:

Project 08S078Z
Report-2006
By: Manuel Rosales and Gary Noller

Serviceberry Seed Collected from Accession 9021438. UCEPC 1993-2006.

Year	Area Harvested-Acres	Harvest Date	Clean Seed lb
1993	0.25		2.88
1994	0.25		0.88
1995	0.25		1.77
1996	0.25	No harvest	
1997	0.25		0.29
1998	0.25	7/30	0.18
1999	0.25	No harvest	
2000	0.25	7/20 – 8/9	0.62
2001	0.25	No harvest	
2002	0.25	No harvest	
2003	0.25	7/10 - 8/13	2.64
2004	0.25	No harvest	
2005	0.25	1/6/06	0.80
2006	0.25	No harvest	

Serviceberries *Amelanchier spp* intergrade and hybridize easily, making species identification difficult. Saskatoon serviceberry *Amelanchier alnifolia* has been successfully crossed with many other species of serviceberry in the laboratory. During 2005, plant samples were sent to Colorado State University for identification of accession 9021438 as a preparation for release. Colorado State University identified the accession as *Amelanchier utahensis.* Further identification will be needed before releasing the accession to make sure of its identity. Below are two pictures of accession 9021438

Serviceberry blooms (Spring)

Serviceberry (Fall)

PROJECT 08S213
Report - 2006
By: Manuel Rosales & Steve Parr

Large-Scale Increase of 9043501 Salina Wildrye *Leymus salinus*

OBJECTIVE

To increase seed (pre-cultivar with seed increase and technology development) for foundation material as well as field plantings, Off Center trials, and Inter-Center Strain Trials.

INTRODUCTION

Salina wildrye has been identified as one of the most important grasses native to the Upper Colorado Region. It has been rated by the Upper Colorado Environmental Plant Center (UCEPC) Advisory Committee as a high priority for coal mined lands, roadside stabilization, surface disturbed areas, and areas of heavy use.

Harrington, 1954, lists *Leymus ambiguus* (Colorado wildrye) and *Leymus salinus* (Salina wildrye) as occurring 5200 to 8500 feet in elevation primarily in central and northwestern Colorado. Both species are perennial, cool-season bunchgrasses with culms standing between 30 to 50 cm. tall. *Leymus ambiguus* is often found on open slopes, canyons, and rocky hillsides in Colorado, Montana, and Utah. *Leymus salinus* is found on rocky slopes, sagebrush hills, and saline soils in Wyoming, Idaho, Utah, Arizona, and Colorado.

The Soil Conservation Service range site manual lists *Leymus salinus* as a component of shale sites in Utah, often associated with Pinyon-Juniper or mountain brush in 15-inch precipitation zones. Colorado range sites with *Leymus salinus* are described as clayey slopes, clayey salt desert, and semi-desert loams above l2-inches of precipitation.

Leymus salinus was described by Dr. Kay Assay, ARS, Logan, UT, as actively hybridizing with other wildryes. The hybrid from this crossing is sterile. The species is wind pollinated. In general, the species is weak to establish and tends to produce poor quality seed that has some inherent dormancies. However, once established, the species tends to be very persistent and vigorous.

Over a five year period (1987 - 1992) accession 9043501 was consistently evaluated as superior in UCEPC Initial Evaluation 08I114. Project 08I114 consisted of five randomized replications, each of which contained five plants per accession of 31 accessions. 'Prairieland' *Leymus angustus* (altai wildrye) was included in the trial for comparison. In 1994, Project 08I114 was removed from UCEPC.

In addition to the field trial, a germination trial was conducted in 1987 at UCEPC for 38 accessions of *Leymus salinus.* In general, 50% of the seed from filled lots germinated within two days after being removed from a 20 day stratification period and being placed in the germinator.

An Advanced Evaluation for *Leymus salinus,* 08Al58, was installed by UCEPC in 1987. One block of 12 plants per accession was established in Field 25 using 27 accessions. Forage tendencies, as well as general notes concerning vigor, were taken for the planting from 1987 to 1992. Similar to the Initial Evaluation accession 9043501 was judged to be superior. Evaluation 08A158 was removed in 1994 from UCEPC.

As result of its superior performance in the Initial and Advanced Evaluations, a seed and plant increase for accession 9043501 was initiated in 1993 and 1994. In addition, in 1993 vegetative samples for the accession were sent to Utah State University for species confirmation. It was determined that accession 9043501 represents *Leymus salinus.*

METHODS

In 1993, a 0.10 acre increase field for accession 9043501 was established by seed in the UCEPC Headquarters Nursery utilizing seed from the original Kaiser Steel of Price, UT, and a Planet Junior. Although establishment has been slow, the planting has filled in quite nicely from residual germination.

In 1994, culms were lifted from the UCEPC Field 25 08I114 and 08A158 plantings and established in Field 4. Survival for the transplanted culms appears to have been 100%. Plants were established on

three-foot centers. Either seed, or perhaps, the plants themselves, will be planted/transplanted from the headquarters nursery to Field 4 in 1995.

In 2004, a new planting was conducted on July 29, 2004. Four rows or 0.13 acre were planted with a hand pushed Planet Junior. Additional treatments for 2005 included a spring burn and an herbicide treatment to open up spaces between established plants.

RESULTS

No appreciable seed has been harvested to date from either the breeder or foundation fields. Seed production records are provided in Table 1, from the initiation of the seed increase project to present. Since seed production has been poor for this accession, alternative cultural management practices will be investigated over several years to find out if seed production can be increased.

Table1. Seed Production Records of Two Salina Wildrye Fields at UCEPC. Accession No. 9043501 Project No. 08S213.

Year	Acres	Harvest Date	Field No.	Cleaned Weight	
1996	0.02	7/22	Hqts.	154.00	g
1996	0.10(B*)	7/22	4	631.00	g
1996	0.20(F)	Planted	4	No harvest	
1997	0.02	Field plowed	Hqts.	No harvest	
1997	0.10(B*)	7/21	4	2.96	lb
1997	0.20(F)	7/21	4	5.32	lb
1998	0.10(B*)	8/4	4	4.00	lb
1998	0.20(F)	8/4	4	9.00	lb
1999	0.10(B*)	7/15	4	22.00	g
1999	0.20(F)	7/15	4	32.00	g
2000	0.10(B*)	No harvest	4	--	
2000	0.20(F)	7/7	4	6.00	g
2001	0.20(F)	7/9	4	174.00	g
2001	0.10(B*)	7/9	4	227.00	g
2002	0.10(B*)	7/11	4	7.00	g
2002	0.20(F)	7/11	4	23.00	g
2003	0.10(B*)	7/9	4	1.69	lb
2003	0.20	7/9	4	0.60	lb
2004	0.10(B*)	7/9	4	19.00	g
2004	0.20(F)	7/9	4	146.00	g
2004	0.13	New planting	4	No harvest	
2005	0.13	New planting	4	No harvest	
2005	0.10(B*)	7/13	4	1.4	lb
2005	0.20(F)	7/13	4	302	g
2006	0.10 (B)	7/12	4	2	g
2006	0.20 (F)	7/13	4	7	
2006	0.13(F-2)	7/13	4	76	g

* B=Breeder field, F = Foundation field, F-2 = Foundation field second planting

In spring of 2005, two sections of the foundation field were chosen to conduct some preliminary testing to enhance seed production. A west section block, approximately 20 x 18 ft, was treated with herbicide-Round-up, and an east block about 120 x 18 ft was burned with a torch. The purpose of the **herbicide treatment was** to thin out some of the old stand and get space plants at about 3 x 3 ft in contrast to an existing crowded solid row of plants. The **burning treatment** was to determine if invigorating the plants by burning and getting rid of old plant material (thatch) might also induce better seed production. The herbicide Round-up was applied May 9, 2005, at the rate of 1-quart /25 gallons of water (1% solution).

PROJECT 08S213
Report - 2006
By: Manuel Rosales & Steve Parr

Evaluations for 2005: On June 7, 2005, **the herbicide** section was evaluated. Round-up worked very well leaving space grass bunches at about 3 x 3 ft as expected, however, no seed set difference was observed between the treated and untreated plants, perhaps because the treatment was done when the plants had already spent a lot of energy in spring growth. The **burned area** showed a more vigorous re-growth after the burning, and also did an excellent job of getting rid of dead plant material. However, no difference in seed set was observed between unburned and burned plants. Burned plants did however, look greener and healthier.

Evaluations for 2006: Breeder and foundation fields were harvested during July 12-13. See Table 1 for amount of seed harvested. The new planting done on July 29, 2004, produced the most seed in 2006, and we hope seed production will be better in 2007, since the planting is new and plants are not crowded yet. The section that was treated with herbicide had more seed heads than the un-spray section, however, seed fill was poor. This might indicate that the salina wildrye might need plenty of space to get into the reproductive mode. The same trend was observed in the new planting, plants that had more ground available had more seed heads. The next step is to set up a trial to compare space plants versus solid row planting to determine if lack of space is what has been hindering seed production in this accession of salina wildrye.

Salina wildrye planted in 2004

Salina wildrye planted in 1996

Project COPMC-F-0201-CR
Progress Report 2006
By: Steve Parr

Miller Creek Conservation Planting

INTRODUCTION

As is the case with many western states, irrigation is critical for crop production. The Upper Colorado region is irrigated primarily from surface water rather than from wells which is more typical of other areas in the west.

In 2002, a major irrigation ditch in the upper White River Valley was partially destroyed from a major landslide. The damage to the ditch and the extent of the land movement was not fully realized until late spring after the snow melted off. However, because 2002 was a near record drought year, the evidence of this major land movement event occurred weeks earlier than it would have in a more normal year. Because of the early discovery and quick action by the local NRCS field office, NRCS area engineer, Farm Service Agency, and shareholders of the ditch company, the ditch was repaired and some irrigation benefit was realized before the end of the growing season.

OBJECTIVE

An emergency request for reseeding the repaired slopes above and below the ditch was received by UCEPC in June 2002. The success of the seeding was deemed critical to prevent further erosion and potential damage to the ditch banks. The location of the damaged area of the ditch is elevated approximately 200 feet above the White River. It was feared that any compromise to the structural integrity of the ditch could result in significant detrimental effects to the White River and the entire slope below the area of ditch repair.

The objectives of the critical area revegetation work were to (1) establish a vegetative cover over the bare slopes above and particularly below the Miller Creek Ditch; (2) select a species mix that would persist on a steep, north facing slope and one that would (3) reduce the likelihood of future site erosion.

METHODS

After repairs were completed to the contour areas below the ditch, personnel from UCPEC, members of the ditch company and the local NRCS field office planted 250 PLS pounds of grass seed on 18 acres of disturbance. On September 5, 2002, a mixture of 14 cultivars with demonstrated performance was broadcast by hand and by the use of an ATV broadcast planter on slopes that were approximately 1.5 to 1. Each of the products is a released cultivar of improved grasses for site enhancement. Twelve of the 14 cultivars are commercial releases from the USDA-NRCS Plant Materials Program, and have been grown for seed production or as components in on and off site plantings by UCEPC.

Seeding of the repaired area was done on ground that had been cut, shaped, filled, contoured and cleared of brush, trees rocks and trash that resulted from the land sloughing. Rain had compacted the previously very loose, dusty soil so that a minor crust was evident on the soil surface. It was also noted that there were a number of areas where the bulldozer had traveled up and down the slope, leaving minute soil bars where the tracks were perpendicular to the slope. These areas looked to be ideal for establishing grasses on such a steep slope.

Seeding below the ditch was done largely with an ATV broadcast seeder. The site was too steep and had too poor of access to seed with conventional equipment. The perimeter of the repaired slope, areas too steep for the ATV and the critical area along the ditch was overseeded by hand held broadcast seeders. A target of 60 seeds per square foot was used for calculation of the seed mix. The area above the ditch was entirely hand broadcast.

RESULTS

An evaluation done in 2006 revealed excellent results from the seeding. The seeded area below the ditch had approximately 85 percent cover, 10 percent litter and 5 percent bare ground. A combination of western, intermediate, slender and thickspike wheatgrass, meadow and mountain brome, and sheep fescue was used for the mixture. Most of the wheatgrasses were identified and were well represented in the established stand. Garnet mountain brome was not very noticeable anywhere in the planting, and 'Covar' was noticeable primarily along the more level portions of the seeded area, including the bottom and the top of the slope. The seeded slope below the ditch appears to be stabilized, and further soil erosion on this slope should be minor.

A relatively level area near the bottom of the slope was left unplanted in anticipation of a replicated plot planting. Due to fence construction, however, the plots were not planted. As a result, we were able to evaluate and compare a non-planted area to the planted area. The level, unplanted site was well represented by 'Covar' sheep fescue. We assumed that wind and perhaps rain or snowmelt carried the small seed to the level area where it established.

Establishment above the ditch is less dramatic. The site is steeper, 2:1, with less topsoil and is not as critical an area as the slope below the ditch. Nonetheless, there is some continuing erosion on this slope and a better stand of vegetation would be desirable. We were not able to cross the ditch to evaluate more closely, but from a distance of 25 feet it appeared that the cover was approaching 30 to 35 percent. Cottonwoods and especially willows along with redtop, orchardgrass, reed canary grass and some sedges were coming in nicely on their own along the ditch. There were even a few tamarisk plants that had established.

CONCLUSIONS

The results of a broadcast planting done in early September with a mixture of well know grass cultivars on a critical site were very impressive. Because of the importance of establishing a cover component, a broad array of cultivars was selected, each of which having individual attributes. If the prevention of erosion along the lower slope of the ditch could not be accomplished from seeding, a much more expensive and elaborate approach would have been

necessary. Thankfully, the seeding was successful. Important factors in the successful seeding include the seed mixture, the time of seeding, and the condition of the soil surface at the time of seeding

Wheatgrasses were particularly effective in establishing on the site. The use of a complement of sod forming and bunch type grasses ensured a good stand without becoming overly competitive for site resources. 'Arriba', Rosana, Rush, Greenar, Sodar and NewHy were very well represented. Bannock, Critana, Schwendimar, 'San Luis' and Pryor were less conspicuous, but were observed without difficulty. Garnet was observed the least of any selection, but it has the reputation as being a vigorous plant soon after planting, but losses vigor and competitive advantages to other species soon after establishment. Covar performed very well on level ground, but was not a significant component on the steep portions of the slope.

2002 was a near record drought year for the Upper Colorado River Basin. Some rainstorm events did occur in July and August, but they would not have been adequate to have germinated the seed. However, those events did compact the previously loose, dusty soil that a more firm seed bed was available to receive seed, even though it was broadcast. A number of microsites in bulldozer tracks were made available for seeds to hold, germinate, and establish, and the later planting date did not have such high evapotranspiration rates that are more common in spring plantings.

Project COPMC-F-0202-OT
Project Report-2006
By: Terri Blanke

Inter-Center Planting of Sweetgrass

OBJECTIVE

To compare and evaluate regionally collected *S*weetgrass, *Hierochloe odorata* as a culturally significant plant.

INTRODUCTION

Four Northern Plains Region Plant Material Centers compared six sources of Sweetgrass: Accession # 9039770, # 9050243, #9070225, #9063351, #9063128, and South Dakota Radora. The variety 'Radora' was used as the standard variety for comparison. The information obtained was to be used to evaluate genetic variability and recommend potential areas of adaptation for local collections.

EXPERIMENTAL DESIGN

Initial evaluation in rod rows, ten plants per row.

MATERIALS & METHODS

Each PMC exchanged a minimum of ten potted (or cone-tainerized) sweetgrass plants of their local plant material. Bismarck PMC provided ten plants of 'Radora' sweetgrass. Materials were shipped May 15, 2002 (approx.).

Notes on initial establishment at the Colorado PMC are recorded in the 2002 Annual Technical Report.

In June of 2006, five collections of sweetgrass, South Dakota, Montana, North Dakota, Kansas, and Colorado were hand dug, sorted, packed, and shipped to Vicki L. Bradley, Agronomy Curator at the Western Regional Plant Introduction Station in Pullman, Washington. These accessions were supplied for germplasm storage.

RESULTS

Plot design, final evaluations and discussion are in the 2003 Annual Technical Report.

CONCLUSIONS

Generally, survival was good and phenotypic differences may be more evident in years to come. The last year of evaluation was 2005. Nothing else needs to be done on this project and this will be the final report.

Project COPMC-F-0501-CR
Report-2006
By: Manuel Rosales

Land's End Field Evaluation Planting-Grass

OBJECTIVE

To determine which plant materials, if any, compete most successfully with Russian knapweed site re-invasion after herbicide treatment.

INTRODUCTION

A 2002 survey conducted by the Colorado Department of Agriculture showed Colorado with more than 118,341 infested acres of Russian knapweed *Acroptilon repens*. Russian knapweed is a creeping perennial that reproduces from seed and vegetative root buds. Controlling Russian knapweed requires an aggressive continual stress with herbicide and mechanical means. After the weed is controlled, sowing with desirable plant species is necessary. Re-invasion of the weed has been prevented in some cases with some sod-forming grasses like thickspike or smooth brome. This field evaluation planting was set up to determine the competitive capability of 49 different grasses in preventing re-invasion of Russian knapweed post herbicide and mechanical control.

EXPERIMENTAL DESIGN

The statistical design for the study is a randomized complete block with four replications.

MATERIALS & METHODS

Eleven rhizomatous grasses, 31 bunch type grasses, and seven Rye grasses were seeded October 27-28, 2004. All plant materials (except small seeded grasses) were planted with a four-row plot cone-seeder. The small seeded grasses such as galleta grass, bluegrass, alkali sacaton, little blue stem, and sheep fescue were planted with a hand pushed belt seeder on October 27, 2005. The rate of seeding was 30 pure live seeds per linear foot of row. The plot size is 4 x 20 ft with four rows per plot (1 ft between rows), for the rhizomatous grasses and bunch grasses. Plot size for Rye grasses is 8 x 20 ft with four rows per plot (2 ft between rows). The site is located about ten miles southeast of the city of Grand Junction, Colorado. The planting location is on Divide Road east of Land's End Road, at the Kannah Creek-Lands End Exit off Colorado Highway 50. The site will not be irrigated.

Project COPMC-F-0501-CR
Report-2006
By: Manuel Rosales

Table1. The following table lists the 49 entries for the study:

Entry #	Cultivar/Release or accession #	Common Name	Scientific Name	Seed Source
Rhizomatous Grasses				
1	Rush	Intermediate Wheatgrass	*Elytrigia intermedia*	Aberdeen , ID
2	Schwendimar	Thickspike Wheatgrass	*Elymus lanceolatus*	Pullman, WA
3	Critana	Thickspike Wheatgrass	*Elymus lanceolatus*	Bridger, MT
4	Arriba	Western Wheatgrass	*Pascopyrum smithii*	Meeker, CO
5	Volga	Mammoth Wildrye	*Leymus racemosus*	Meeker, CO
6	TH-2 Intermediate	Intermediate Wheatgrass	*Elytrigia intermedia*	ARS-Logan, UT
7	Rosana	Western Wheatgrass	*Pascopyrum smithii*	Bridger, MT
8	Sodar	Streambank Wheatgrass	*Elymus lanceolatus*	Aberdeen , ID
9	Viva**	Galleta Grass	*Pleuraphis jamesii*	Los Lunas, NM
10	Bannock	Thickspike Wheatgrass	*Elymus lanceolatus*	Aberdeen , ID
11	Manska	Intermediate Wheatgrass	*Elytrigia intermedia*	Bismarck, ND
Bunch Grasses				
12	Expedition	Snake River Wheatgrass	*E. lanceolatus spp.wawawaiensis*	ARS-Logan, UT
13	White River	Indian Ricegrass	*Achnatherum hymenoides*	ARS-Logan, UT
14	Ephraim	Crested Wheatgrass	*Agropyrum cristatum*	Aberdeen, ID
15	Nordan	Crested Wheatgrass	*Agropyrum cristatum*	Bismarck, ND
16	High Plains**	Bluegrass	*Poa secunda*	Bridger, MT
17	Pryor	Slender Wheatgrass	*Elymus trachycaulus*	Bridger, MT
18	Paloma	Indian Ricegrass	*Achnatherum hymenoides*	Los Lunas, NM
19	Salado**	Alkalai Sacaton	*Sporobolus airoides*	Los Lunas, NM
20	Bad River**	Little Bluestem	*Schizachyrium scoparium*	Bismarck, ND
21	9092261-Northwest	Junegrass	*Koeleria macrantha*	Meeker, CO
22	Anatone	Bluebunch Wheatgrass	*Pseudoroegnaria spicata*	Aberdeen, ID
23	Tusas	Bottlebrush Squirreltail	*Elymus elymoides*	Los Lunas, NM
24	Lodorm	Green Needlegrass	*Stipa viridula*	Bismark, ND
25	Columbia bunch	Bluebunch Wheatgrass	*Pseudoroegnaria spicata*	ARS-Logan, UT
26	Alma**	Blue Grama	*Bouteloua gracilis*	Los Lunas, NM
27	Goldar	Bluebunch Wheatgrass	*Pseudoroegnaria spicata*	Aberdeen, ID
28	Whitmar	Beardless Wheatgrass	*Pseudoroegnaria spicata*	Pullman, WA
29	Niner	Sideoats Grama	*Bouteloua curtipendula*	Los Lunas, NM
30	Wapiti (Buford)	Bottlebrush Squirreltail	*Elymus elymoides*	Meeker, CO
31	Badlands	Blue Grama	*Bouteloua gracilis*	Bismark, ND
32	Vaughn	Sideoats Grama	*Bouteloua curtipendula*	Los Lunas, NM
33	Pueblo	Bottlebrush Squirreltail	*Elymus elymoides*	Meeker, CO
34	Rimrock	Indian Ricegrass	*Achnatherum hymenoides*	Bridger, MT
35	San Luis	Slender Wheatgrass	*Elymus trachycaulus*	Meeker, CO
36	Hycrest	Crested Wheatgrass	*Agropyrum cristatum*	Aberdeen, ID
37	Douglas	Crested Wheatgrass	*Agropyrum cristatum*	Aberdeen, ID
38	P-7	Bluebunch Wheatgrass	*Pseudoroegnaria spicata*	ARS-Logan, UT

Entry #	Cultivar/Release or accession #	Common Name	Scientific Name	Seed Source
39	Secar	Snake River Wheatgrass	*E. lanceolatus spp.wawawaiensis*	Pullman, WA
40	Covar**	Sheep Fescue	*Festuca ovina*	Pullman, WA
41	Newhy	Hybrid Wheatgrass	*Elymus hoffmannii*	Aberdeen, ID
42	Vavilov	Siberian Wheatgrass	*Agropyron fragile*	Aberdeen, ID
Rye Grasses				
43	Salina	Wildrye	*Leymus salinus*	Meeker, CO
44	L-45	Basin Wildrye Cross	*Leymus cinereus*	ARS-Logan, UT
45	Bozoisky	Russian Wildrye	*Psathyrostachys juncea*	Bridger, MT
46	Trailhead	Basin Wildrye	*Leymus cinereus*	Bridger, MT
47	Magnar	Basin Wildrye	*Leymus cinereus*	Aberdeen, ID
48	Mankota	Russian Wildrye	*Psathyrostachys juncea*	Bismark, ND
49	L-46	Basin Wildrye/Creeping Cross	*Leymus cinereus*	ARS-Logan, UT

** Small seeded grasses planted with Belt Seeder, all other planted with Cone Seeder

RESULTS

This is the second year of evaluations for this field evaluation planting**:**
In 2005, the study was evaluated in June 28, 2005. Most entries germinated well; however, we had rabbit damage in most plots, especially plots with grasses palatable to rabbits. Some plots were grazed almost to bare soil. The evaluation for stand establishment was done after the rabbit damage. Some of the rye grasses such as L-45, Bozoisky, and Trailhead were untouched by the rabbits and had very good plant stands.

In 2006, the plots were evaluated on May 10. At this time, the plots were hand-weeded and a pre-emergence application of Ronstar-G granular was applied to prevent germination of broadleaved weeds and annual grasses. Also an application of Spotrete, a turf fungicide and animal repellent, was applied at the recommended rate to repel the rabbits. Later on the fall-2006, Charlie Holcomb, area Agronomist with the Natural Resources Conservation Service, visited the plots and reported that all plots had been mowed to the ground by the rabbits.

The evaluations (prior to rabbit damage) done in 2006 for percent plant stand and vigor are summarized in the following table:

Table 2. Average percent plant stand and vigor for 49 grasses at Land's End Field Evaluation Planting-2006

Cultivar	Common Name	% Plant Stand*	Plant Vigor**
Rhizomatous Grasses			
Arriba	Western Wheatgrass	9	1.3
Bannock	Thickspike Wheatgrass	30.5	1.8
Critana	Thickspike Wheatgrass	35	2.3
Manska	Intermediate Wheatgrass	1.8	1.3
Rosana	Western Wheatgrass	20.2	1.8
Rush	Intermediate Wheatgrass	15.5	1.3
Schwendimar	Thickspike Wheatgrass	27	2
Sodar	Streambank Wheatgrass	32.5	1.5
TH-2 Intermediate	Intermediate Wheatgrass	6.3	1
Viva	Galleta Grass	0	0
Volga	Mammoth Wildrye	0	0
Bunch Grasses			
Alma	Blue Grama	0	0
Anatone	Bluebunch Wheatgrass	32.5	2
Bad River	Little Bluestem	0	0
Badlands	Blue Grama	0	0
Columbia bunch	Bluebunch Wheatgrass	31.5	1.5
Covar	Sheep Fescue	0	0
Douglas	Crested Wheatgrass	40	1.8
Ephraim	Crested Wheatgrass	7	2.3
Expedition	Snake River Wheatgrass	47.5	2.3
Goldar	Bluebunch Wheatgrass	7.5	1.5
High Plains	Bluegrass	0.5	0.8
Hycrest	Crested Wheatgrass	18.8	2
Junegrass	9092261-Northwest	0.5	0.8
Lodorm	Green Needlegrass	0.5	0.8
Newhy	Hybrid Wheatgrass	13.5	1.5
Niner	Sideoats Grama	0.8	1.3
Nordan	Crested Wheatgrass	45	1.8
P-7	Bluebunch Wheatgrass	29.5	2
Paloma	Indian Ricegrass	0.3	0.5
Pryor	Slender Wheatgrass	20	1.5
Pueblo	Bottlebrush Squirreltail	0.8	0.8
Rimrock	Indian Ricegrass	0.8	1
Salado	Alkali Sacaton	0.5	0.8
San Luis	Slender Wheatgrass	22.8	1.5
Secar	Snake River Wheatgrass	47.5	1.8
Tusas	Bottlebrush Squirreltail	1	1.3
Vaughn	Sideoats Grama	0	0
Vavilov	Siberian Wheatgrass	53.8	1.8
Wapiti	Bottlebrush Squirreltail	0.8	1
White River	Indian Ricegrass	1.7	1.3
Whitmar	Beardless Wheatgrass	23.3	2

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By: Manuel Rosales

Cultivar	Common Name	% Plant Stand*	Plant Vigor**
Rye Grasses			
Bozoisky	Russian Wildrye	38.8	1.8
L-45	Basin Wildrye Cross	72.5	1.5
L-46	Basin Wildrye/Creeping Cr.	51.2	2
Magnar	Basin Wildrye	37.5	1.5
Mankota	Russian Wildrye	8	1.5
Salina	Wildrye	3.8	1.3
Trailhead	Basin Wildrye	60	1.5

* Percent plant stand, visual evaluation based on number of plants per plot (4 rows/plot)
Ex: Four complete rows = 100 percent
** Vigor visual evaluation: 1 = Very vigorous
2 = Moderately vigorous
3 = Weak

SUMMARY

Of the 49 grasses planted, seven had no germination at all: Volga-mammoth wildrye, Viva-galleta grass, Alma-blue grama, Badlands-blue grama, Vaughn-side oats, and Covar- sheep fescue. Four entries had an average percent plant stand greater than 50 percent: Vavilov-Siberian wheatgrass, L-45-basin wildrye, Trailhead-basin wildrye, and L-46- basin wildrye. Plots will be evaluated during growing season of 2007 to see if there is any growth after the damage done by the rabbits during the growing season of 2006.

Project COPMC-F-0505-PA
Report-2006
By: Manuel Rosales & Patrick Davey

Boulder County Open Space Demo

OBJECTIVE

To demonstrate to land owners, land managers, and area Field Office employees some of the attributes of various selected plant materials

INTRODUCTION

Boulder County, Colorado, has an area of 753 square miles with 475,000 acres. The terrain in Boulder County is very diverse, including; plains, foothills grasslands, forest montane and alpine zones. This demonstrational planting was set up in cooperation with Boulder County Parks & Open Space, Longmont USDA-NRCS Field Office, Longmont and Boulder County Conservation Districts, Colorado State University Boulder Extension Service, and the Arkansas and Pawnee Buttes Seed companies. The purpose of the planting is to demonstrate the potential of a variety of native grasses and some introduced grasses for Pasture and Hayland purposes as well as for other uses such as Prairie restoration, prevention of noxious weeds, xeroscaping, etc, in Boulder County and nearby counties in Colorado. The Planting will also be used for educational purposes.

EXPERIMENTAL DESIGN

This is a non-replicated planting.

MATERIALS & METHODS

A total of 65 entries were seeded March 7-9, 2005: Fifty-seven single grass species (41 native & 16 non-native), six grass-mixtures and one legume (planted at two seeding rates). The seeder was a 16-row FLEX-II Truax. Rows were spaced about 7.5 inches apart. The plot size is 20 x 100 ft with 32 rows per plot. The rate of seeding was based on the recommended Pure Live Seed rate/acre per species. Small and fluffy seeded grasses were enhanced with number-1 rice hulls to provide a better flow through the drill. The site is located on Boulder County Open Space land, southeast of Lafayette, Colorado, on South 120 Street. The planting will be maintained as dry-land.

A list of all the entries is presented in the following table:

Project COPMC-F-0505-PA
Report-2006
By: Manuel Rosales & Patrick Davey

Table 1. List of 65 entries for the demonstrational planting

Entry #	Cultivar/Release or accession #	Common Name	Scientific Name	Seed Source
	Single Grass Species			
1	Cheyenne	Indiangrass (ws)**	*Sorghastrum nutans*	Arkansas Valley Seed Co
2	9005439	Switchgrass (ws)	*Panicum virgatum*	Bridger, PMC
3	Dacotah	Switchgrass ((ws)	*Panicum virgatum*	Bismarck, PMC
4	Kaw	Big Bluestem (ws)	*Andropogon gerardii*	Arkansas Valley Seed Co
5	Bonilla	Big Bluestem(ws)	*Andropogon gerardii*	Bismarck, PMC
6	Pawnee	Big Bluestem(ws)	*Andropogon gerardii*	Arkansas Valley Seed Co?
7	Lodorm	Green needlegrass	*Nassella viridula*	Bismarck, PMC
8	Aldous	Little bluestem (ws)	*Schizachyrium scoparium*	Arkansas Valley Seed Co
9	Camper	Little bluestem (ws)	*Schizachyrium scoparium*	Arkansas Valley Seed Co
10	Pastura	Little bluestem (ws)	*Schizachyrium scoparium*	Arkansas Valley Seed Co
11	Niner	Sideoats grama (ws)	*Bouteloua curtipendula*	Los Lunas, PMC
12	BSOG-02B	Sideoats grama (ws)	*Bouteloua curtipendula*	
13	El Reno	Sideoats grama (ws)	*Bouteloua curtipendula*	Manhattan, PMC
14	Hachita	Sideoats grama (ws)	*Bouteloua curtipendula*	Los Lunas, PMC
15	Bad river	Sideoats grama (ws)	*Bouteloua curtipendula*	Bismarck, PMC
16	Lovington	Sideoats grama(ws)	*Bouteloua curtipendula*	Los Lunas, PMC
17	Texoka	Buffalograss (ws)	*Buchloe dactyloides*	Arkansas Valley Seed Co
18	Viva	Galleta grass(ws)	*Pleuraphis jamesii*	Los Lunas, PMC
19	9092261	Prairie Junegrass (cs)	*Koeleria macrantha*	Meeker, PMC
20	Covar	Sheep fescue (cs)	*Festuca ovina*	Arkansas Valley Seed Co
21	Redondo	Arizona fescue (cs)	*Festuca arizonica*	Meeker, PMC
22	Sherman	Big bluegrass (ws)	*Poa secunda*	Arkansas Valley Seed Co
23	Rimrock	Indian ricegrass (cs)	*Achnatherum hymenoides*	Bridger, PMC
24	Paloma	Indian ricegrass (cs)	*Achnatherum hymenoides*	Los Lunas, PMC
25	Tusas	Squirreltail (cs)	*Elymus elymoides*	Los Lunas, PMC
26	San Luis	Slender wheatgrass (cs)	*Elymus trachycaulus*	Meeker, PMC
27	Pryor	Slender wheatgrass (cs)	*Elymus trachycaulus*	Bridger, PMC
28	Volga	Mammoth wildrye (cs)	*Leymus racemosus*	Meeker, PMC
29	UNIDENTIFIED	Needle & thread (cs)	*Hesperostipa comata*	Arkansas Valley Seed Co
30	Climax	Timothy (cs)	*Phleum pratense*	Arkansas Valley Seed Co
31	Paiute	Orchard grass(cs)	*Dactylis glomerata*	Aberdeen, PMC

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By: Manuel Rosales & Patrick Davey

Entry #	Cultivar/Release or accession #	Common Name	Scientific Name	Seed Source
32	Renegade	Orchard grass (cs)	*Dactylis glomerata*	Arkansas Valley Seed Co.
33	Salado	Alkali sacaton (ws)	*Sporobolus airoides*	Los Lunas, PMC
34	Fawn	Tall fescue (cs)	*Festuca arundinacea*	Arkansas Valley Seed Co.
35	Trailhead	Basin wildrye (cs)	*Leymus cinereus*	Bridger, PMC
36	Magnar	Basin wildrye (cs)	*Leymus cinereus*	Aberdeen, PMC
37	Garnet	Mountain brome (cs)	*Bromus marginatus*	Meeker, PMC
38	UNIDENTIFIED	Nodding brome (cs)	*Bromus anomalus*	Arkansas Valley Seed Co.
39	Regar	Meadow brome cs)	*Bromus erectus*	Aberdeen, PMC
40	Manchar	Smooth brome (cs)	*Bromus inermis*	Arkansas Valley Seed Co.
41	Critana	Streambank wheatgrass (cs)	*Elymus lanceolatus*	Bridger, PMC
42	Bannock	Streambank wheatgrass cs)	*Elymus lanceolatus*	Aberdeen, PMC
43	Goldar	Bluebunch wheatgrass (cs)	*Pseudoroegneria spicata*	Aberdeen, PMC
44	Anatone	Bluebunch wheatgrass (cs)	*Pseudoroegneria spicata*	Aberdeen, PMC
45	Luna	Pubescent wheatgrass cs)	*Thinopyrum intermedium*	Meeker, PMC
46	Rush	Intermediate wheatgrass(cs)	*Thinopyrum intermedium*	Aberdeen, PMC
47	Arriba	Western wheatgrass(cs)	*Pascopyrum smithii*	Meeker, PMC
48	Rosana	Western wheatgrass(cs)	*Pascopyrum smithii*	Bridger, PMC
49	Sodar	Streambank wheatgrass(cs)s	*Elymus lanceolatus*	Aberdeen, PMC
50	UNIDENTIFIED?	Tufted hairgrass (cs)	*Deschampsia caespitosa*	Arkansas Valley Seed Co.
51	Jose	Tall wheatgrass cs)	*Thinopyrum ponticum*	Los Lunas, PMC
52	Mandan	Canada wildrye (cs)	*Elymus canadensis*	Bismarck, PMC
53	Bozoisky-select	Russian wildrye cs)	*Psathyrostachys juncea*	Bridger, PMC
54	Newhy	Hybrid wheatgrass cs)	*Elymus hoffmannii*	Aberdeen, PMC
55	Douglas	Crested wheatgrass (cs)	*Agropyron cristatum*	Aberdeen, PMC
56	Hycrest	Crested wheatgrass (cs)	*Agropyron cristatum X desertorum*	Aberdeen, PMC
57	Ephraim	Crested wheatgrass (cs)	*Agropyron cristatum*	Aberdeen, PMC
	Grass-Mixtures			
58	Rocky Mountain. Native mix	Mix-1* See entries below		Arkansas Valley Seed Co.
59	Aggressive dryland mix	Mix-2* See entries below		Pawnee Butte Seed Co.
60	Low grow mix	Mix-3* See entries below		Arkansas Valley Seed Co.
61	Dryland mix	Mix-4*-See entries below		Arkansas Valley Seed Co.
62	Boulder NRCS-mix-			

Entry #	Cultivar/Release or accession #	Common Name	Scientific Name	Seed Source
	Regular	Mix-5*-See entries below		
63	Boulder NRCS-mix-heavy	Mix-6*-See entries below		
Legume				
64	Medic-@14.2lb/ac	Medic	*Medicago spp.*	CSU Ext. Service
65	Medic @29.1lb/ac	Medic	*Medicago spp*	CSU Ext. Service

Entries for Grass-Mixtures				
Mix-1*	**Mix-2***	**Mix -3***	**Mix-4***	**Mix-5/6***
Slender wheatgrass	Green needle grass	Crested wheatgrass	Crested Wheatgrass-Hycrest	Pubescent wheatgrass
Slender wheatgrass	Slender wheatgrass	Perennial rye grass	Smooth brome-Lincoln	Smooth brome
Thickspike wheatgrass	Slender wheatgrass	Blue fescue	Wild rye-Bozoisky	
Buffalograss	Pubescent wheatgrass	Canada bluegrass	Tetraploid PER	
Blue gramma	Intermediate wheatgrass	Chewing fescue	Orchard grass-Renegade	
Big bluestem			Intermediate wheatgrass-Oahe	
Arizona fescue-Sherman-				

** (ws) = warm season grass; (cs) = cool season grass

RESULTS

Growing Season of 2005

During the late spring of 2005, most of the plots were sprayed with herbicide Round-up to control emerging weeds. All plots were mowed in July to control Kochia *Kochia scoparia*. Plant establishment was evaluated during summer-2005. Results are presented in Table 2.

Table 2. Plant stand for 65 entries four month after planting. Boulder County Open Space Demo-Summer-2005

Entry #	Cultivar/Release or accession #	Common Name	Scientific Name	Plant Stand*
Single Grass Species				
1	UNIDENTIFIED?	Nodding brome	*Bromus anomalus*	5
2	Regar	Meadow brome	*Bromus erectus*	5
3	Garnet	Mountain brome	*Bromus marginatus*	5
4	Paiute	Orchard grass	*Dactylis glomerata*	5
5	Renegade	Orchard grass	*Dactylis glomerata*	5
6	Fawn	Tall fescue	*Festuca arundinacea*	5
7	Paloma	Indian ricegrass	*Achnatherum hymenoides*	4
8	Douglas	Crested wheatgrass	*Agropyron cristatum*	4
9	Hycrest	Crested wheatgrass	*Agropyron cristatum X desertorum*	4
10	Manchar	Smooth brome	*Bromus inermis*	4
11	Mandan	Canada wildrye	*Elymus canadensis*	4
12	Newhy	Hybrid wheatgrass	*Elymus hoffmannii*	4
13	Critana	Streambank wheatgrass	*Elymus lanceolatus*	4
14	Bannock	Streambank wheatgrass	*Elymus lanceolatus*	4
15	San Luis	Slender wheatgrass	*Elymus trachycaulus*	4
16	Pryor	Slender wheatgrass	*Elymus trachycaulus*	4
17	Lodorm	Green needlegrass	*Nassella viridula*	4
18	Arriba	Western wheatgrass	*Pascopyrum smithii*	4
19	Rosana	Western wheatgrass	*Pascopyrum smithii*	4
20	Goldar	Bluebunch wheatgrass	*Pseudoroegneria spicata*	4
21	Anatone	Bluebunch wheatgrass	*Pseudoroegneria spicata*	4
22	Rush	Intermediate wheatgrass	*Thinopyrum intermedium*	4
23	Luna	Pubescent wheatgrass	*Thinopyrum intermedium*	4
24	Jose	Tall wheatgrass	*Thinopyrum ponticum*	4
25	Ephraim	Crested wheatgrass	*Agropyron cristatum*	3
26	Kaw	Big Bluestem	*Andropogon gerardii*	3
27	Texoka	Buffalograss	*Buchloe dactyloides*	3
28	Tusas	Squirreltail	*Elymus elymoides*	3
29	Sodar	Streambank wheatgrass	*Elymus lanceolatus*	3
30	Magnar	Basin wildrye	*Leymus cinereus*	3

Entry #	Cultivar/Release or accession #	Common Name	Scientific Name	Plant Stand*
31	Dacotah	Switchgrass	*Panicum virgatum*	3
32	Rimrock	Indian ricegrass	*Achnatherum hymenoides*	2
33	Bonilla	Big Bluestem	*Andropogon gerardii*	2
34	Pawnee	Big Bluestem	*Andropogon gerardii*	2
35	Bad river	Sideoats grama	*Bouteloua curtipendula*	2
36	Lovington	Sideoats grama	*Bouteloua curtipendula*	2
37	Redondo	Arizona fescue	*Festuca arizonica*	2
38	UNIDENTIFIED	Needle & thread	*Hesperostipa comata*	2
39	Trailhead	Basin wildrye	*Leymus cinereus*	2
40	9005439	Switchgrass	*Panicum virgatum*	2
41	Niner	Sideoats grama	*Bouteloua curtipendula*	1
42	BSOG-02B	Sideoats grama	*Bouteloua curtipendula*	1
43	El Reno	Sideoats grama	*Bouteloua curtipendula*	1
44	Hachita	Sideoats grama	*Bouteloua curtipendula*	1
45	Covar	Sheep fescue	*Festuca ovina*	1
46	9092261	Prairie Junegrass	*Koeleria macrantha*	1
47	Volga	Mammoth wildrye	*Leymus racemosus*	1
48	Climax	Timothy	*Phleum pratense*	1
49	Sherman	Big bluegrass	*Poa secunda*	1
50	Bozoisky-select	Russian wildrye	*Psathyrostachys juncea*	1
51	Aldous	Little bluestem	*Schizachyrium scoparium*	1
52	Camper	Little bluestem	*Schizachyrium scoparium*	1
53	Pastura	Little bluestem	*Schizachyrium scoparium*	1
54	Cheyenne	Indiangrass	*Sorghastrum nutans*	1
55	Salado	Alkali sacaton	*Sporobolus airoides*	1
56	UNIDENTIFIED?	Tufted hairgrass	*Deschampsia caespitosa*	0
57	Viva	Galleta grass	*Pleuraphis jamesii*	0
Grass-Mixtures				
58	Dry-land mix.	Mix-4* See entries inTable-1		5
59	Aggressive dry-land mix	Mix-2* See entries inTable-1		4
60	Rocky Mountain Native mix	Mix-1* See entries inTable-1		4

Entry #	Cultivar/Release or accession #	Common Name	Scientific Name	Plant Stand*
61	Low grow mix	Mix-3*- See entries inTable-1		4
62	Boulder NRCS-mix-Regular	Mix-5*- See entries inTable-1		4
63	Boulder NRCS-mix-heavy	Mix-6*- See entries inTable-1		4
Legume				
64	Medic @29.1lb/ac	Medic	*Medicago spp.*	3
65	Medic-@14.2lb/ac	Medic	*Medicago spp*	2

* Plant stand: 0 = Poor or no establishment; and 5 = Excellent establishment

Growing Season of 2006

In March of 2006, the plots and surrounding area caught many plastic trash bags (mainly grocery store type plastic bags) in the weed stems that were mowed last summer. Trash had blown from adjacent businesses west of the plots. The demonstrational plots were located in an accessible and visible area from the road for demonstrational purposes. However, in this occasion the view was not very pleasant and a complaint was placed to the Longmont Conservation District to remove the trash. On April 11, 2006, Patrick Davey, Plant Materials Specialist for Colorado Natural Resources Conservation Service, used an All-Terrain-Vehicle with a chain to pull a gravel pit crusher screen over the 9-acre field to knock down the standing weed stems and release the attached trash. The operation worked and the trash was collected and removed. After removal of the trash the cool season grass plots were visible. All wheatgrassess and both the Paiute Orchard and Renegade Orchard grasses had about 100 percent stands. No written evaluation was done at this time.

On July 26, 2006, Patrick Davey, visited the plots to perform a summer evaluation. He reported that all cool season species were completely dried up and in a dormant stage, perhaps due to lack of precipitation and summer heat. Leaves were brown and crispy, and crumbling when touched. Again, 'Texoka' buffalograss was the only grass showing signs of growth. No formal evaluation of all the plots was done for this summer.

Due to the poor condition of the majority of the warm season grass plots and invasion of kochia and Russian thistle weeds, these plots will need to be sprayed with an herbicide and be replanted.

Project COPMC-F-0506-RA
Project Report – 2006
By: Dr. Joe Brummer and Steve Parr

63 Ranch Conservation Field Trial

INTRODUCTION

The South Park area of Colorado is characterized as a high, cold desert. The harsh growing conditions associated with this environment coupled with drought, historic overgrazing, and the transfer/removal of irrigation water have led to many degraded range sites in the Park. Some of the more productive native grasses, such as Arizona fescue *Festuca arizonica* and prairie Junegrass *Koeleria macrantha* have been displaced. Low growing species, such as blue grama *Bouteloua gracilis* and fringed sage *Artemisia frigida,* have taken the place of these more productive species. With the recent drought conditions, even blue grama has given way to fringed sage. Although fringed sage is a native plant, it has come to dominate many sites throughout the Park. It is particularly troublesome because it is low producing, is unpalatable to livestock, and is very competitive and persistent once established. Upper Colorado Environmental Plant Center, Colorado State University, Natural Resources Conservation Service, Teller and Park County Conservation Districts, and the Colorado Division of Wildlife cooperated to establish two conservation field trials south of Fairplay, Colorado. The study will evaluate various herbicides for controlling or reducing the density of fringed sage; reseeding at three different times – an early summer planting, a mid-summer planting and a dormant fall planting - with both a native grass mixture and an introduced grass mixture on two different sites in South Park.

The two sites differ primarily in the amount of organic matter in the soil profile, but are representative of several thousand acres within South Park (MLRA 48B) with similar site characteristics.

Site Description

63 Ranch east of Highway 285 (Owned by the Colorado Division of Wildlife)

The study area was formerly irrigated. When the water was transferred for municipal uses, most of the irrigated forage species eventually died and were replaced by fringed sage with minor amounts of dryland grasses such as bottlebrush squirreltail. There are many areas within the Park that went through this same successional process and are now dominated by fringed sage. This site has a layer of organic matter on the soil surface that accumulated when it was irrigated. This layer of organic matter does not have good water holding capacity and tends to dry out quickly. The area receives only 12"-14" of annual precipitation and is characterized by high winds, all of which makes establishing new plantings difficult.

OBJECTIVE

The objective of the planting is to compare the most effective methods and products for re-establishing desirable vegetation on altered or degraded range sites in South Park.

Project COPMC-F-0506-RA
Project Report – 2006
By: Dr. Joe Brummer and Steve Parr
METHODS

The methods used in the study include the use of four different herbicides, three seeding dates and two seed mixes. Herbicides were applied at the rates identified below the first week in June 2005.

Treatments:

Herbicide Main Plots: (30 x 112 ft)	**Rate: (per acre)**
Unsprayed control	------
2,4-D ester (4 lb a.i./gal)	4 pt
Curtail	6 pt
Tordon + 2,4-D ester	1 pt + 2 pt
Cimarron Max (2 part herbicide)	1 oz + 4 pt

Seeding Date Split Plot: (32 x 150 ft)
Unseeded control (16 x 150 ft)
Mid summer (Between July 1 and 15)
Fall (Dormant - Early November)

Seed Mix Split-Split Plot: (16 x 150 ft)
Native (See Table 1)
Introduced (See Table 1)

The plantings were conducted on July 6, 2005, November 2-3, 2005, and July 2006 with the seed mixtures identified in Table 1. Different planting times were selected to attempt to optimize the use of precipitation patterns. In mid to late July, South Park receives monsoonal flows from the southwest. This precipitation pattern generally lasts through early September. In order to capitalize on this monsoonal pattern, the first planting was done before the onset of the monsoon season. The dormant, fall seeding was done in early November 2005 to make use of early spring moisture for establishment prior to the very dry period of mid-May through June and to ensure that seed germination would not occur until spring 2006.

Table 1
Grass Species Planted for Fringed Sage Renovation Project
At 63 Ranch and Ranch of the Rockies in Park County Colorado

Native Mixture	**Average PLS of Native Mixture is 74%**				
Grasses	Variety	% in Mix	Seeding Rate lb/acre	Grams Per Rep	PLS lb/acre
Arizona fescue	Redondo	20	2.5	20	0.5
Bottlebrush squirreltail	Tusas	10	7.0	22	0.7
Indian ricegrass	Paloma	10	6.0	16	0.6
Mountain bromegrass	Garnet	15	12.5	104	2.0
Prairie Junegrass	Northwest CO	10	0.5	5	0.1
Sandberg's bluegrass	High Plains	10	1.0	3	1.0
Western wheatgrass	Rosanna	25	8.0	57	2.0
Total:				**227**	**6.9**

Introduced Mixture	**Average PLS of Introduced Mixture is 86%**				
Grasses	Variety	% in Mix	Seeding Rate lb/acre	Grams Per Rep	PLS lb/acre
Crested wheatgrass	Douglas	15	5.0	22	0.8
Crested wheatgrass	Hycrest	15	5.0	24	0.8
Hybrid wheatgrass	Newhy	15	7.0	36	1.1
Intermediate wheatgrass	Rush	15	9.0	38	1.4
Meadow bromegrass	Regar	15	6.5	26	1.0
Pubescent wheatgrass	Luna	15	9.0	52	1.4
Siberian wheatgrass	Vavilov	10	5.5	16	0.6
Total:				**214**	**7.1**

The two grass mixes were compiled in part from results of an earlier trial in South Park. However, a number of new, untested products were also used in each mix.

Experimental Design:

Split-split plot within a randomized complete block with 4 replications
Total plot area needed per site = 1.68 acres (with a 20 ft alley)

Data Collection:
Evaluations will be initiated in 2006 at both planting sites. Data will be collected on the effects of the treatments for the following:

Density and productivity of fringed sage
Grass establishment as measured by seedling density
Grass productivity by species
Density and productivity of the more abundant forb and shrub species
Economic analysis of treatment costs/benefits

RESULTS

General observations were made on November 2, 2005, about the effectiveness of the treatments conducted in July. The herbicides did not seem to have any significant or glaring differences, but establishment appeared better in the sprayed plots than in the unsprayed control plots. In addition, the introduced seed mixture was more vigorous and had better average stands than the native mixture. Complete evaluations will be conducted in 2006. However, both seed mixtures from the July planting are performing well based on preliminary observations.

Evaluations conducted in 2006 provided additional insight into fringed sage control and desirable forage enhancement or establishment. Initial results from 2005 were based on density counts of fringed sage and indicated that Cimarron Xtra and 2,4-D alone worked well at the 63 Ranch while Tordon and 2,4-D alone were the treatments of choice at the ROR. Additional data was collected in 2006 which altered these initial conclusions. Fringed sage biomass averaged 1735 and 895 kg/ha in the untreated control plots at the 63 Ranch and ROR, respectively. Although 2,4-D appeared to reduce density of fringed sage in 2005, a number of plants had recovered sufficiently by the 2006 growing season to the point where biomass was reduced by only 45% at both sites. This compares to biomass reductions of 93, 99, and 92% for Cimarron, Curtail, and

Tordon, respectively, at the 63 Ranch. Tillage was no better than 2,4-D at the 63 Ranch site with only a 45% reduction in fringed sage biomass. The disturbance and lack of competition created by the tillage treatment allowed fringed sage to quickly reestablish from the seedbank. Control was not as good at the ROR with reductions in fringed sage biomass of 70, 73, and 81% for Cimarron, Curtail, and Tordon, respectively. Grass biomass averaged 392 and 246 kg/ha in the controls at the 63 Ranch and ROR, respectively. Except for the tillage treatment at the 63 Ranch, grass biomass responded positively in all treatments. At the 63 Ranch, grass biomass averaged 1235 and 1472 kg/ha for Cimarron and Curtail, respectively, but only 734 kg/ha for Tordon. Baltic rush (included in grass category) was present at the 63 Ranch and Tordon appeared to have detrimental effects on this plant which accounted for most of the reduced grass response in this treatment. At the ROR, grass response was highest for Tordon with an average of 1082 kg/ha. Grass response for 2,4-D, Cimarron, and Curtail averaged 594, 820, and 742 kg/ha, respectively, at this site.

Table 2. Biomass of fringed sage, grasses, and forbs as affected by herbicide treatments on the 63 Ranch, South Park, Colorado. Samples were taken on August 19, 2006.

Herbicide Treatment	Sage	Grass	Forb	Total
	----------kg/ha----------			
2,4-D	947	891	5	1843
Cimarron	117	1235	0	1353
Control	1735	392	4	2131
Curtail	7	1473	3	1482
Tillage	951	204	344	1499
Tordon	142	734	13	889

The Curtail and Cimarron herbicide applications reduced the fringed sage component substantially while increasing the grass component by two times over the next most effective treatment. However, tillage provided for the most forb production when compared to the other treatment methods. In addition, the Tordon plots produced the lowest biomass, which suggests that the grass component may have been affected by the application one year later.

Cover values mimicked those for biomass. Seeding success was evaluated by ranking each plot from 0 (no seeded plants) to 5 (all drill rows well defined by seeded plants). Establishment was generally minimal at the 63 Ranch, regardless of seed mix or time of seeding. The best establishment at this site was in the tillage treatment (2.4) due to reduced competition and seeding into a prepared seedbed. Establishment was better in both summer plantings (average of 1.4) compared to the fall (1.0) with the native seed mix doing slightly better (1.6) compared to the introduced mix (1.3) at this site. At the ROR, establishment was also generally low with rankings of 1.9, 1.7, 1.5, and 1.2 for Tordon, Curtail, Cimarron, and 2,4-D, respectively. The fall and summer 2006 plantings ranked less than 1.0 for both native and introduced seed mixes while the summer 2005 planting ranked at 3.7 and 2.9 for the introduced and native mixes, respectively.

Table 3. Cover of fringed sage, grasses, and forbs as affected by herbicide treatments on the 63 Ranch, South Park, Colorado. Samples were taken on August 19, 2006.

Herbicide Treatment	Sage	Grass	Forb
	----------%----------		
2,4-D	29.1	32.9	0.3
Cimarron	2.1	50.5	0.1
Control	60.5	19.6	0.4
Curtail	1.1	56.3	0.5
Tillage	24.8	9.8	8.6
Tordon	1.8	32.0	1.0

Table 4. Effect of herbicide treatments, time of seeding, and seed mix on grass establishment at 2 sites in South Park, Colorado. Samples were taken on August 16, 2006 at the 63 Ranch and September 1, 2006 at the Ranch of the Rockies.

Herbicide Treatment	63 Ranch	Ranch of the Rockies
2,4-D	0.9	1.2
Cimarron	1.0	1.5
Control	0.4	0.9
Curtail	1.1	1.7
Tillage	2.4	----
Tordon	1.6	1.9
Seed Treatment		
Fall-Introduced	1.0	0.7
Fall-Native	1.0	0.5
Spring-Introduced	1.2	0.6
Spring-Native	1.6	0.4
Summer-Introduced	1.3	3.7
Summer-Native	1.5	2.9
Ratings were based on a scale of 0 (no seeded plants) to 5 (all drill rows well defined by seeded plants).		

CONCLUSION

Fringed sage can be effectively controlled with several types of herbicides (Cimarron Xtra, Curtail, and Tordon) thereby allowing established grasses to increase productivity. Although Curtail performed well, it was higher priced at $35.63/acre compared to $17.11 and $19.98/acre for Tordon and Cimarron, respectively. Seeding success is often minimal in high-elevation, harsh environments such as the South Park area of Colorado. Mid-summer plantings appear to be the best approach for improving establishment of seeded grasses in areas that typically receive

monsoonal (July and August) precipitation. Performance of the introduced grass mix was not consistently better than the native mix. Although native grasses are slower to establish, they may be the better choice for long-term productivity. There are thousands of acres in the South Park area alone that could benefit from control of fringed sage including over 40,000 acres that have experienced increases in sage due to the sale of irrigation water.

Project COPMC-F-0507-RA
Project Report – 2006
By: Dr. Joe Brummer and Steve Parr

Ranch of the Rockies Conservation Field Trial

INTRODUCTION

The South Park area of Colorado is characterized as a high, cold desert. The harsh growing conditions associated with this environment coupled with drought, historic overgrazing, and the transfer/removal of irrigation water have led to many degraded range sites in the Park. Some of the more productive native grasses, such as Arizona fescue *Festuca arizonica* and prairie Junegrass *Koeleria macrantha* have been displaced. Low growing species, such as blue grama *Bouteloua gracilis*, and fringed sage *Artemisia frigida*, have taken the place of these more productive species. With the recent drought conditions, even blue grama has given way to fringed sage. Although fringed sage is a native plant, it has come to dominate many sites throughout the Park. It is particularly troublesome because it is low producing, is unpalatable to livestock, and is very competitive and persistent once established. Upper Colorado Environmental Plant Center, Colorado State University, Natural Resources Conservation Service, Teller and Park County Conservation Districts, and the Colorado Division of Wildlife cooperated to establish two conservation field trials south of Fairplay, Colorado. The study will evaluate various herbicides for controlling or reducing the density of fringed sage; reseeding at three different times – an early summer planting, a mid summer planting and a dormant fall planting - with both a native grass mixture and an introduced grass mixture on two different sites in South Park.

The two sites differ primarily in the amount of organic matter in the soil profile, but are representative of several thousand acres within South Park (MLRA 48B) with similar site characteristics.

Site Description

Ranch of the Rockies south of Highway 24

This is an upland site that has experienced an increase in fringed sage due to the drought and past grazing practices. Although many of the native grasses are present at the site, their density and vigor have been significantly reduced which has allowed fringed sage to increase to the point where it dominates large areas.

OBJECTIVE

The objective of the planting is to compare the most effective methods and products for re-establishing desirable vegetation on altered or degraded range sites in South Park.

METHODS

The methods used in the study include the use of four different herbicides, three seeding dates and two seed mixes. Herbicides were applied at the rates identified below the first week in June

Project COPMC-F-0507-RA
Project Report – 2006
By: Dr. Joe Brummer and Steve Parr
2005.

Treatments:

Herbicide Main Plots: (30 x 112 ft)	**Rate: (per acre)**
Unsprayed control	------
2,4-D ester (4 lb a.i./gal)	4 pt
Curtail	6 pt
Tordon + 2,4-D ester	1 pt + 2 pt
Cimarron Max (2 part herbicide)	1 oz + 4 pt

Seeding Date Split Plot: (32 x 150 ft)
Unseeded control (16 x 150 ft)
Mid summer (Between July 1 and 15)
Fall (Dormant - Early November)

Seed Mix Split-Split Plot: (16 x 150 ft)
Native (See Table 1)
Introduced (See Table 1)

The plantings were conducted on July 6, 2005, November 2-3, 2005, and again in July 2006, with the seed mixtures identified in Table 1. Two planting times were selected to attempt to optimize the use of precipitation patterns. In mid to late July, South Park receives monsoonal flows from the southwest. This precipitation pattern generally lasts through early September. In order to capitalize on this monsoonal pattern, the first planting was done before the onset of the monsoon season. The dormant, fall seeding was done in early November 2005 to make use of early spring moisture for establishment prior to the very dry period of mid-May through June and to ensure that seed germination would not occur until spring 2006.

Table 1
Grass Species Planted for Fringed Sage Renovation Project
At 63 Ranch and Ranch of the Rockies in Park County Colorado

Native Mixture	**Average PLS of Native Mixture is 74%**				
Grasses	Variety	% in Mix	Seeding Rate lb/acre	Grams Per Rep	PLS lb/acre
Arizona fescue	Redondo	20	2.5	20	0.5
Bottlebrush squirreltail	Tusas	10	7.0	22	0.7
Indian ricegrass	Paloma	10	6.0	16	0.6
Mountain bromegrass	Garnet	15	12.5	104	2.0
Prairie Junegrass	Northwest CO	10	0.5	5	0.1
Sandberg's bluegrass	High Plains	10	1.0	3	1.0
Western wheatgrass	Rosanna	25	8.0	57	2.0
Total:				**227**	**6.9**

Introduced Mixture	**Average PLS of Introduced Mixture is 86%**				
Grasses	Variety	% in Mix	Seeding Rate lb/acre	Grams Per Rep	PLS lb/acre
Crested wheatgrass	Douglas	15	5.0	22	0.8
Crested wheatgrass	Hycrest	15	5.0	24	0.8
Hybrid wheatgrass	Newhy	15	7.0	36	1.1
Intermediate wheatgrass	Rush	15	9.0	38	1.4
Meadow bromegrass	Regar	15	6.5	26	1.0
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Siberian wheatgrass	Vavilov	10	5.5	16	0.6
Total:				**214**	**7.1**

The two grass mixes were compiled in part from results of an earlier trial in South Park. However, a number of new, untested products were also used in each mix.

Experimental Design:

Split-split plot within a randomized complete block with 4 replications
Total plot area needed per site = 1.68 acres (with a 20 ft alley)

Data Collection:

Evaluations will be initiated in 2006 at both planting sites. Data will be collected on the effects of the treatments for the following:

Density and productivity of fringed sage
Grass establishment as measured by seedling density
Grass productivity by species
Density and productivity of the more abundant forb and shrub species
Economic analysis of treatment costs/benefits

RESULTS

General observations were made on November 2, 2005, about the effectiveness of the treatments conducted in July. The herbicides did not seem to have any significant or glaring differences, but establishment appeared better in the sprayed plots than in the unsprayed control plots. In addition, the introduced seed mixture was more vigorous and had better average stands than the native mixture. However, both seed mixtures from the July planting are performing well based on preliminary observations.

Evaluations conducted in 2006 provided additional insight into fringed sage control and desirable forage enhancement or establishment. Initial results from 2005 were based on density counts of fringed sage and indicated that Cimarron Xtra and 2,4-D alone worked well at the 63 Ranch while Tordon and 2,4-D alone were the treatments of choice at the ROR. Additional data was collected in 2006 which altered these initial conclusions. Fringed sage biomass averaged 1735 and 895 kg/ha in the untreated control plots at the 63 Ranch and ROR, respectively. Although 2,4-D appeared to reduce density of fringed sage in 2005, a number of plants had recovered

sufficiently by the 2006 growing season to the point where biomass was reduced by only 45% at both sites. This compares to biomass reductions of 93, 99, and 92% for Cimarron, Curtail, and Tordon, respectively, at the 63 Ranch. Tillage was no better than 2,4-D at the 63 Ranch site with only a 45% reduction in fringed sage biomass. The disturbance and lack of competition created by the tillage treatment allowed fringed sage to quickly reestablish from the seedbank. Control was not as good at the ROR with reductions in fringed sage biomass of 70, 73, and 81% for Cimarron, Curtail, and Tordon, respectively. Grass biomass averaged 392 and 246 kg/ha in the controls at the 63 Ranch and ROR, respectively. Except for the tillage treatment at the 63 Ranch, grass biomass responded positively in all treatments. At the 63 Ranch, grass biomass averaged 1235 and 1472 kg/ha for Cimarron and Curtail, respectively, but only 734 kg/ha for Tordon. Baltic rush (included in grass category) was present at the 63 Ranch and Tordon appeared to have detrimental effects on this plant which accounted for most of the reduced grass response in this treatment. At the ROR, grass response was highest for Tordon with an average of 1082 kg/ha. Grass response for 2,4-D, Cimarron, and Curtail averaged 594, 820, and 742 kg/ha, respectively, at this site.

Table 2. Biomass of fringed sage, grasses, forbs, and shrubs as affected by herbicide treatments on the Ranch of the Rockies, South Park, Colorado. Samples were taken on September 1, 2006.

Herbicide Treatment	Sage	Grass	Forb	Shrub	Total
	----------kg/ha----------				
2,4-D	490	594	22	89	1194
Cimarron	267	820	5	75	1167
Control	895	246	14	6	1162
Curtail	243	742	57	88	1129
Tordon	170	1083	26	10	1289

It is interesting to note that the use of Curtail, while not the most effective at controlling fringed sage, released the most forb production. Curtail also ended up producing the least amount of plot biomass overall in 2006. Perhaps this will affect biomass production; plot composition in 2007. Tordon was the most effective herbicide for controlling fringed sage on this site and was also the best choice for improving grass production and overall plot biomass production.

Cover values mimicked those for biomass. Seeding success was evaluated by ranking each plot from 0 (no seeded plants) to 5 (all drill rows well defined by seeded plants). Establishment was generally minimal at the 63 Ranch, regardless of seed mix or time of seeding. The best establishment at this site was in the tillage treatment (2.4) due to reduced competition and seeding into a prepared seedbed. Establishment was better in both summer plantings (average of 1.4) compared to the fall (1.0) with the native seed mix doing slightly better (1.6) compared to the introduced mix (1.3) at this site. At the ROR, establishment was also generally low with rankings of 1.9, 1.7, 1.5, and 1.2 for Tordon, Curtail, Cimarron, and 2,4-D, respectively. The fall and summer 2006 plantings ranked less than 1.0 for both native and introduced seed mixes while the summer 2005 planting ranked at 3.7 and 2.9 for the introduced and native mixes, respectively.

Table3. Cover of fringed sage, grasses, forbs, and shrubs as affected by herbicide treatments on the Ranch of the Rockies, South Park, Colorado. Samples were taken on September 1, 2006.

Herbicide Treatment	Sage	Grass	Forb	Shrub
	----------%----------			
2,4-D	19.4	34.5	2.3	3.1
Cimarron	10.1	40.2	0.7	2.0
Control	34.8	15.1	1.6	0.4
Curtail	14.0	40.6	3.5	3.3
Tordon	7.9	44.3	1.9	0.3

Table 4. Effect of herbicide treatments, time of seeding, and seed mix on grass establishment at 2 sites in South Park, Colorado. Samples were taken on August 16, 2006 at the 63 Ranch and September 1, 2006 at the Ranch of the Rockies.

Herbicide Treatment	63 Ranch	Ranch of the Rockies
2,4-D	0.9	1.2
Cimarron	1.0	1.5
Control	0.4	0.9
Curtail	1.1	1.7
Tillage	2.4	----
Tordon	1.6	1.9
Seed Treatment		
Fall-Introduced	1.0	0.7
Fall-Native	1.0	0.5
Spring-Introduced	1.2	0.6
Spring-Native	1.6	0.4
Summer-Introduced	1.3	3.7
Summer-Native	1.5	2.9

Ratings were based on a scale of 0 (no seeded plants) to 5 (all drill rows well defined by seeded plants).

CONCLUSION

Fringed sage can be effectively controlled with several types of herbicides (Cimarron Xtra, Curtail, and Tordon) thereby allowing established grasses to increase productivity. Although Curtail performed well, it was higher priced at $35.63/acre compared to $17.11 and $19.98/acre for Tordon and Cimarron, respectively. Seeding success is often minimal in high-elevation, harsh

environments such as the South Park area of Colorado. Mid-summer plantings appear to be the best approach for improving establishment of seeded grasses in areas that typically receive monsoonal (July and August) precipitation. Performance of the introduced grass mix was not consistently better than the native mix. Although native grasses are slower to establish, they may be the better choice for long-term productivity. There are thousands of acres in the South Park area alone that could benefit from control of fringed sage including over 40,000 acres that have experienced increases in sage due to the sale of irrigation water.

Project COPMC-F-0508-CR
Report-2006
By: Manuel Rosales

Forb Field Evaluation Planting-Land's End

OBJECTIVE

To determine adaptability of selected forbs for revegetating post-treated Russian knapweed range land.

INTRODUCTION

A 2002 survey conducted by the Colorado Department of Agriculture showed Colorado with more than 118,341 infested acres of Russian knapweed (*Acroptilon repens)*. Russian knapweed is a creeping perennial that reproduces from seed and vegetative root buds. Russian knapweed requires an aggressive continual stress with herbicide and mechanical means in order to control it. After the weed is controlled, sowing with desirable plant species is necessary. Re-invasion of the weed has been prevented in some cases with some sod-forming grasses like thickspike or smooth brome. This field evaluation planting was set up to determine the adaptability of nine native forbs and one shrub in post treated Russian knapweed land and to determine their ability to prevent re-invasion by the weed

EXPERIMENTAL DESIGN

The statistical design for the study is a randomized complete block with four replications

MATERIALS & METHODS

Nine forbs and one shrub were planted on October 27, 2005, with a hand pushed belt seeder. The rate of seeding was 30 pure live seed per linear foot of row. The plot size is 4 x 20 ft with four rows per plot. The following table lists the 10 entries for the study:

Common Name	**Scientific Name**	**Release Name/Accession No.**	**Plant Type**
Firecracker penstemon	*Penstemon eatonii*	Richfield	Forb
Four wing saltbush	*Atriplex canescens*	Rincon	Shrub
Fringed sage	*Artemisia frigida*	CO-9021471	Forb
Lewis flax	*Linum lewisii*	Maple Grove	Forb
Lewis flax	*Linum perenne*	Appar	Forb
Louisiana sage	*Artemisia ludoviciana*	Summit	Forb
Maximillian sunflower	*Helianthus maximiliani*	Medicine Creek	Forb
Narrow leaf penstemon	*Penstemon angustifolius*	San Juan	Forb
Utah sweet vetch	*Hedysarum boreale*	Timp	Forb
Yarrow	*Achillea millefolium*	Great Northern	Forb

The site is located about ten miles south east of the city of Grand Junction, Colorado. The planting location is on Divide Road east of Land's End Road, at the Kannah Creek-Lands End

Exit off Colorado Highway 50. The site will not be irrigated. Plots will be evaluated for stand establishment and ability to compete with weeds, especially re-invasion of Russian knapweed

RESULTS

The study was evaluated on May 10, 2006; unfortunately, 'Timp' Utah sweetvetch was the only forb that had some plants established at this time. Plots will be evaluated again in late spring 2007 and a determination will be made to discontinue or continue the study.

Project COPMC-F-0601-CR
Report-2006
By: Manuel Rosales & Patrick Davey

South Park Field Evaluation Planting

OBJECTIVE

To determine which selected materials will establish and persist in peat rich soils once irrigated and now dryland

INTRODUCTION

Historically, ranchers and developers have been interested in the peatlands (also referred to as fens) of South Park, Colorado. Peatlands were ditched and drained to grow crops for livestock grazing and to prevent cattle from becoming bogged down in their soft soils. Peatland is a generic term for any wetland that accumulates decayed plant material. In Colorado peatlands are classified as fens. This type of peatland is only found in high-elevation sites above 8000 feet. These peatlands form in places where a constant supply of ground water maintains the soil saturated. This field evaluation planting was designed to help select plant materials, especially native grasses, that will grow in peatlands that were previously drained and irrigated, and no longer will be irrigated.

EXPERIMENTAL DESIGN

The statistical design for the study is a randomized complete block with four replications

MATERIALS & METHODS

The planting site was prepare by rototilling, let stand, sprayed with roundup, and then rolled to firm up the soil prior to seeding.

Seventeen native grass species and 11 introduced or manipulated grass species were planted November 2-3, 2005. The planting was done with a four-row plot cone-seeder. The rate of seeding was 60 pure live seeds per linear foot of row (30 x 2 for critical area planting). The plot size is 4 x 20 ft with four rows per plot. Table 1 lists the 28 entries for the study:

Table 1. South Park Field Evaluation Planting. UCEPC

Common Name	Scientific Name	Release Name or Accession No.
Natives		
Arizona fescue	*Festuca arizonica*	Redondo
Bluebunch wheatgrass	*Pseudoroegneria spicata spp.spicata*	Anatone
Bluebunch wheatgrass	*Pseudoroegneria spicata spp.spicata*	Goldar
Blue grama	*Bouteloua gracilis*	Bad River
Bottlebrush squirreltail	*Elymus elymoides spp.brevifolius*	Pueblo

Common Name	Scientific Name	Release Name or Accession No.
Bottlebrush squirreltail	*Elymus elymoides*	Tusas
Bottlebrush squirreltail	*Elymus elymoides spp.brevifolius*	Wapiti
Columbia needlegrass	*Achnatherum nelsonii*	9024804
Columbia needlegrass	*Achnatherum nelsonii*	9040137
Indian ricegrass	*Achnatherum hymenoides*	Paloma
Indian ricegrass	*Achnaterum hymenoides*	Rimrock
Mountain brome	*Bromus marginatus*	Garnet
Prairie Junegrass	*Koeleria macrantha*	9092261
Sandberg's bluegrass	*Poa secunda*	High plains
Streambank wheatgrass	*Elymus lanceolatus*	Sodar
Western wheatgrass	*Pascopyrum smithii*	Arriba
Western wheatgrass	*Pascopyrum smithii*	Rosana
Introduced or Manipulated		
Basin wildrye-hybrid	*Leymus cinerus*	Continental
Crested wheatgrass	*Agropyrum cristatum*	Douglas
Crested wheatgrass	*Agropyrum cristatum*	Nordan
Crested-desertorum hybrid	*Agropyrum cristatum x A. desertorum*	Hycrest
Intermediate wheatgrass	*Thinopyrum intermedia*	Rush
Meadow brome	*Bromus biebersteinii*	Regar
Pubescent wheatgrass	*Thinopyrum intermedia*	Luna
Russian wildrye	*Psathyrostachys juncea*	Bozoisky
Siberian wheatgrass	*Agropyrum fragile spp. sibiricum*	Vavilow
Smooth brome	*Bromus inermis*	Liso
Wheatgrass-hybrid	*Elymus hoffmanni*	Newhy

The site is located 15 miles south of the city Fairplay, Park County, Colorado, on U. S. highway 285. **Elevation at the site is 9000 feet**. The planting site is on 63-Ranch State Wildlife Area. A six-foot tall game-fence enclosed the planting area. Plots will be evaluated for stand establishment and performance.

RESULTS

The following table presents percent plant stand (establishment) and plant vigor for the growing season of year 2006. The over-all average for plant establishment was 8.2 percent which is low. Bad River-blue grama performed best for the native grasses and Liso-smooth brome performed best for the introduced grasses.

Table 2. Plant stand & Vigor for 28 entries. South Park FEP-2006

Common Name	Release Name or Accession No.	%Plant Stand Average[1]	Plant Vigor Average[1]
Natives			
Arizona fescue	Redondo	0.25	2
Blue grama	**Bad River**	32	3.5
Bluebunch wheatgrass	**Anatone**	18.2	3.5
Bluebunch wheatgrass	Goldar	10.5	3.7
Bottlebrush squirreltail	Pueblo	2.7	2.2
Bottlebrush squirreltail	Wapiti	0.5	2
Bottlebrush squirreltail	Tusas	0.25	2
Columbia needlegrass	9024804	2.5	2.3
Columbia needlegrass	9040137	1.7	2.3
Indian ricegrass	**Rimrock**	14.5	3.5
Indian ricegrass	Paloma	7.2	3.5
Mountain brome	Garnet	2	3.2
Prairie Junegrass	9092261	1	2.6
Sandberg's bluegrass	High plains	1.2	2
Streambank wheatgrass	Sodar	0.7	2.5
Western wheatgrass	Rosana	12.5	3.2
Western wheatgrass	Arriba	5.5	2.7
Introduced or Manipulated			
Basin wildrye-hybrid	Continental	12.5	3.7
Crested wheatgrass	Nordan	11.5	3.7
Crested wheatgrass	Douglas	5	2.5
Crested-desertorum hybrid	Hycrest	7.7	3.2
Intermediate wheatgrass	Rush	8.7	3.7
Meadow brome	**Regar**	17.7	3.2
Pubescent wheatgrass	Luna	7.5	3.2
Russian wildrye	**Bozoisky**	14.5	3.7
Siberian wheatgrass	Vavilov	7.2	3.2
Smooth brome	**Liso**	23	2.7
Wheatgrass-hybrid	Newhy	1.5	2.6

[1] Average of four replications. Plant stand & vigor were statistically significantly different at the 5% level of probability.
The ratings for Vigor are: 2 = poor, 3 = fair, 4 = Good and 5 = Excellent. Plant stand is a visual estimate per plot basis; if entire four-row/ plot germinated is = 100 percent establishment.

Project COPMC-F-0602-WI
Report-2006
By: Manuel Rosales

Windbreak Demonstration Planting

OBJECTIVE

To demonstrate the use of different woody species for windbreak purposes at Upper Colorado Environmental Plant Center (UCEPC).

INTRODUCTION

UCEPC is located in an area that experiences strong winds throughout the year. To protect the Center from prevailing winds, a windbreak is being planted with multipurpose benefits in mind. In addition to providing protection from the wind, the windbreak will serve educational and demonstrational, as well as aesthetic purposes.

EXPERIMENTAL DESIGN

This is a non-replicated planting.

MATERIALS & METHODS

A multiple-row windbreak with five to eight rows of woody plant materials will be planted along the west side perimeter of the Center. Three rows of evergreen trees, two rows of deciduous trees and two to three rows of shrubs will be planted during 2006 to 2008. Native woody species will be planted where possible, following the Natural Resources Conservation Services guidelines for establishing a windbreak/shelterbelt. The planting will be irrigated as needed until the plants get well established. Plant materials for the windbreak will be acquired through Colorado State Forest Service tree program and/or UCEPC's own woody collections.

RESULTS/ACCOMPLISHMENTS

On May 25, 2006, sixty potted Colorado blue spruce *Picea pungens* seedlings were planted by hand. Tree seedlings were about 6 to12 inches in height. The trees were purchased at the Local NRCS field office through the State Forest Program. Trees were planted in a single row (north-south) that runs parallel to the UCEPC west fence at 16-feet spacing within the row Adjacent rows will be set at 20 feet between rows. Trees were watered by hand immediately after planting. Trees were irrigated during the summer with a hand-moved 2-inch line sprinkler set. Trees were also mulched with a 2 to 3-inch layer of wood chips around each tree with a 2-feet diameter. The mulch kept soil moist and prevented weeds from competing with the trees.

On July 10, 2006, the trees were evaluated for survivability. All 60 trees were alive and growing well. More trees will be planted during 2007 growing season.

Project COPMC-P-0301-RA
Report - 2006
By: Manuel Rosales

Advanced Evaluation of Indian Ricegrass *Achnatherum hymenoides* for Heavy Soils

OBJECTIVE

To find a selection that is adapted to heavy soils.

INTRODUCTION

Indian ricegrass *Achnatherum hymenoides* is a native cool season, perennial bunchgrass; one to two feet tall that is often a major stand component of harsher, sandy sites. It occurs in Canada from Manitoba to British Columbia, in the United States in all states west of the Missouri River, and Northern Mexico. While the species is best adapted to dry, sandy soils, it can also be found on clayey, silty, and shaley sites. It does well on southern exposures, especially at higher elevations. Indian ricegrass is found in the 6 to 18 inch precipitation zone at elevations ranging from 2000 to 10,000 feet. Stands tend to be short-lived (three to four years) and reproduction is primarily from seed. It is very drought tolerant and is often a pioneer species on open or disturbed sites. It tends not to compete well with other perennial grasses. Indian ricegrass moderately tolerates saline or alkaline soils, but does best under more mesic conditions. The species performs poorly under shade and high water tables.

Indian ricegrass is highly palatable and serves to provide nutritious forage for wildlife and livestock under harsh site conditions. It reaches peak production from mid June through mid July, holding its nutrient value at maturity. It also has strong potential for use with mined land reclamation, critical area stabilization, and as a standing winter feed.

Past releases of Indian ricegrass ('Nezpar', 'Paloma', 'Rimrock', and Ribstone germplasm) are more adapted to light to medium textured soils. As a consequence of its good nutrition, palatability, and establishment characteristics on critical areas, there is a need for a cultivar or selection of Indian ricegrass that is adapted to heavier (clayey) soil types.

EXPERIMENTAL DESIGN

The experimental design for the advanced study is a randomized complete block with three replications.

MATERIALS & METHODS

In 1988, collections of Indian ricegrass ecotypes from heavy soils were made in Colorado, Wyoming, Utah, and Nevada. From 1991 to 1998, Upper Colorado Environmental Plant Center (UCEPC) conducted initial evaluations that led to ten superior selections for an advanced study.

In September 2003, preparations were made to plant the advanced study, however, due to unforeseen circumstances the study was postponed until 2004. On July 29, 2004, the advanced study was planted at UCEPC with a hand pushed belt seeder. Twelve entries; nine accessions,

and three cultivars used as standards for comparison were planted. The rate of seeding was 30 pure live seeds per linear foot of row.

The soil for the study site was identified by Charles Peacock, USDA-NRCS Soil Scientist, to contain 27 percent clay (texture class-silty clay loam) in the surface with an average of 40 to 50 percent clay (texture class-clay) in the subsoil. A plot plan for the study and a table with the entries and their collection site are presented below:

Indian Ricegrass
Plot Plan - Summer/2004

↑
North

Rep I				Rep II				Rep III			
741	Alley	735	Alley	818	Alley	Paloma	Alley	716	Alley	Rimrock	Alley
739		818		661		664		818		735	
Rimrock		661		749		Rimrock		749		741	
749		716		735		Nezpar		715		661	
664		Nezpar		739		741		Nezpar		664	
715		Paloma		715		716		Paloma		739	

Note: The last 3 digits of the accession numbers were used in the table.
Plot size: (20 Feet x 12 Feet) = 240 square feet, 181.5 plots/acre
Rows/Plot = Four (3 foot centers)
Number of entries = 12
Alley width = 10 feet

Accessions/Cultivar	Collection Site
Nezpar	Whitebird, ID
Paloma	Pueblo, CO
Rimrock	Bridger, MT
9024661	Delta, CO
9024664	Moffat Co., CO
9024715	Colorado Springs, CO
9024716	Colorado Springs, CO
9024735	Grand Junction, CO
9024739	Pagosa, CO
9024741	Pagosa, CO
9024749	Durango, CO
9024818	unknown
A total of 12 entries were planted on July 29, 2004	

RESULTS

Results for 2006 are presented in the following table:

Table 1. Seed Yield and Other Parameters for 12 Entries of Indian Ricegrass. UCEPC-2006

Accession/ Release	Seed Yield (Lb/acre)	Forage (dry-wt) Ton/acre[1]	Plant Height[2] (cm)	Percent Plant Stand[3]	Re-growth[4]
Nezpar	83.7	0.65	77.5	90.7	2.0
Paloma	24.0	0.68	52.3	60.0	1.0
Rimrock	165.5	0.76	70.0	94.4	2.7
9024661	113.8	0.83	69.4	89.3	1.3
9024664	68.2	**0.94**	58.2	91.7	1.7
9024715	119.9	**0.91**	70.0	91.7	2.0
9024716	58.4	0.68	65.2	91.0	1.3
9024735	103.9	0.87	59.7	95.0	1.3
9024739	165.2	0.68	67.4	90.0	2.7
9024741	**191.0**	0.76	71.0	93.3	2.0
9024749	95.7	0.83	65.6	90.0	1.7
9024818	13.3	0.36	47.3	61.7	1.0
Mean	**100.3**	**0.75**	**64.5**	**86.5**	**1.7**
	S[5]	**NS**	**S**	**S**	**S**

1. Air-dry above ground biomass (cut four inches above soil surface)
2. Plant height measure in centimeters to top of seed panicle
3. Visual estimate per plot basis.
4. Visual rating taken 35 days after forage cutting: 1 = Excellent re-growth, 2 = Moderate & 3 = poor.
5. Significant(S) or not significant (NS) at the 5 percent level of significance.

Note: All data is the average of three replications.

Data collection will continue for at least two more years in order to conclude the project.

Project COPMC-S-0201-WL
Project Report-2006
By: Steve Parr

Seed Increase of Prairie Junegrass
Koeleria macrantha

INTRODUCTION

Koeleria macrantha prairie Junegrass is a perennial, cool-season bunchgrass that is widely distributed throughout the United States. According to Hitchcock, 1935, its range extends from Ontario to British Columbia, south to Delaware, Missouri, California, and Mexico. The species is also widely distributed in the temperate regions of the old world. In the Central Rocky Mountains, it is commonly found as a component of prairies, open woods, mountain parks, sagebrush, and mountain brush communities. In Colorado, it is found in elevations ranging from below 4,000 feet to over 11,000 feet. The species provides good forage for both livestock and grazing wildlife species, and fair forage for browsing species of wildlife. *Koeleria macrantha* is usually sparsely distributed and is generally not found as the dominant range species in a particular stand. Because of this, its importance as forage to both wildlife and livestock may be more related to its abundance than its preference.

Prairie Junegrass also responds well after fire and studies have found positive effects to plant size and seed head abundance following fire. Other studies show it has increased in abundance after prolonged drought conditions and man induced surface disturbances. Although prairie Junegrass has a number of characteristics that make it an attractive product for inclusion in seed mixtures for revegetation, there is only one released variety, Barkoel, which is from the Netherlands. There is no release from the United States. This may be a factor in whether the species is recommended in mixtures. Because of the potential benefit to native ranges, prairie Junegrass has been a product under selection at Upper Colorado Environmental Plant Center (UCEPC) since 1984.

Forty accessions of *Koeleria macrantha* were planted as a fall seeding, Project 08I115, on August 23, 1985. Due to poor establishment of this planting, a spring planting, Project 08I152, was established on June 12, 1986. Because of insufficient seed, only 32 accessions of the original 40 were included in Project 08I152. In addition, 19 International collections were included in Project 08I152, bringing its total number of accessions up to 51. In 1988, Projects 08I115 and 08I152 were combined into a single project designated as 08I115.

In 1991, Dr. Jack Carlson, who was at the time the Northwestern Regional Plant Materials Specialist for the SCS, recommended that a composite of the best strains from the Central Highlands of Turkey (PI-204451, PI-206274, PI-383672, PI-383673, and PI-383674), be made. In addition, Dr. Carlson recommended that a second composite be put together that consisted of the best performing strains from Northwestern Colorado. At that time, Northwest Colorado accessions 9024197, 9024421, and 9039787 were recommended.

In 1993, Dr. Gary Noller, UCEPC Senior Scientist, determined the top three Northwest Colorado and the top three Turkish Central Highlands accessions for the project. Dr. Noller recommended

that accessions PI-383672, PI-383673, and PI-204451 be chosen from the Turkish Ecotypes. In addition, Dr. Noller recommended that accessions 9024197, 9039786, and 9039787 be chosen to represent the Northwest Colorado ecotypes. Accession 9024197 is from Rio Blanco County, while accession 9039786 and 9039787 are from Routt County.

During the summer of 1994, UCEPC established separate crossing nurseries for the Northwest Colorado and Central Turkish Highland accessions in UCEPC. The nurseries were established with vegetative culms transplanted from UCEPC Field 21 onto 3-foot centers. Each nursery was laid out in a Randomized Complete Block design and included three replications. Each genotype is represented within a given replication seven times. The Northwest Colorado crossing block represents Project 08A207 while the Turkish Central Highlands crossing block represents Project 08A208. Dr. Tom Jones, ARS, Logan, Utah pointed out that *K. macrantha* cross-pollinates and is self-incompatible. Upon cross-pollination, seed borne on each individual representing one of the three accessions will be considered a half-sib family (one parent known, one parent unknown).

OBJECTIVE

To develop a release of *Koeleria macrantha* for conservation use from a composite selection of superior Northwest Colorado ecotypes.

METHODS FOR PRODUCT DEVELOPMENT

The original project methodology was to utilize genotypic recurrent selection only for the establishment of an F1 nursery. The original parental plants, 63 in all, were to provide the seed source for 63 F1 type plants, replicated three times, to produce an F1 nursery with 189 plants.

Each of the F1 plants was to be maintained as a separate line and eventually used to create an F2 nursery. The F1 seed, F2 seed, and Parental seed would be compared and a subsequent release be initiated based on the results.

In 1996, seed was collected and harvested by individual plant, but was not identified as to which plant or accession. In 1997-2000, seed was harvested and identified for parental determination. In 2001-2003, the seed from the crossing block was bulk harvested. Because a recurrent selection process would take an additional three to five years to establish and compare seed production results, it was determined by UCEPC to go forward with a release of prairie Junegrass based on results of advanced evaluations.

RESULTS

Individual plant harvests were conducted with reference to accession from years 1997-1999. Harvest results from accession 1 (9024197) from Rio Blanco County and accession 2 (9039786) and accession 3 (9039787) from Routt County are provided below.

Year	Accession 1	Accession 2	Accession 3	Total
1997	209	240	225	674
1998	653	710	581	1944
1999	174	237	255	666
Totals	1036	1187	1061	

Analysis of variance statistics were run for the randomized complete block design of this study. Although there is an apparent accessional difference, the difference is not significant at the 5% level. Of the 63 parental plants, there is mortality in ten.

CONCLUSION

Data from three years (1997-1999) indicates there is no significant difference in accessional performance relative to seed production. Furthermore, accession 9039786 has produced the highest total and highest average amount of seed over the three-year period. However, this accession has also had the highest plant mortality with five dead plants out of ten total dead plants in the project. On the other hand, the poorest producing accession, #9039787, had the least mortality with two plants.

Because there is no statistically significant difference between accessions for seed production, and there are other characteristics within accessions that may contribute positive attributes (plant survival) to the germplasm, it was determined that a blend of all three accessions be used to establish a Northwest Colorado Junegrass seed increase field for eventual release.

On July 16, 2002, blended seed from the 2001 harvest was used to seed one acre of prairie Junegrass in Field 11 at UCEPC. Seed density was targeted at 30 seeds per linear foot and the seeding was completed with a hand pushed Planet Junior. A poor to weak stand was noted until late fall, when a good stand was finally evident.

On July 15, 2003, 47 pounds of Junegrass were harvested by direct combining. Seed test results indicated a low purity and 71% germination. This resulted in 24 PLS pounds produced on the one seeded acre in the first production year. This seed will be used for testing at other locations to test for the range of adaptation for the release of this product.

Project COPMC-S-0201-WL
Project Report-2006
By: Steve Parr

On July 7, 2004, 221 pounds of cleaned Junegrass were harvested by direct combine from the seed increase field of one acre. Seed test results from this field show that purity is 93.4% and germination 45.0%. This resulted in 93 pounds of Pure Live Seed per acre.

July 13, 2005, 100 pounds of clean seed were harvested with the combine. Seed test results are not available at this time.

In 2006, 120 pounds were harvested with the combine on July 1. However, the pure live seed component is only 23%. An additional problem was identified during seed analysis with species identity. The Colorado Seed Laboratory reported the seed to be that of *Poa secunda*, big bluegrass. An additional lot was sent for resampling, but it too, was determined to be big bluegrass. Identification was attempted by UCEPC personnel, but there are very close resemblances of several *Poa* species to *Koeleria*. Tom Jones with ARS was asked if ARS could do genetic testing of our product or if he knew of competent taxonomists with whom he felt comfortable, but he suggested using university taxonomists. After our product heads out, we will send samples to several taxonomists for physical identification.

Project COPMC-S-0401-CR
Project Report 2006
By Steve Parr

Seed Increase for Fire Rehabilitation Needs
Bureau of Land Management-Colorado

INTRODUCTION

The Bureau of Land Management has reseeded over 50 thousand acres in western Colorado over the past 15 years. Like many western states, large wildfires in Colorado are recently more common; being both more numerous and larger in scale than had been historic wildfires. In fact, the largest fire in Colorado's history occurred in 1988. The "I Do" fire near Maybell, Colorado, consumed more than 15,000 acres with about one third of those acres on BLM managed lands. Only two years later, the "Bircher" fire near Cortez, Colorado, broke the record again by burning over 23,000 acres. In 2002, the Hayman fire consumed over 70,000 acres. The trend does not appear to have peaked, as much of the west is consumed by individual wildfire events burning thousands of acres annually. Since much of the burned acreage is also treated with some type of seeding to reduce erosion and to reestablish vegetative cover, seed has been in high demand.

With increases in sizes of wildfires and frequency of events, the demand on the seed industry, especially for native species, has been greater than the supply during recent years. This demand has created an unfavorable situation in which seed of desired species may be in short supply, costly, of low quality (poor germination or purity), or unavailable altogether. This often results in price fluctuations and quality or even species sacrifices by entities purchasing seed for revegetation projects. These seed substitutions result in revegetation projects achieving less than they are capable.

BACKGROUND

During the record fire season of 2000, BLM of Colorado treated over 18,000 acres at a cost of over one million dollars. Limited availability and quality of desired native materials prompted the BLM office in Meeker, Colorado, to contact Upper Colorado Environmental Plant Center (UCEPC) about a potential cooperative project for seed increase. An informational meeting was held on January 16, 2001, with UCEPC staff and Meeker BLM personnel to determine what the local BLM office needed and how UCEPC could help them get what they needed. What was expressed by BLM as the most important items included a consistent supply of locally adapted native seed with purity and germination standards no less than the industry standard for certified seed of that individual species, and at a price that was not prohibitive for project inclusion.

Interest in the project soon expanded from the Meeker field office to include a good portion of those offices affected by the same chronic seed source problems related to revegetation projects. Jim Cagney of the Meeker BLM office contacted Mark Stiles about the project potential in late February, and interest was expressed at the state level. On March 19, 2001, a meeting was held at UCEPC, which included local and state BLM personnel, Plant Center staff, and members of the Administrative Board. BLM needs were addressed as well as the capabilities of UCEPC to deliver products and services to meet the expressed needs. A review of UCEPC facilities and its

structure as well as a potential scope of activities were discussed. In addition, a list of potential seed increase species was reviewed and Rusty Roberts agreed to survey field offices for input regarding desired species for fire rehabilitation.

Rusty reported back via e-mail on May 7, 2001, that six of the species reviewed during the meeting in March had favorable responses and three additional species were added to the list of candidates. A preliminary proposal from UCEPC was submitted to Dennis Zachman of the state BLM office for review. Dennis submitted to the state a proposal to determine the level and willingness of the state to support a seed increase project. Revisions and further proposal development continued, but species for the increase effort had to be targeted so collections could be initiated and conducted as efficiently as possible.

Rusty followed up with an e-mail to field offices on June 7, 2001, that five species had been selected for initial increase efforts and that contact by UCEPC personnel would be forthcoming. On June 8, a detailed project proposal with budgetary estimates was submitted by UCEPC to Dennis Zachman for inclusion into a cooperative agreement between BLM, UCEPC, and NRCS.

METHODS

Project activities started with a sit down session in Grand Junction on June 25, 2001. This, as with the other sit down sessions at field office locations, was extremely beneficial in identifying potential collection sites, revegetation history, grazing or other use history, fire history etc. These factors and others were discussed to aid in selecting the sites with the highest potential for successful collecting.

A few days later, on July 3, the first day of collection by UCEPC occurred in the Little Park area on the Uncompahgre Plateau south of Grand Junction. A recap of the coordination meetings, collection areas, and clean seed amounts obtained from 2001, 2002, 2003, and 2004 is included in this report as a separate attachment.

Seed collection results were disappointing for the first year. Drought conditions over much of the collection area produced little amounts of viable seed. In addition, a hard freeze occurred on May 20, which also contributed to the poor seed fill in much of Northwest Colorado. Seed of one species, Utah sweetvetch, was collected in quantities large enough to plant a seed increase field, but was collected primarily from one site. It is the recommendation of UCEPC that we add to the genetic variability and diversity of the increase species by collecting from several locations, bulking the seed and then planting the source field. Additional collections will be attempted in 2007, as time and resources allow. The other four materials, bottlebrush squirreltail, beardless bluebunch wheatgrass, western wheatgrass, and Sandberg's bluegrass were collected in gram quantities in 2001. One species that was noted to have produced good quantities of seed but was not collected was bluebunch wheatgrass *Pseudoroegneria spicata spicata*. Our agreement called for the collection of beardless bluebunch *Pseudoroegneria spicata inermis*. Because of such limited success with beardless bluebunch collections (12 grams), we decided during our coordination meeting with Dennis Zachman on March 30, 2002, to expand the

collection list to include bluebunch wheatgrass and needle and thread. Adding these two species would increase the opportunities to collect quantities necessary to establish some production fields for the project.

In 2002, collection results were also limited. As the driest recorded year since the establishment of the Plant Center, extremely poor seed fill resulted in collections of gram quantities of two species, Sandberg's bluegrass and bottlebrush squirreltail. A single site produced a little less than two pounds of needle and thread.

As fate would have it, collections in 2003 were quite good. Even though 2002 was one of the driest years in recorded history in the west, spring moisture was adequate to produce seed in most early season species in 2003. As a result, good quantities of seed of five of the targeted six species were obtained. Utah sweetvetch was the only targeted species that did not produce good collections in 2003. One site located north of Gypsum, Colorado, had good numbers of plants blooming on a collection trip June 17, 2003. The following week, a brush fire encompassed the area which prohibited access. In addition, Carla Scheck, Glenwood office BLM indicated there would likely be no seed to collect for a few years on the sites we were using because of the scope and location of the fire.

A cool but dry spring in 2004 also resulted in extremely poor seed fill. On two collection trips, no seed of targeted materials was collected. As a result, no additional attempts at seed collection were made in 2004. Seed collection quantities were good in 2003, and after confirmation with Dennis Zachman, BLM state office, it was determined to proceed with the project. As planned, blended collections were used for the seed increase plantings to maximize species diversity within the range of anticipated use.

Bottlebrush squirreltail was planted using two separate collections from separate years, but from the same source. Accession 9092275 was collected in 2001 and again in 2003. Together, the collections provided adequate seed for an increase planting. Furthermore, the bottlebrush squirreltail complex was undergoing taxonomic transformation during the collection years. Historically, bottlebrush squirreltail was know as *Sitanion hystrix*, but was renamed *Elymus elymoides.* There had been much confusion on separate species, subspecies or genetic gradients of individual populations by taxonomists with squirreltails. Currently, there are two accepted species, *E. multisetus* and *E. elymoides*, with four subspecies of the latter. In Colorado, two subspecies of *E. elymoides* exist in identifiable populations: *E. elymoides elymoides* and *E. elymoides brevifolius.* We had also collected from extreme northwest Colorado an *E. elymoides elymoides* sup-species. Again, after consultation with Dennis Zachman, we opted to use the same source material rather than mixing subspecies or waiting for a good collection opportunity for the *elymoides* sub-species.

Western wheatgrass is represented by one collection, accession 9092278, from one location during a single year. This increase, although containing the least genetic diversity of the collected increase species, was also the only collected population with enough viability in the seed to establish a planting.

The third material, bluebunch wheatgrass, was the most equally represented blend used for increase. Three collections from northwest Colorado were utilized to establish this species. Collections were obtained from Pisgah Mountain in north central Colorado, State Bridge in the central portion of the mountains and Irish Canyon in extreme northwest Colorado. These collections are identified by accessions 9092276, 9092277, and 9092274, respectively.

On April 28, 2005, a site visit was conducted with the State Plant Materials Specialist and the State Range Conservationist for NRCS to determine the collection potential for Utah sweetvetch. It was determined that the site would not have adequate seed for a collection effort, so no collection effort for this species was conducted for 2005. To date, Utah sweetvetch has been collected one year out of five from a single site. Concern had been expressed about the lack of genetic composition for a material that may be used throughout the state of Colorado on BLM lands. However, the species has been recognized as being an important component in the fire rehabilitation seed mix. Because the species is also insect pollinated, subsequent seed collections could be added to a seed production field to increase the genetic base if the opportunity exists for additional collections.

A collection trip was taken on June 2, 2006 along Highway 64 and Highway 40 in extreme northwest Colorado. A small amount of seed was acquired from the trip, but seed collection potential looked to be grim for 2006. Thirteen grams of Sandberg's bluegrass were collected from two different sites. No other collections of target species were made in 2006.

Two additional plantings for Utah sweetvetch were made by UCEPC in 2006 in order to improve the stand. One was done on July 26. In addition, containerized stock is being produced to supplement the direct seeding efforts. In light of the difficulties encountered with Utah sweetvetch collections, planned activities for 2007 include a transplant effort of containerized stock and innerseedings in the spaced planting of Utah sweetvetch in efforts to complete the stand. The Sandberg's bluegrass was not strongly evident in 2006, so additional efforts will be necessary for the establishment of it in 2007. A small seeding is also planned for the north end of the bottlebrush squirreltail field. The bluebunch and western fields have filled in nicely, and they should be productive in 2007.

Seed harvest in two of three fields planted in 2004 was accomplished in 2006. In addition to seed harvest and maintenance, a comprehensive plan for the infusion of contracted seed production will also be completed. It is estimated that seed distribution to growers will be initiated in 2008 and 2009 for contracted seed increase.

The table below outlines the establishment and production accomplishments of UCEPC to date.

SPECIES	UCEPC FIELD #	ACREAGE	PLANTING DATE	HARVEST DATE	YIELD
Bluebunch	6	0.87	Aug.13, 2004	6/29/2006	32 #
Bottlebrush	17	0.80	Aug. 13, 2004	7/13/2006	45 #
Sandberg's bluegrass	12	1.00	Aug. 8, 2005		
Utah sweetvetch	12	1.00	Sept. 15, 2005		
Western	7A	0.80	Aug. 13, 2004		

CONCLUSION

After attempting to collect seed for five years, seed from minimal prior collections was used to establish plantings for each of the identified project species. Additional collections may be necessary to supplement the existing collections and to ensure that "source seed" is on hand for future testing or development. Additional field establishment efforts will be necessary to obtain good stands of target materials. Coordination between UCEPC and field offices will again be necessary as this project progresses. A comprehensive and equitable distribution plan must also be completed and agreed upon for pre-determined contract production.

Seed production has been obtained on two of five species. Three species, bluebunch, western and bottlebrush, should produce seed in 2007. The Utah sweetvetch may produce a limited amount of seed. Colorado State University Extension Entomologist Bob Hammon has also agreed to bring some bees to the Center in an effort to assure the presence of pollinators for the crop. But it is not expected that there will be much production. Efforts to supplement the breeder seed will be a priority, as will the establishment of Sandberg's bluegrass.

Project COPMC-S-0402-WL
Project Report 2006
By Steve Parr

Seed Increase for Uncompahgre Restoration Project

INTRODUCTION

Years of noticeable mule deer declines in areas that once held healthy populations prompted a series of studies by Colorado Division of Wildlife to determine the cause(s) for these dramatic population declines. What was discovered was not specific to mule deer, but rather was much more widespread. It was apparent that many of the problems related to mule deer declines were shared by other species, including plants. Because of the recognition of declining habitat on the Uncompahgre Plateau, and the ramifications that unchecked decline would have on mule deer and other species, a collaborative, community based effort was formulated to address the concerns. As a result, the Public Lands Partnership was created. Upper Colorado Environmental Plant Center (UCEPC) was contacted by Rick Sherman. A summary of this partnership and the Uncompahgre Plateau Project is provided below.

EXECUTIVE SUMMARY

The Uncompahgre Plateau Project (UP) was formalized in a 2001 MOU by the Public Lands Partnership (PLP), Bureau of Land Management (BLM), Colorado Division of Wildlife (CDOW), and U.S. Forest Service (USFS). These organizations formed a partnership to work collaboratively to restore and sustain the ecological, social, cultural, and economic values of the Uncompahgre Plateau. The UP area, located in southwest Colorado, comprises over 1.5 million acres of private, state, and federal lands. Approximately 75 percent of the area is public land.

Native plant communities on the Plateau are maturing and becoming less diverse and productive. As a result, water quality, wildlife habitat, and forage yields have declined while soil erosion and noxious weed invasion have increased. Changes on the Plateau have resulted due to natural processes and past management practices including fire suppression and historic overgrazing. A decline in landscape health is particularly evident in the pinyon-juniper zone. A number of agency management plans and studies document these concerns. UP is assisting in the coordination of management across jurisdictional boundaries to address ecosystem needs.

The overarching goal of the project is to improve the ecosystem health and natural functions of the Uncompahgre Plateau through active restoration projects. Sustaining social, cultural, and economic values to the local communities are also important goals. The primary role of UP is to help coordinate and facilitate restoration activities on the Plateau. UP does not supercede management authority on any federal, state, or private lands.

Project COPMC-S-0402-WL
Project Report 2006
By Steve Parr

METHODS

Collections

No seed collections were conducted by UCEPC in 2005 or 2006. To date, UCEPC has collected four grass species, three shrubs, and two forbs that can be utilized for seed increase or containerized production. Table 1 outlines the clean seed quantities collected during the 2002, 2003, and 2004 field seasons. A total of five collection days were used to obtain the seed. The six materials collected in 2002 were from two trips. The first trip on July 1 was conducted south and east of Montrose and the second trip, July 19, was done on the Uncompahgre Plateau. In 2003, a collection was conducted June 23 on Sims Mesa and on July 30, the entire staff again collected on the Plateau. A single trip, August 12, was taken to the Uncompahgre Plateau in 2004. All of these materials remain on inventory at the Plant Center.

Table 1
Uncompahgre Restoration Project
UCEPC Collections

Species	Scientific name	2002	2003	2004
Blue wildrye	*Elymus glaucus*	---	---	308 g
Bluestem penstemon*	*Penstemon cyanocaulis*	11 g	76 g	
Bottlebrush squirreltail	*Elymus elymoides*	47 g	361 g	
Indian ricegrass	*Achnatherum hymenoides*	---	361 g	
Lewis flax*	*Linum lewisii*	23 g	---	
Mexican cliffrose	*Cowania mexicana*	2 g	---	
Mountain mahogany	*Cercocarpus montanus*	18 g	566 g	
Needle and thread	*Hesperostipa comata*	---	169 g	
Utah serviceberry*	*Amelanchier utahensis*	13 g	87 g (rust)	
Utah serviceberry*	*Amelanchier utahensis*		120 g	

* Positive identification pending

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Plantings
The project plans had originally called for the use of seed from collections rather than greenhouse grown stock. However, region wide drought conditions did not provide good collectible populations of target materials. Steve Monsen, Native Plant Coordinator for the UP Project, provided seed to greenhouses for container production. In 2004, three species were provided to UCPEC for field increase as containerized stock. These materials were placed in production fields with the use of two Holland Old Faithful model transplanters. On June 16, 2004, a crew of eight people planted six rows (0.2 acre) of yarrow plugs that were grown in cone type containers. The crew started preparing the plugs for planting at 10:30 a.m. and by 3:30 p.m. the yarrow transplanting was done. The following day, 0.27 acre of muttongrass was transplanted by 12:30 p.m. and on June 18, 0.27 acre of Junegrass was done. A crew of seven transplanted the muttongrass and six people transplanted the Junegrass.

Two transplanters were placed on a toolbar, each with seating for two. This allowed four people to transplant into two rows, alternating the placement of plugs. Depth adjustments were made on the planting shoe for the size of the rooted stock. As the shoe opened the furrow, the plugs were placed at a slight angle in the furrow, held in place until the packer wheels approached the planting spot, and then released as the packer wheels pressed the soil around the plug. The second person would have the next plug in place while the first person closely observed and adjusted the placement of the plug being planted. Alternating in this way with two people planting per row provided excellent placement. Two people followed on foot, one for each row, to adjust planting depths on the transplants as necessary. Hand move sprinklers were set immediately after the plantings were completed each day. Survival and stand establishment were excellent on all three products utilizing these methods. In 2005, an additional material was planted in UCEPC Field 3A. Approximately 1800 “Conetainer” type transplants of *Senecio multilobatus* were planted the first of July in the same manner the other materials were planted.

Harvests
Each product was harvested with the Hege plot combine in 2005 and 2006. In addition to direct combining, a tarp was attached to the back of the combine such that the straw and chaff that exited off the straw walkers would be captured. This material was then transported to a straw/seed drying area for further seed recovery. After the material was dry, it was run through the Hege combine repeatedly until no additional appreciable seed recovery was obtained.

RESULTS

On November 2, 2004, forty-three clean grams of UP yarrow were hand collected. This represents the first field produced seed by UCEPC for this project. Each field established in 2004 produced seed in 2005 and 2006. The Senecio field, established in 2005, also produced seed in 2006.

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By Steve Parr

Below, a summary of planting dates, acreage, harvest dates and harvest amounts is provided as a table.

Species	Accession	Year Established	Acreage	Harvest Amount	Harvest Date
Junegrass	9092273	6/18/2004	0.27 acre	-0-	NA
				15 lb	7/26/2005
				10.4 lb	7/12/2006
Muttongrass	9092272	6/17/2004	0.27 acre	-0-	NA
				2 lb	6/8/2005
				16.5 lb	5/30/2006
Senecio	9092280	7/1/2005	0.13 acre	-0-	NA
				15 lb	6/21/2006
Yarrow	9092271	6/16/2004	0.20 acre	43 g	11/2/2004
				17.5 lb	8/6/2005
				14 lb	8/02/2006

After harvest, the Senecio plants went dormant, which is not unusual for cool season materials. However, with time, even the leaves dried up and became decadent. Upon further observation, it was apparent that many of the plants were dead or dying. Bob Hammon, Colorado State University Extension Agent and area entomologist, was summoned for assistance with diagnosis of any insect or fungal pest problems that may have had an effect on plant mortality.

With further assistance from Laura Pottorff, three fungal pathogens were isolated from the Senecio samples Bob provided and could be the cause of both root rot and crown rot. The two species, *Colletotrichum spp*. and *Pythium spp*., were considered most suspect for causing harm to the plants while the third isolated pathogen, *Fusarium,* was largely disregarded as being a primary concern.

It appeared that over 70 percent of the field was dead from an observation made in September. However, there were some "volunteer" plants showing up that may warrant further observation before removing the field.

One reference indicated that the species may be a "short lived perennial, or a biennial or winter annual". This characteristic could further explain the behavior of the plant after seed harvest. Although the plugs were planted in 2005, they did not produce flowers until 2006. In this regard, the plants behaved at UCEPC much like a biennial. The identified pathogens may have infected already weak or dying plants.

Another disturbing result this year was the very low Pure Live Seed component in each of the four harvests, (see included seed test results). The muttongrass, for example, had a purity analysis of 93.63 percent, but only 20 percent germination.

		2006 Harvest Results		
Species	**Clean Weight**	**Purity %**	**Germination %**	**PLS Pounds**
Muttongrass	16.5 lb	93.63	20	3.09
Prairie Junegrass	10.4 lb	83.25	75	6.49
Senecio	15 lb	40.94	20	1.23
Yarrow	14 lb	26.79	66	2.48

CONCLUSION

UCEPC will continue to produce seed through 2007 of the fields established in 2004 if this is agreeable with the Uncompahgre Technical Committee. At this time, it has not been determined by the committee which, if any, of the materials will continue to be produced through time. However, it is anticipated that other materials will be planted and the size of the established fields may be expanded to increase the amount of seed produced and delivered to UP growers.

Verbally, it has been noted that a formal agreement between UCEPC and the PLP will be drafted. In 2002, UCEPC received a $50,000 contribution from the UP committee for the initiation of work on the project. After two years of collections and three years of production, a new agreement is necessary to extend the project. In 2006, there was $2085 of the original amount remaining from which UCEPC drew funds, with a balance of $9898. This was invoiced in December 2006.

Project COPMC-S-9104-WL
Project Report-2006
By: Terri Blanke

Clark Source Serviceberry Seed Increase

OBJECTIVE

To produce seed for additional testing and possible release of accession 9021442.

INTRODUCTION

The Saskatoon serviceberry *Amelanchier alnifolia* is a native shrub found in the North Central United States, Northern Great Plains, Central and Rocky Mountain states. It is a cool season, clump forming deciduous shrub or small tree that will grow from 3 to 10 feet. Stems will be numerous, branching and erect with a dark gray to reddish brown bark. Leaves are alternate, simple, oblong to nearly rounded and grow 1 to 2 inches in size. They will be toothed above the middle and somewhat hairy beneath. Flowers are white, bell shaped and clustered with red to purple diminutive apple-like pome fruit. The fruit contains four to ten dark seeds and is covered with a leathery seedcoat. Roots will be well branched and both deep and superficial. This plant can reproduce by sprout suckers as well as seeds. Seed for the accession 9021442 was collected in 1975 from Clark (thus its name) in Routt County, Colorado. The estimated elevation was 7200 feet. The plant is winter hardy, moderately drought tolerant, has good fire tolerance in native, established stands and has a moderately strong tolerance to close browsing or defoliation.

EXPERIMENTAL DESIGN

This study is a non-replicated test.

MATERIALS & METHODS

Clark's serviceberry was planted in the Plant Material Center orchard on August 8, 1977. Fourteen years later and due to superior performance, it along with two other shrubs, Silver Buffaloberry and Chokecherry, were chosen for isolation and further evaluation.

On May 24, 1991, twenty-two serviceberry sprouts were dug by hand. A channel was plowed and the sprouts were planted in one row on 10 foot spacings next to the channel. They were hand watered as needed. In July of 1992, thirty sprouts were potted for field increase. Only five of the original plants had survived. Eight of the potted sprouts were transplanted in 1993 and in April of 1994, seven additional holes were planted with multiple plants, watered and pruned back. The planting receives no supplemental water.

RESULTS

The planting was evaluated from 1991 to 1994. Seed has never been collected from the serviceberry. The wildlife has browsed it heavily since the beginning of the project. There are currently 15 small bushes remaining. The shrubs were fenced, measured and photographed in the fall of 2006. They will be re-evaluated, manicured, and monitored in the spring of 2007.

Project No. COPMC-T-0502-RA
Project Report-2006
By: Manuel Rosales

Mountain Brome *Bromus marginatus* Seed Treatment-Spring Seeding

OBJECTIVE

To determine effectiveness of fungicides in controlling or reducing incidence of head smut *Ustilago bullata*, in mountain brome (Garnet Germplasm).

INTRODUCTION

During the year 2000, Upper Colorado Environmental Plant Center (UCEPC) released Garnet Germplasm mountain brome as a tested class release. Garnet Germplasm (the term "Germplasm" denotes that the material is not a cultivar, but a pre-cultivar release recognized by the Association of Official Seed Certifying Agencies), was selected for its head smut *Ustilago bullata* resistance, longevity and ease of establishment and good production of both forage and seed. Mountain brome is widely used for conservation and reclamation plantings in Colorado. Unfortunately, seed producers in Colorado have reported more than 5 percent incidence of the disease smut in Garnet Germplasm. This might imply that Garnet is not totally resistant to head smut or perhaps another strain of the disease has been developed to which Garnet is susceptible. The disease is limiting production of Garnet and its use for conservation purposes. Distribution and production of Garnet Germplasm has been halted at UCEPC. At present there is no means to control smut in our seed production fields, nor can we recommend to our seed producers any control method for smut.

This fungal disease has been reported to reduce seedling establishment. It can affect seed yields substantially, depending on incidence of infected plants. Head smut, when present in the head, produces smut instead of seed, thereby, reducing seed production. It can also reduce forage production. The disease is found on a wide range of grass hosts, but is a most important disease of cool-season grasses, especially **brome grasses** and wheat grasses. Head smut has been reported as being primarily seed-borne; however, reports also indicate that spores in the soil can infect emerging seedlings. The fungus develops systemically within the host plant. At flowering the ovaries in the infected plants are converted to bulky masses of spores covered by a thin membrane. Black or brown spore masses are released when this membrane breaks. Fungal spores disperse by wind. Spores infect seed embryos at flowering. The disease also affects the morphology of the plant. The internodes in the stem are shortened, producing a shorter stem bearing a more erect, compact panicle.

This technology development study was designed to determine if seed treatment with fungicide can prevent or reduce the incidence of head smut. Also, the study is being conducted at two planting times, **spring** versus **fall** to find out if environmental conditions during germination and establishment influence head smut incidence.

Project No. COPMC-T-0502-RA
Project Report-2006
By: Manuel Rosales

EXPERIMENTAL DESIGN

The statistical design for the study is a randomized complete block with a split plot arrangement, replicated three times.

Treatments consist of:

1. **Contaminated seed**
    a. Treated with vitavax-captan
    b. Treated with Dividend
    c. Untreated seed /check
2. **Non-contaminated seed**
    a. Treated with vitavax-captan
    b. Treated with Dividend
    c. Untreated seed /check

MATERIALS & METHODS

Contaminated and uncontaminated seed of Garnet mountain brome was treated with two fungicides prior to planting. The two fungicides were selected with the assistance and advice of Dr. Ned Tisserat, Plant Pathologist with Colorado State University. Naturally-infected seed of Garnet mountain brome was secured from a grower's field for a source of contaminated seed. The uncontaminated seed was from seed grown and harvested at UCEPC, from a non-infected field, with seed lot number SG1-04-UC6. The two fungicides used were: Enhance (vitavax-captan 20-20) and Dividend Extreme. Both seed treatment fungicides were used following the recommended rates to control head smut (often called loose smut) according to label instructions.

The experimental site is located at UCEPC in a field that previously had mountain brome and was infected with head smut. The site was chosen to insure that we get an infection by the disease and evaluate the effectiveness of the fungicides. Seed bed preparation was done by preparing flat-beds spaced at 3 foot centers. The **plot size** is 240 square feet: 12 feet wide x 20 feet in length. Each plot consists of four rows spaced at 3 foot centers. All the data to be collected will be done from the two middle rows to eliminate border effect. The **Spring-study** was planted on **May 24, 2005**. The seed was drilled with a hand-pushed Planet Junior seeder. The rate of seeding was 30 pure live seeds per linear foot of row. The plots received no initial fertilizer or irrigation.

The parameters to be measured in the study are: **percent plant stand**, **disease incidence**, and **seed yield**. Disease incidence will be assessed by counting the total number of panicles within a random length of three to ten feet in the middle of the plots, and getting a percent of infected panicles within this length. Seed yield and percent stand will also be collected from this area. The study will be conducted for at least three years depending on survivability of the stand.

Project No. COPMC-T-0502-RA
Project Report-2006
By: Manuel Rosales

RESULTS

Year-2005: Excellent stands were established in all plots seeded in May 24, 2005. In June 14, 2005, all plots had 90 to 100 percent germination. In September 26, 2005, all plots were growing well, with an average height of 4 to 6 inches.

Year-2006:
Results for 2006 are presented in the following table:

Table1. Effect of fungicide treatment on seed yield, percent smutted heads, and plant height on infected and non-infected seed of Garnet Germplasm Mountain Brome tested release. UCEPC-2006

Seed Quality	*Fungicide*	*Seed Yield (Lb/A)*	*% Smutted Heads**	*Plant Height (cm)*
Clean Seed	Control	279 bc	8 c	69 a
	Dividend	321 ab	0 c	72 a
	Vitavax	301 b	0 c	74 a
Infected Seed	Control	154 c	68 a	68 a
	Dividend	447 a	1 c	71 a
	Vitavax	328 ab	37 b	71 a
Mean		305	19	71

Means within columns followed by the same letters are not significantly different as determined by least significant difference test at P<0.05 for the interaction seed-quality by fungicide
*** Percent smutted heads was calculated by counting the number of smutted heads out of a total number of heads in a meter sample within each plot.**

As indicated in the table above, the fungicide treatment had a positive effect in the contaminated seed infected with the smut disease. Dividend performed better than Vitavax for the growing season of 2006. Pure live seed (as per lab results) of seed treated with Dividend was double the percentage of seed treated with Vitavax or control.

We will collect data again for the growing season of 2007 to determine if the effect of the fungicide in protecting against the disease lasts for more than one season of growth. Below is a picture showing clean seed (left) vs. infected seed (right).

Project COPMC-T-0503-RA
Project Report-200
By: Manuel Rosales

Prairie Junegrass *Koeleria macrantha* Seeding Study

OBJECTIVE

To determine best time for establishing prairie Junegrass

INTRODUCTION

Koeleria macrantha (prairie Junegrass) is a perennial, cool-season bunchgrass that is widely distributed throughout the United States. According to Hitchcock, 1935, its range extends from Ontario to British Columbia, south to Delaware, Missouri, California, and Mexico. The species is also widely distributed in the temperate regions of the old world. In the Central Rocky Mountains, it is commonly found as a component of prairies, open woods, mountain parks, sagebrush, and mountain brush communities. It is found in elevations ranging from below 4000 feet to over 11,000 feet. The species provides good forage for both livestock and grazing wildlife species, and fair forage for browsing species of wildlife. *Koeleria macrantha* is usually sparsely distributed and is generally not found as the dominant range species in a particular stand. Because of this, its importance as forage to both wildlife and livestock may be more related to its abundance than its preference.

This is a technology development study designed to generate the information needed to develop the agronomic production techniques for a release of Junegrass

EXPERIMENTAL DESIGN

The statistical design for the study is a randomized complete block with three replications

MATERIALS & METHODS

A composite blend of three accessions (9024197, 9039786, and 9039787) recorded as accession 9092261 of Junegrass was seeded on September 12, 2005, (late summer planting) and October 18, 2005, (fall planting) and May 18 for spring 2006. The **plot size** is 6 feet wide by 20 feet long with two rows per plot. Seed was drilled and also broadcast at each date. The seed was drilled with a hand pushed Planet Junior seeder, in flat beds spaced at 3 foot centers. The target seed rate for drilled seed was 40 pure live seed per linear foot of row. The broadcast seed rate was about three times more than the drilled seed. Broadcasting was accomplished by raking the entire seed bed, then the seed was broadcast by hand, and covered by dragging the rake upside down, with a final packing of the seed bed.

The plots were neither irrigated nor fertilized and will be kept as a dry land planting.

RESULTS

Even though some seed germinated for the late summer and fall planting of 2005 none of the seedlings survived the winter of 2005-2006 due to frost heaving. Plots were evaluated on July 11, 2006, and no plants were visible to do any type of evaluation. The study is being re-planted with the summer component replanted on July 28, 2006, and dormant planting on October 13, 2006. The spring component will be replanted as soon as possible during the spring of 2007.

Project COPMC-T-0504-RA
Project Report-2006
By: Manuel Rosales

Mountain Brome *Bromus marginatus* Seed Treatment-Fall Seeding

OBJECTIVE

To determine if seed treatment materials (fungicides) and time of seeding affects smut incidence in mountain brome.

INTRODUCTION

During the year 2000, Upper Colorado Environmental Plant Center (UCEPC) released Garnet Germplasm mountain brome as a tested class release. Garnet Germplasm (the term "Germplasm" denotes that the materials is not a cultivar, but a pre-cultivar release recognized by the Association of Official Seed Certifying Agencies), was selected for its head smut *Ustilago bullata* resistance, longevity and ease of establishment and good production of both forage and seed.. Mountain brome is widely used for conservation and reclamation plantings in Colorado. Unfortunately, seed producers in Colorado have reported more than 5 percent incidence of the disease smut in Garnet Germplasm. This might imply that Garnet is not totally resistant to head smut or perhaps another strain of the disease has been developed to which Garnet is susceptible. The disease is limiting production of Garnet and its use for conservation purposes. Distribution and production of Garnet Germplasm has been halted at the UCEPC. At present there is no means to control smut in our seed production fields, nor can we recommend to our seed producers any control method for smut.

This fungal disease has been reported to reduce seedling establishment. It can affect seed yields substantially, depending on incidence of infected plants. Head smut when present in the head produces smut instead of seed, thereby, reducing seed production. It can also reduce forage production. The disease is found on a wide range of grass hosts, but is a most important disease of cool-season grasses, especially **brome grasses** and wheat grasses. Head smut has been reported as being primarily seed-borne; however, reports also indicate that spores in the soil can infect emerging seedlings. The fungus develops systemically within the host plant. At flowering the ovaries in the infected plants are converted to bulky masses of spores covered by a thin membrane. Black or brown spores masses are released when this membrane breaks. Fungal spores disperse by wind. Spores infect seed embryos at flowering. The disease also affects the morphology of the plant. The internodes in the stem are shortened, producing a shorter stem bearing a more erect, compact panicle.

This technology development study was designed to determine if seed treatment with fungicide can prevent or reduce the incidence of head smut. Also, the study is being conducted at two planting times, **spring** versus **fall** to find out if environmental conditions during germination and establishment influence head smut incidence.

Project COPMC-T-0504-RA
Project Report-2006
By: Manuel Rosales

EXPERIMENTAL DESIGN

The statistical design for the study is a randomized complete block with a split plot arrangement, replicated three times.

Treatments consist of:

1. **Contaminated seed**
    a. Treated with vitavax-captan
    b. Treated with Dividend
    c. Untreated seed /check
2. **Non-contaminated seed**
    a. Treated with vitavax-captan
    b. Treated with Dividend
    c. Untreated seed /check

MATERIALS & METHODS

Contaminated and uncontaminated seed of Garnet mountain brome was treated with two fungicides prior to planting. The two fungicides were selected with the assistance and advice of Dr. Ned Tisserat, Plant Pathologist with Colorado State University. Naturally-infected seed of Garnet mountain brome was secured from a grower's field for a source of contaminated seed. The uncontaminated seed was from seed grown and harvested at UCEPC, from a non-infected field, with seed lot number SG1-04-UC6. The two fungicides used were: Enhance (vitavax-captan 20-20) and Dividend Extreme. Both seed treatment fungicides were used fallowing the recommended rates to control head smut (often called loose smut) according to label instructions.

The experimental site is located at UCEPC in a field that previously had mountain brome and was infected with head smut. The site was chosen to insure that we get an infection by the disease and evaluate the effectiveness of the fungicides. Seed bed preparation was done by preparing flat-beds spaced at 3 foot center. The **plot size** is 240 square feet: 12 feet wide x 20 feet in length. Each plot consists of four rows spaced at 3 foot centers. All the data to be collected will be done from the two middle rows to eliminate border effect. The **Fall- study** was planted on **October 18, 2005**. The seed was drilled with a hand-pushed Planet Junior seeder. The rate of seeding was 30 pure live seed per linear foot of row. The plots received no initial fertilizer or irrigation.

The parameters to be measured in the study are: **percent plant stand**, **disease incidence**, and **seed yield**. Disease incidence will be assessed by counting the total number of panicles within a random length of 3 to 10 feet in the middle of the plots, and getting a percent of infected panicles within this length. Seed yield and percent stand will also be collected from this area. The study will be conducted for at least three years depending on survivability of the stand.

Project COPMC-T-0504-RA
Project Report-2006
By: Manuel Rosales

RESULTS

Plots were examined on May 19, 2006, to determine how they were progressing after the winter season. Most plots had emerged at this time with an average seedling height of 3 inches. Replication No. III suffered water erosion after the snow melted in the spring, and some plots have fewer plants as compared to the other two replications in the test. On July 7, 2006, the study was evaluated for percent plant stand. Results are presented in the following table.

Table1. Percent Plant Stand for Garnet Germplasm Mountain Brome Tested Release (Fall Treatment Study). UCEPC-2006.

Seed Quality	*Fungicide*	*% Plant Stand*
Clean Seed	**Control**	**60.0**
	Dividend	**56.7**
	Vitavax	**55.0**
Infected Seed	**Control**	**51.7**
	Dividend	**58.3**
	Vitavax	**68.3**
Mean		**58.3**
LSD (0.05)*		**7.84**
*Least Significant Difference at P<0.05. For same level of seed quality		

Project COPMC-T-0601-UR
Report-2006
By: Manuel Rosales

Native Shrub Seeding Trial

OBJECTIVE

To determine relative success with direct seeding of native shrubs identified for conservation use.

INTRODUCTION

Upper Colorado Environmental Plant Center (UCEPC) has identified a number of native shrub species with different conservation attributes such as wildlife habitat improvement, windbreaks, landscaping, riparian enhancement, etc., since its inception in 1975. Most of the shrubs planted in 1977 are still growing at the center. The shrubs have potential of being released for conservation use by the general public; however, there is still some information that is needed before completing their release. We need to find propagation techniques necessary to grow the shrubs, and provide a continuous supply of plant materials to our customers. This technology development study makes an effort to fulfill this gap.

EXPERIMENTAL DESIGN

The statistical design for the study is a randomized complete block with three replications

MATERIALS & METHODS

Seven native shrub species were direct-seeded on January 11, 2006. Two of the seven species were planted with and without the berry. The seed used for the planting was collected from the shrubs growing at the center. Plots were planted by hand at the rate of 30 seeds per plot. Plot size is 30 feet long by 3 feet wide. Table 1 lists the species and source and Table 2 presents the plot plan for the study:

Table 1. Native Shrub Seeding Trial

Entry No.	Common Name/ Scientific Name	Weight/30 Seed or Berries	Accession No.	Seed Lot UCEPC	Year Harvested
1	Chokecherry *Prunus Virginiana*	5 gram	9024060	F-18	1998
2	Silver Buffaloberry(w/o flesh) *Shepherdia argentea*	0.2 gram	9008027	F-18	2003
3	Squaw apple *Peraphyllum ramosissimum*	0.6 gram	untagged	F-15	1999
4	Cliff Fendlerbush *Fendlera rupicola*	0.1 gram	9024143	F-15	1995
5	Maybell Bitterbrush *Purshia tridentata*	1.4 gram	Release	F-18&21	1997
6	Smith's Buckthorn(w/o flesh) *Rhamnus smithii*	0.3 gram	9024308	F-15	1998
7	Silver Buffaloberry (w/ flesh)	1.4 gram	900827	?	2004
8	Smith's Buckthorn(w/ flesh)	1.8 gram	9024308	F-15	2004
9	Serviceberry *Amelanchier utahensis*	0.4 gram	9021438	F-3	2005

Table 2. Plot plan for Native shrub seeding trial

Block-I	**Block-II**	**Block-III**
4-cliff	**1**-chokecherry	**3**-Squaw apple
1-chokecherry	**8**-Smith's-w-flesh	**5**-Maybell
2-S.B-w/o-flesh	**6**-Smithw/o-flesh	**9**-serviceberry
8-Smith's-w-flesh	**5**-Maybell	**7**-S-B-w/flesh
3-Squaw apple	**2**-S.B-w/o-flesh	**4**-cliff
7-S-B-w/flesh	**7**-S-B-w/flesh	**8**-Smith's-w-flesh
5-Maybell	**9**-serviceberry	**6**-Smithw/o-flesh
9-serviceberry	**4**-cliff	**1**-chokecherry
6-Smithw/o-flesh	**3**-Squaw apple	**2**-S.B-w/o-flesh
Row direction	⇨	West

A seed cut-test was performed in all entries before planting to determine viability. All seed entries had 90 to100 percent seed fill. Entries will be evaluated for percent establishment and growth rate for two years.

RESULTS

On July 12, 2007, the plots were weeded and evaluated for emergence. Only two species, Maybell bitterbrush and serviceberry had a few plants that germinated within the test. Four plants germinated for bitterbrush and five plants of serviceberry. We believed frost heaving of our clayey soil might be the culprit of such poor establishment. Plots will be evaluated again during spring of 2007 to make a final determination for the study.

Project COPMC-T-0602-UR
Report-2006
By: Manuel Rosales

Native Shrub Seeding Trial - Greenhouse

OBJECTIVE
To determine germination rate with non-stratified seed of native shrub species.

INTRODUCTION
Upper Colorado Environmental Plant Center (UCEPC) has identified a number of native shrub species with different conservation attributes such as wildlife habitat improvement, windbreaks, landscaping, riparian enhancement, etc., since its inception in 1975. Most of the shrubs planted in 1977 are still growing at the center. The shrubs have potential of being released for conservation use by the general public; however, there is still some information that is needed before completing their release. We need to find propagation techniques necessary to grow the shrubs, and provide a continuous supply of plant materials to our customers. This technology development study makes an effort to fulfill this gap. The greenhouse study is a complement of the native shrub seeding trial that is being conducted in field conditions at the center.

EXPERIMENTAL DESIGN
The statistical design for the study is a randomized complete block with three replications.

MATERIALS & METHODS
Seven native shrub species were seeded in the greenhouse on January 17, 2006. Two of the nine species, Silver buffaloberry and Smith's buckthorn, were seeded with and without the berry. The seed used for the planting was collected from the shrubs growing at the center. Thirty "Ray Leach" cone containers per species were filled with a professional super fine soil potting mix (ten containers per replication with three replications per species) and then seeded. Table 1 lists the species and source.

Table 1. Native Shrub Seeding Trial

Entry No.	Common Name/ Scientific Name	Weight/30Seed or Berries	Accession No.	Seed Lot UCEPC	Year Harvested
1	Chokecherry *Prunus Virginiana*	5 gram	9024060	F-18	1998
2	Silver Buffaloberry (w/o berry) *Shepherdia argentea*	0.2 gram	9008027	F-18	2003
3	Squaw apple *Peraphyllum ramosissimum*	0.6 gram	untagged	F-15	1999
4	Cliff Fendlerbush *Fendlera rupicola*	0.1 gram	9024143	F-15	1995
5	Maybell Bitterbrush *Purshia tridentata*	1.4 gram	Release	F-18&21	1997
6	Smith's Buckthorn (w/o berry) *Rhamnus smithii*	0.3 gram	9024308	F-15	1998
7	Silver Buffaloberry(w/ berry)	1.4 gram	900827	F-18	2004
8	Smith's Buckthorn(w/ berry)	1.8 gram	9024308	F-15	2004
9	Serviceberry *Amelanchier utahensis*	0.4 gram	9021438	F-3	2005

Project COPMC-T-0602-UR
Report-2006
By: Manuel Rosales

A seed cut-test was performed on all entries before planting to determine viability. All seed entries had 90 to percent seed fill. Entries will be evaluated for germination rate for one year.

RESULTS

Out of the nine entries that were planted, only four entries germinated during the evaluation period of 12 months.

Results are presented in the following table:

Table 2 Germination rate for nine native shrubs evaluated for 12 months (Jan-2006 to Jan-2007). UCEPC-2006.

Shrub Entry	Total Germination Out of 30 seeds	Percent Germination
Maybell Bitterbrush	22	73.3 a*
Silver Buffaloberry w/o berry	19	63.3 a
Silver Buffaloberry w/berry	8	26.7 b
Squaw apple	4	13. 3 b
Chokecherry	0	0
Cliff Fendlerbush	0	0
Smith's Buckthorn w/o berry	0	0
Smith's Buckthorn w/berry	0	0
Serviceberry	0	0

- Means within column followed by the same letters are not significantly different as determined by least significant difference test at $P<0.05$. Only the four entries that germinated were evaluated statistically.
- Entries were planted without cold stratification treatment to determine if cold stratification was needed. Seed had been in cold dry storage(40-50 $F^{0)}$ at UCEPC. See table-1 for year harvested.

2006 ANNUAL PROGRESS REPORT
ON THE
COOPERATIVE AGREEMENT
BETWEEN
ROUTT-MEDICINE BOW NATIONAL FOREST
AND
UPPER COLORADO ENVIRONMENTAL PLANT CENTER
By: Steve Parr

INTRODUCTION

Upper Colorado Environmental Plant Center (UCEPC) and Routt-Medicine Bow National Forest formally entered Cooperative Agreement 06-CS-11020604-042 in August of 2006. The agreement calls for the increase of a single species, blue wildrye, collected within the boundaries of Routt-Medicine Bow National Forest. In addition, UCEPC will initiate an Initial Evaluation Planting of no less than 30 accessions of blue wildrye collections from several seed collection zones from within Routt-Medicine Bow. These collections will serve as the primary components in the IEP. UCEPC is also to provide 16 man hours of seed collection training to forest service personnel, including sub-contractors.

Seed increase efforts will be limited to a single source collection, and will utilize collection ELGL-080106-A1 which is from California Park.

OBJECTIVES

There are multiple objectives which the agreement will attempt to complete. These objectives are outlined below.

1) UCEPC will train Routt Medicine Bow personnel in proper seed collection and curation methods.
2) Routt Medicine Bow National Forest personnel will make at least 30 collections of blue wildrye and western wheatgrass for initial evaluation plantings at UCEPC and North Park High School.
3) UCEPC will clean 30 forest service collections of each species for IEP use.
4) UCEPC will increase one-third acre of a single accession of Routt-Medicine Bow collected blue wildrye.
5) Routt-Medicine Bow National Forest and UCEPC will provide technical assistance to North Park High School faculty and students.

Native seed of local ecotypes is often limited at best, and more commonly is unavailable. The overall objective of this project is to share technology on seed collection methods so that successful collections of identified priority species can be obtained by Routt Medicine Bow National Forest. Once seed collections are obtained, common garden studies will be initiated at UCEPC to identify potential superior performers that can be released by UCEPC and increased by the commercial seed industry. In addition, because of the identified need of a source of local seed, UCEPC will also increase a one-third acre planting of blue wildrye for Routt-Medicine

Bow National Forest uses. Blue wildrye and western wheatgrass are also listed as high priority species for UCEPC, and collections for initial evaluations are important for project development.

METHODS

Plant Center facilities and operations were shown to John Proctor, Routt-Medicine Bow National Forest Botanist, on May 15, 2006. John had been instrumental in moving the project forward, and felt a tour of the Plant Center would be helpful.

Dr. Gary Noller and Steve Parr from UCEPC met John and several staff and seasonal employees of Routt-Medicine Bow National Forest on July 6 at California Park, north of Hayden, Colorado, for a hands-on training in seed collection methods. Methods for determining seed maturation and caryopsis development were identified, and handouts of publications covering the information were supplied for reference. Actual on site collections were evaluated for "filled" seed, and areas for collecting three species, western wheatgrass, blue wildrye and bluebunch wheatgrass were investigated for collection potential. After a day's training, the collectors were confident in their ability to make successful collections.

On August 8, 2006, Mary Mahalovich, U.S. Forest Service Geneticist, and John Proctor visited UCEPC. Manuel Rosales and Steve Parr gave a tour to Mary and John on seed production, cleaning, storage, and harvest methods.

RESULTS

Collections of blue wildrye were conducted by Routt-Medicine Bow staff during July and August in four different seed collection zones in the Routt National Forest. In all, 39 accessions of blue wildrye were collected. Each of these collections was cleaned by UCEPC in December of 2006. There were also two limited collections of western wheatgrass that were provided to UCEPC for use in an initial evaluation planting. Cleaned seed quantities and Forest Service collection numbers and seed collection zones are provided in the table below for reference. UCEPC will inventory and accession each collection that is used for seed increase and in our Initial Evaluation Planting, but will need to obtain specific collection information prior to planting.

Seed Collection Zone	Species	Collection	Collection Date	Clean Seed (grams)
214	Blue wildrye	214-01	8/15/06	40
	" "	214-02	8/10/06	47
	" "	214-03	8/24/06	99
	" "	072006-A1*		45
	" "	080906-A1	8/09/06	38
	" "	081006-A1		31
	" "	083106-A1		27
	" "	080906-A2		32
	" "	083106-A2		25

Seed Collection Zone	Species	Collection	Collection Date	Clean Seed (grams)
	“ “	091306-A2		27
	“ “	072706-A3		45
215	Blue wildrye	073106-A1		870
	“ “	080106-A1		770
	“ “	082406-A1		32
	“ “	073106-A2		270
	“ “	080106-A2		447
	“ “	080106-A3		193
	“ “	080106-A4		269
221	Blue wildrye	221-01	8/23/06	36
	“ “	221-02	8/24/06	53
	“ “	221-03	8/15/06	136
	“ “	080306-A1		177
	“ “	080406-A1		267
	“ “	080306-A3		23
481	Blue wildrye	481-01	8/16/06	4
	“ “	481-02	8/14/06	129
	“ “	481-03	8/14/06	33
	“ “	481-04	8/17/06	130
	“ “	481-05	8/16/06	75
	“ “	481-06	8/16/06	128
	“ “	481-07	8/17/06	92
	“ “	481-08	8/7/06#	9
	“ “	081806-A1		28
	“ “	091206-A1		97
	“ “	091306-A1		27
	“ “	091406-A1		72
	“ “	091206-A2		86
	“ “	091406-A2		100
	“ “	091206-A3		91
215	Western wheatgrass	082306-A1 Sack hadA2; sheet A1		8
		082306-A2 Sack had A1; sheet A2		9

* Collection date on sack was 7/28/06

Collection date inconsistent with collection sequence

CONCLUSION

Collection 080106-A1 will be submitted for seed analysis and testing and will be used as the single source for seed increase for Routt-Medicine Bow as called for in the agreement. Additional collections of western wheatgrass and other species may be conducted in 2007.

Seed Production - 2006
Upper Colorado Envronmental Plant Center
by Dr. Gary L. Noller

INTRODUCTION

The following plant materials had seed harvested in 2006. This report does not include seed produced for special contracts. Species and planting information can be requested from the UCEPC.

Common Name/ Variety	Scientific Name	Project No.	Accession No.	Year	Acres	Harvest Date	Field No.	Cleaned Weight
GRASSES								
Smooth Brome	*Bromus inermis*	08S229		1996	0.01	7/22	25	2.19 lb
'Liso'				1997	0.01	7/26	25	1.10 lb
				1998	0.01	8/12	25	1.25 lb Heavy shatter
				1999	0.01	No harvest	25	--
				2000	0.01	No harvest	25	--
				2001	0.01	No harvest	25	--
				2002	0.01	No harvest	25	--
				2003	0.01	7/16	25	256.00 g
				2004	0.01	No harvest	25	--
				2005	0.01	No harvest	25	--
				2006	0.01	No harvest	25	--
Mountain Brome	*Bromus marginatus*	08S217	9005308	1989	0.20	--	17	--
Garnet - tested class				1990	0.20	--	17	75.00 lb
				1991	0.20	--	17	92.00 lb
				1992	0.20	--	17	104.00 lb
				1993	0.20	--	17	6.20 lb
				1994	1.00	--	6	1235.00 lb
				1995	1.00	--	6	1266.00 lb
				1996	1.00	7/8	6	610.00 lb
				1997	1.00	7/8	6	473.00 lb
				1998	1.00	7/12	6	479.00 lb
				1999	1.00	7/8 - 7/9	6	607.00 lb
				2000	1.00	6/28	6	6.60 lb
				2000	--	Plowed 26 rows	6	--
				2000	0.18	6 rows not plowed	6	--
				2001	0.18	6/27	6	43.00 lb

Common Name/ Variety	Scientific Name	Project No.	Accession No.	Year	Acres	Harvest Date	Field No.	Cleaned Weight
				2002	0.18	6/5	6	10.00 lb
				2003	0.18	7/1	6	41.00 lb
				2004	0.18	7/1	6	95.00 lb
				2004	1.10	New planting	6	--
				2005	0.18	7/8	6	33.00 lb
				2005	1.10	7/8	6	37.00 lb
				2006	0.18	6/26	6	16.50 lb
				2006	1.10	6/26	6	112.00 lb
Purple reedgrass	*Calamagrostis purpurascens* Planted 2005		9070968	2006	plot	7/26	20	1.00 g
Bottlebrush Squirreltail	*Elymus elymoides*		9040187	2005	1.00	New planting	18	--
Wapiti - selected class			Poor stand	2006	1.00	No harvest	18	--
'Peru creek'	*Deschampsia caespitosa*		9024403	2006	Plot	7/26	20	13.00 g
Slender Wheatgrass	*Elymus trachycaulus*		483079	2004	1.00	New planting	3	--
'San Luis'				2005	1.00	7/22	3	204.00 lb
				2006	1.00	7/15	3	253.00 lb
Pubescent wheatgrass	*Elytrigia intermedia*	08S216	106831	1993	1.00	--	11	--
'Luna'				1994	1.00	--	11	379.00 lb
Foundation				1995	1.00	9/30	11	335.00 lb
				1996	1.00	8/15	11	150.00 lb
				1997	1.00	8/20	11	161.00 lb
				1997	0.66	Planted 6/6	11	--
				1998	1.66	8/26	11	353.00 lb
				1999	0.66	Removed 1993 planting	11	121.50 lb
				2000	0.66	No harvest	11	--
				2001	0.66	8/16	11	24.50 lb
				2002	0.66	Field plowed	11	--
				2002	0.70	Planted 7/18	11	--
				2003	0.70	9/8	11	43.00 lb
				2004	0.70	8/24	11	213.00 lb
				2005	0.70	8/15	11	138.00 lb
				2006	0.70	9/27	11	10.00 lb
				2006	1.30	July (New planting)	11	--

Common Name/ Variety	Scientific Name	Project No.	Accession No.	Year	Acres	Harvest Date	Field No.	Cleaned Weight	
Arizona fescue	*Festuca arizonica*	08S214	469218	1994	1.00	--	6	--	
'Redondo'				1995	1.00	8/7	6	191.50 lb	
Foundation				1996	1.00	8/1	6	97.00 lb	
				1997	1.00	8/11	6	111.00 lb	
				1998	1.00	8/8	6	89.00 lb	
				1999	1.00	8/3	6	33.50 lb	
				2000	1.00	7/21	6	57.00 lb	
				2001	1.00	8/1	6	45.00 lb	
				2002	1.00	7/30	6	54.00 lb	
				2003	1.00	No harvest	6	--	Reduced to .18 ac
				2004	1.00	No harvest	18	--	New planting
				2005	0.18	7/28	6	9.00 lb	
				2005	1.00	No harvest	18	--	Replant
				2006	0.18	No harvest	6	--	
				2006	1.00	No harvest	18	--	
Praire junegrass	*Koeleria cristata*	08S244	9092261	2002	1.00	Planted 7/16/02	11A	--	
	Not released			2003	1.00	7/17	11A	47.00 lb	
				2004	1.00	7/7	11A	221.00 lb	
				2005	1.00	7/13	11A	100.00 lb	
				2006	1.00	7/1	11A	120.00 lb	
Salina wildrye	*Leymus salinus*	08S213	9043501	1996	0.02	7/22	Hqts.	154.00 g	
				1996	0.10	7/22	4	631.00 g	
				1996	0.20	Planted	4	No harvest	Breeders
				1997	0.02	Field plowed	Hqts.	No harvest	Foundation
				1997	0.10	7/21	4	2.96 lb	Breeders
				1997	0.20	7/21	4	5.32 lb	Foundation
				1998	0.10	8/4	4	4.00 lb	Breeders
				1998	0.20	8/4	4	9.00 lb	Foundation
				1999	0.10	7/15	4	22.00 g	Breeders
				1999	0.20	7/15	4	32.00 g	Foundation
				2000	0.10	No harvest	4	--	Foundation
				2000	0.20	7/7	4	6.00 g	Breeders
				2001	0.20	7/9	4	174.00 g	Breeders
				2001	0.10	7/9	4	227.00 g	Foundation
				2002	0.10	7/11	4	7.00 g	Breeders
				2002	0.20	7/11	4	23.00 g	Foundation

Common Name/ Variety	Scientific Name	Project No.	Accession No.	Year	Acres	Harvest Date	Field No.	Cleaned Weight	
				2003	0.10	7/9	4	1.69	lb Breeders
				2003	0.20	7/9	4	0.60	lb Foundation
				2004	0.10	7/9	4	19.00	g Foundation
				2004	0.20	7/9	4	146.00	g Breeders
				2004	0.10	New planting	4	--	Foundation
				2005	0.10	7/13	4	1.40	lb Foundation
				2005	0.30	7/13	4	302.00	g Breeders
				2006	0.30	7/13	4	83.00	g Foundation
				2006	0.10	7/13	4	2.00	g Breeders
Western wheatgrass	*Pascopyron smithii*	08S226	432402	1996	1.00	Planted	4	--	
'Arriba'				1997	1.00	8/14	4	640.00	lb
Foundation				1998	1.00	8/22	4	238.00	lb
				1999	1.00	8/26	4	87.00	lb
				1999	0.80	10/6	6A	New planting	
				2000	0.80	No harvest	6A	--	
				2000	1.00	Field plowed	4	--	
				2001	0.80	8/3	6A	173.00	lb
				2002	0.80	8/14	6A	100.00	lb
				2003	0.80	8/22	6A	126.00	lb
				2004	0.80	No harvest-plowed	6A	--	
				2004	1.30	New planting	4	--	
				2005	1.30	8/27	4	35.00	lb
				2006	1.30	7/28	4	273.00	lb
FORBS									
Fringed sage	*Artemisia frigida*		9021471	2006	plot	9/26	20	2.45	lb
Louisiana sage	*Artemisia ludoviciana*	08S109	9021474	1984	0.25	--	2	--	
'Summit'				1985	0.25	No harvest	2	--	
Foundation				1986	0.25	10/6	2	2.44	g
				1987	0.25	9/14	2	0.96	g
				1988	0.25	10/5	2	0.10	g
				1989	0.25	10/11	2	4.00	g
				1990	0.25	No harvest	2	--	
				1991	0.25	9/10	2	3.43	lb

Common Name/ Variety	Scientific Name	Project No.	Accession No.	Year	Acres	Harvest Date	Field No.	Cleaned Weight
				1992	0.25	9/2	2	57.00 g
				1993	0.25	9/15	2	4.39 lb
				1994	0.35	9/8	2	4.38 lb
				1995	0.35	9/11	2	28.00 lb
				1996	0.35	9/10	2	0.78 lb
				1997	0.35	9/8	2	0.90 lb
				1998	0.35	Stand dead-field plowed	2	--
				1998	0.06	New planting	2	No harvest
				1999	0.06	Field plowed	--	--
				1999	0.10	New planting	25	--
				2000	0.10	No harvest	25	--
				2001	0.10	No harvest	25	--
				2002	0.10	No harvest	25	--
				2003	0.10	No harvest	25	--
				2004	0.10	No harvest	25	--
				2005	0.10	No harvest	25	--
				2006	0.10	No harvest	25	--
Utah sweetvetch	*Hedysarum boreale*		9024375	2005	1.00	New planting	1	
'Timp'				2006	1.00	Poor stand	1	No harvest
Rocky Mtn penstemon	*Penstemon strictus*		9004712	2004	0.10	New planting	8	--
'Bandera'				2005	0.10	No harvest	8	--
Foundation				2006	0.10	No harvest (Deer used heavily)	8	--
SHRUBS								
Serviceberry	*Amelanchier alnifolia*	08S078Z	9021438	1984	0.25	--	3	
Long's ridge				1993	0.25	--	3	2.88 lb
				1994	0.25	--	3	0.88 lb
				1995	0.25	--	3	1.77 lb
				1996	0.25	No harvest	3	--
				1997	0.25	--	3	131.00 g
				1998	0.25	7/30	3	0.18 lb
				1999	0.25	No harvest	3	--

Common Name/ Variety	Scientific Name	Project No.	Accession No.	Year	Acres	Harvest Date	Field No.	Cleaned Weight		
				2000	0.25	7/20 - 8/9	3	283.00	g	
				2001	0.25	No harvest	3	--		
				2002	0.25	No harvest	3	--		
				2003	0.25	7/10 - 8/13	3	2.64	lb	
				2004	0.25	No harvest	3			
				2005	0.25	No harvest	3	--		
				2006	0.25	1/6	3	0.8	lb	
Mountain mahogany 'Montane' Foundation	*Cercocarpus montanus*	08S035Z	477976	1979	0.02	--	17	--		
				1984	0.02	9/24	17	43.00	g	
				1985	0.02	9/11	17	286.00	g	
				1986	0.02	10/7	17	37.00	g	
				1987	0.02	8/31 - 9/15	17	2.47	lb	
				1988	0.02	9/1 - 9/13	17	2.05	lb	
				1989	0.02	9/15	17	0.20	lb	
				1990	0.02	No harvest	17	--		
				1991	0.02	10/17	17	285.00	g	
				1992	0.02	9/21	17	0.83	lb	
				1993	0.02	9/15	17	2.44	lb	
				1994	0.02	8/12	17	2.30	lb	Not all harvested
				1995	0.02	No harvest	17	--		
				1996	0.02	--	17	0.82	lb	Not all harvested
				1997	0.02	No harvest	17	--		
				1998	0.02	11/2	17	0.86	lb	
				1999	0.02	No harvest	17	--		
				2000	0.02	No harvest	17	--		
				2001	0.02	No harvest	17	--		
				2002	0.02	No harvest	17	--		
				2003	0.02	No harvest	17	--		
				2004	0.02	No harvest	17	--		
				2005	0.02	No harvest	17			
				2006	0.02	No harvest	17	--		
Winterfat 'Hatch' Foundation	*Krascheninnikovia lanata*	08S161	9040973	1985	0.04	--	21	--		
				1986	0.04	--	21	9.00	g	
				1987	0.04	--	21	137.00	g	
				1988	0.30	9/22 - 11/8	21	249.00	g	
				1989	0.30	9/29 - 11/8	21	1.11	lb	
				1990	0.30	10/11 - 10/17	21	0.96	lb	

Common Name/ Variety	Scientific Name	Project No.	Accession No.	Year	Acres	Harvest Date	Field No.	Cleaned Weight	
				1991	0.30	--	21	2.55 lb	
				1992	0.30	10/2	21	275.00 g	
				1993	0.30	10/13	21	0.60 lb	
				1994	0.30	10/12	21	0.92 lb	
				1995	0.30	10/11	21	2.80 lb	
				1996	0.30	11/1	21	361.00 g	Heavy shatter
				1997	0.30	11/25	21	428.00 g	Heavy shatter
				1998	0.30	12/9	21	19.00 g	
				1999	0.30	10/26	21	2.18 lb	
				2000	0.30	10/16	21	5.00 lb	
				2001	0.30	No harvest	21	--	
				2002	0.30	10/16-10/17	21	2.60 lb	
				2003	0.30	No harvest	21	--	
				2004	0.30	10/15	21	0.93 lb	
				2005	0.30	No harvest (Brush beat and disced)	21		
Bitterbrush	*Purshia tridentata*	08S077Z	9024373	1983	0.30	--	18	--	
Maybell select class		08A210		1984	0.30	--	21	--	
				1987	0.30	--	18	13.00 lb	
				1988	0.30	--	18	12.80 lb	
				1989	0.30	--	18	16.00 lb	
				1987-90	0.30	No harvest	21	--	
				1990-92	0.30	No harvest	18	--	
				1991	0.30	--	21	3.90 lb	
				1992	0.30	--	21	7.40 lb	
				1993	0.30	--	21	18.50 lb	
				1993	0.30	--	18	18.00 lb	
				1994	0.30	--	18	56.00 lb	
				1994	0.30	--	21	56.00 lb	
				1995	0.60	--	18-21	14.00 lb	
				1996	0.60	7/22	18-21	9.66 lb	
				1997	0.60	7/23 - 8/7	18-21	30.00 lb	
				1998	0.60	7/31	18-21	7.00 lb	
				1999	0.60	7/28	18-21	8.62 lb	
				1999	0.30	Field 21 plowed	18	--	
				2000	0.30	7/18	21	8.00 lb	
				2001	0.30	7/19	21	5.18 lb	
				2002	0.30	7/23	21	30.00 g	

Common Name/ Variety	Scientific Name	Project No.	Accession No.	Year	Acres	Harvest Date	Field No.	Cleaned Weight
				2003	0.30	No harvest-shattered		--
				2004	0.30	No harvest-shattered		--
				2005	0.30	No harvest-brushbeat	21	
Bitterbrush	*Purshia tridentata*	08A073J	9038521	1995	0.01	7/29	21	239.00 g
Fire tolerant				1996	0.01	8/15	21	66.00 g
				1997	0.01	No harvest	21	--
				1998	0.01	No harvest	21	--
				1999	0.01	8/6	21	27.00 g
				2000	0.01	7/18	21	153.00 g
				2001	0.01	7/19	21	159.00 g
				2002	0.01	No harvest	21	--
				2003	0.01	No harvest	21	--
				2004	0.01	No harvest	21	--
				2005	0.01	No harvest	21	
				2006	0.01	No harvest	21	--
								Not processed
Chokecherry	*Prunes virginiana*	08S235	9024060	1997	0.01	8/15	18	11.90 lb
			EPC229	1998	0.01	8/25-8/27	18	115.00 lb
				1999	0.01	8/20	18	9.00 lb
				2000	0.01	7/28	18	30.50 lb
				2001	0.01	--	18	21.92 lb
				2002	0.01	July - Aug.	18	Few grams
				2003	0.01	8/4	18	4.80 lb
				2004	0.01	No harvest	18	--
				2005	0.01	No harvest	18	--
				2006	0.01	No harvest	18	--
Silver buffaloberry	*Shepherdia argentea*	08S235	9008027	1998	0.01	9/1	18	13.00 g
			EPC476	1999	0.01	No harvest	18	--
				2000	0.01	No harvest	18	--
				2001	0.01	No harvest	18	--
				2002	0.01	No harvest	18	--
				2003	0.01	8/10	18	238.00 g
				2004	0.01	No harvest	18	--
				2005	0.01	No harvest	18	
				2006	0.01	No harvest	18	--

Common Name/ Variety	Scientific Name	Project No.	Accession No.	Year	Acres	Harvest Date	Field No.	Cleaned Weight
Thinleaf alder	*Alnus tenuifolia*		9070975	2000	0.25	10/4	3	558.00 g
				2001	0.25	10/2-10/3	3	2.13 lb
				2002	0.25	No harvest	3	--
				2003	0.25	No harvest	3	--
				2004	0.25	No harvest	3	--
				2005	0.25	No harvest	3	
				2006	0.25	No harvest	3	--

Live Plant Production - 2006

Upper Colorado Environmental Plant Center

By Dr. Gary L. Noller

INTRODUCTION

Only two live plant shipments were provided by the Upper Colorado Environmental Plant Center in 2006, except for materials that were grown for **special contracts**. A sample of the five collections of Sweetgrass were sent to the Western Regional Plant Introduction Station for Germplasm Storage and plants of Garnet mountain brome were provided to the Plant Science Research Laboratory in Stillwater, Oklahoma, for an aphid study. The Distribution and Deliver Records (D&Ds) are attached.

SCS-ECS-596a

DISTRIBUTION AND DELIVER RECORD
MEEKER, COLORADO ENVIRONMENTAL PLANT CENTER

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

ORDER NUMBER: CO PMC-06-015 LivePlants

D & D TO: SOIL CONSERVATION SERVICE
ATTN: PAT DAVEY
655 PARFET STREET
LAKEWOOD, CO 80215

CC : Russ Haas

SHIP TO: VICKI L. BRADLEY, AGRONOMY CURATOR
USDA/ARS
WESTERN REGIONAL PLANT INTRODUCTION STATION
PO BOX 646402
59 JOHNSON HALL, WSU
PULLMAN, WA 99164-6402
PH: 509 335-3616

Order Date: June 7, 2006 **Ship Date:** June 23, 2006 **Ship via:** US Mail

PM-1 No: N/A **Number of Packages:** 1

ACCESSION	COMMON NAME SCIENTIFIC NAME	LOT NUMBER STORAGE LOC	CERT CLASS TYPE	QUANTITY SHIPPED BULK	 PLS	 U/M
	Sweetgrass:					
'Radora'	South Dakota			5		Plants
9063351	Montana			5		Plants
9063128	North Dakota			5		Plants
9050243	Kansas			5		Plants
9070988	Colorado			5		Plants

FOR:

****

PLEASE SIGN AND RETURN ONE COPY TO:

UCEPC
5538 RBC #4
Meeker, CO 81641

****

Ordered by: Vicki Bradley **Order filled by:** Gary L. Noller

Received by _____ **Approved by** _____

Title _____ **Name/Title** Plant Materials Consultant

Date _____ **Date** 6/22/2006

Billed To: No charge

SCS-ECS-596a

DISTRIBUTION AND DELIVER RECORD
MEEKER, COLORADO ENVIRONMENTAL PLANT CENTER

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

ORDER NUMBER: CO PMC-06-026 Study

D & D TO: SOIL CONSERVATION SERVICE
ATTN: PAT DAVEY
655 PARFET STREET
LAKEWOOD, CO 80215

CC :

SHIP TO: Gary Puterka
Plant Science Research Lab
USDA-ARS
1301 N. Western Rd
Stillwater, Ok 74075
405-624-4141 x 257

Order Date: October 25, 2006 **Ship Date:** October 31, 2006 **Ship via:** Fed-Ex

PM-1 No: N/A **Number of Packages:** 1

ACCESSION	COMMON NAME SCIENTIFIC NAME	LOT NUMBER STORAGE LOC	CERT CLASS TYPE	QUANTITY SHIPPED BULK	 PLS	 U/M
	Garnet			4.00		Plant

FOR: Aphid Study

****

PLEASE SIGN AND RETURN ONE COPY TO:

UCEPC
5538 RBC #4
Meeker, CO 81641

****

Ordered by: Bob Hammon **Order filled by:** Dr. Gary Noller

Received by _____ **Approved by** _____

Title _____ **Name/Title** Plant Materials Consultant

Date _____ **Date** _____

Billed To: N/C

Project 08S208
Annual Report – December 2006
By: Terri Blanke

MESA VERDE
COOPERATIVE AGREEMENT

INTRODUCTION - Upper Colorado Environmental Plant Center (UCEPC) signed an amendment to an agreement with Mesa Verde National Park September 24, 2003, for the production of containerized material. Two additional agreements were made directly between Mesa Verde National Park and UCEPC for the production of another 320 similar containerized materials. A total of 4420 plants were to be provided to Mesa Verde National Park in order to complete those contracts.

Contract Species with Deliverable Targets

Common Name	**Scientific Name**	**Quantity**
Bitterbrush	*Purshia tridentata*	40
Chokecherry	*Prunus virginiana*	250
Douglas fir	*Pseudotsuga menziesii*	100
Fendlerbush	*Fendlera rupicola*	150
Fourwing saltbush	*Atriplex canescens*	100
Gambel oak	*Quercus gambelii*	875
Mountain mahogany	*Cercocarpos montanus*	260
Pinyon pine	*Pinus edulis*	35
Rabbitbrush	*Chrysothamnus nauseosus*	160
Rocky Mt. juniper	*Juniperus scopulorum*	20
Snowberry	*Symphoricarpos oreophilus*	880
Squaw apple	*Peraphyllum ramosissima*	135
Utah juniper	*Juniperus utahensis*	35
Utah serviceberry	*Amelanchier utahensis*	875
Woods' rose	*Rosa woodsii*	320
Yucca	*Yucca baccata*	185
	Total	**4420**

OBJECTIVE – Work continues on the main entrance road to Mesa Verde National Park. The objective of this agreement is for UCEPC to produce quality plants of the target numbers by species for restoration work after road construction. The addition of containerized shrubs to the revegetation work will contribute to the overall appearance and aesthetic appeal of the construction work once completed.

ACTIVITIES - UCEPC initiated production on the above species in 2003 with anticipated delivery of September 2005. UCEPC utilized four different types of containers to optimally match root structure with container in terms of shape and size. Six cell "Tubepacks", four cell "Bookplanters", ten cubic inch "Conetainers" and thirty two cubic inch "Zipsets" were all used for production. A standard soil mix of vermiculite, perlite and peat moss was used in each container type for propagation. In most cases, materials were planted as they germinated after and during cold moist treatment.

RESULTS – On September 19, 2006, a delivery of 687 containerized plants was provided to the park for revegetation of areas along the entrance road and around the resident housing. In addition, on August 15, 2006, a shipment of six species of Mesa Verde collected seed (131 lbs) was sent to the park. Several of the seed varieties were shipped in their entirety, including the 1998 hairy goldenaster, 1995 Louisiana sage and 1998 western wheatgrass. This seed was field produced by UCEPC in a previous agreement.

Production of Gambel oak and chokecherry exceeded production targets. However, some materials were either not produced in adequate numbers or were not of large enough stature for successful transplanting. Gambel oaks, Douglas fir, chokecherry, serviceberry, squaw apple and fendlerbush were transplanted into gallon containers and held through the remainder of the 2006 year. Several woods' rose plants were planted on site at UCEPC for the purpose of increasing rooting stock.

Since UCEPC is 270 plants short of the agreement, additional materials will be produced in 2007 to make up for the shortfall. Present inventory (09/09/06) consists of 192 containerized shrubs for 2007 delivery. Propagation of several species will continue.

SUMMARY – Production of containerized materials will continue into 2007 to make up for materials not delivered by UCEPC in 2006. Utah serviceberry and mountain snowberry fell short of their target numbers and efforts will be focused on producing these materials.

Project 08S232
Annual Report – December 2006
By: Dr. Gary L. Noller

DINOSAUR NATIONAL MONUMENT
COOPERATIVE AGREEMENT

Project 08S232
Annual Report – December 2006

INTRODUCTION - This report covers the activities conducted by Upper Colorado Environmental Plant Center, for the Dinosaur National Monument Plant Materials Agreement in 2006. The agreement was initiated in September of 1996 and was amended in August 1997. A new agreement was developed in 2002. These agreements involve collecting and increasing five grass species native to Dinosaur National Monument. One grass seed field was removed so that the agreement now involves four grasses. These grasses will be used for restoration and to prevent non-indigenous weedy plants from invading. No personnel from Dinosaur National Monument came to the plant center in 2006. Seed was harvested from all seed fields in 2006.

TARGETED SPECIES OF GRASS

Common Name	**Number**	**Scientific Name** (Old)
Alkali sacaton	9070954	*Sporobolus airoides*
Bluebunch wheatgrass	9070952	*Psuedoroegneria spicata ssp. spicata* (*Agropyron spicatum)*
Great basin wildrye	9070951	*Leymus cinereus* (*Elymus cinereus)*
Indian ricegrass	9070953	*Oryzopsis hymenoides*
Salina wildrye	(not collected)	*Leymus salinus ssp. salinus* (*Elymus salinus)*
Sand dropseed	(not collected)	*Sporobolus cryptandrus*
Western wheatgrass	9070955	*Pascopyron smithii* (*Agropyron smithii*)

In 2002 an additional species was added to the targeted list:

Squirreltail	(not collected)	Elymus elymoides (*Sitanion hystrix*)

SEED COLLECTION AND CONDITIONING INFORMATION

INTRODUCTION - No additional seed was collected from Dinosaur National Monument for seed production at the plant center in 2006.

SEED PRODUCTION

INTRODUCTION - Seed fields were planted on November 5 and 6, 1997 and one additional field was added on July 20, 1998. In addition, one seed field (western wheatgrass) was removed in 1999, reducing the number of seed fields to four. Two seed fields (Indian ricegrass and alkali sacaton) were interseeded in 1999, to improve stands. An additional planting of bluebunch wheatgrass was planted in 2001 due to the poor appearance of the field and no seed production in 2001. The original planting of bluebunch wheatgrass was removed after harvest in 2005. Table 1 lists the seed from Dinosaur National Monument stored at the plant center. The following updates the seed fields through 2006.

1. Indian ricegrass - November 5, 1997 - planted 8 rows (0.24 acre) - field 4 - planted at rate of about 30 seeds per foot of row - total seed lot (1.42 lb) used. Harvested light seed crop (52.0 g), September 8, 1998 - moderate to good stand November 20, 1998. Harvested July 14, 1999, produced 1.24 lb clean seed. Harvested July 3, 2000, produced 0.97 lb clean seed.

2. Harvested July 9, 2001, produced 0.69 lb clean seed. Harvested July 2, 2002, produced 3.6 lb clean seed. Harvested July11, 2003, produced 8.0 lb of clean seed. Harvested July 8, 2004, produced 10.0 lb of clean seed. Harvested July 12, 2005, produced 12.0 lbs clean seed. Harvested July 3, 2006, produced 5.6 lbs of clean seed.

3. Bluebunch wheatgrass - November 5, 1997 - planted 8 rows (0.24 acre) - field 1 - planted at rate of about 30 seeds per foot of row - had few seed heads 1998, no harvest - good stand November 20, 1998. Harvested July 20, 1999, produced 16.5 lb clean seed. Harvested July 12, 2000, produced 1.4 lb clean seed. Not harvested in 2001. November 16, 2001, planted 6 rows (0.18 acre) at a rate of about 30 seeds per foot of row (0.35 lb planted), field 1, just south of original planting. New planting had good stand 2002, no harvest. Harvested old stand July 12, 2002, produced 300 g clean seed. Harvested both plantings July 16, 2003, produced 32.0 lb clean seed. Harvested July 14, 2004, produced 25.5 lb clean seed. Harvested July 20 and 21, 2005, produced 13.0 lbs of clean seed. The original 8 rows of this planting were removed after 2005 harvest due to off types. Field now 0.18 ac – Harvested July 5, 2006, produced 10.8 lbs of clean seed.

4. Western wheatgrass - November 6, 1997 - planted 8 rows (0.24 acre) - field 6A - planted at rate of about 20 seeds per foot of row, due to small quantity of seed and rhizomatous habit of species. Noted some off type plants in 1998, will rouge these out in 1999 - few seed heads 1998, no harvest - excellent stand with numerous sprouts November 20, 1998. Field had numerous off type plants 1999, field plowed.

5. Basin wildrye - November 6, 1997 - planted 8 rows (0.24 acre) - field 8A - planted at rate of about 30 seeds per foot of row. Few seed heads fall 1998, no harvest - excellent stand November 20, 1998. Harvested August 5, 1999, produced 29.0 lb clean seed. Harvested July 25, 2000, produced 2.4 lb of clean seed. Harvested July17, 2001, produced 10.8 lb of clean seed. Harvested July 23, 2002, produces 25.0

lb. clean seed. Harvested July 25, 2003, produced 52.0 lb clean seed. Harvested July 28, 2004, produced 43.0 lb of clean seed. Harvested August 4 and 5, 2005, produced 37.0 lbs of clean seed. Harvested July 24, 2006, produced 74.0 lb of clean seed.

6. Alkali sacaton - July 20, 1998 - planted 6 rows (0.18 acre) - field 4 - planted at a rate of about 30 seeds per foot of row - noted seedlings on September 2, 1998 - fair stand November 20, 1998. Harvested September 1, 1999, produced 99 g of clean seed. Harvested two seed crops in 2000 (July 12 and September 11), produced 2.4 lb clean seed. Harvested two seed crops in 2001 (July 18 and September 14) produced 13.0 lb of clean seed. Harvested two seed crops 2002 (July 17 and September 10) produced 6.2 lb clean seed. Harvested only once on August 4, 2003, produced 6.0 lb clean seed. Harvested two seed crops July 16 and September 10, 2004, produced 8.0 lb clean seed. Harvested August 9, 2005, produced 2.0 lb of clean seed. Harvested July 18, 2006, produced 88.0 g of clean seed.

SEED SHIPMENTS

No seed was provided to Dinosaur in 2006.

SUMMARY

1. A cooperative agreement between Dinosaur National Monument and Upper Colorado Environmental Plant Center was initiated in September of 1996 and amended in August of 1997. A new agreement was developed in 2002.

2. The agreement involved the collection, evaluation and increase of five grasses native to Dinosaur National Monument. Only four seed fields are now grown for seed production.

3. Seed fields were planted in November 1997 for four contract species and the final seed field (alkali sacaton) was added in July 1998.

4. The western wheatgrass seed field was plowed in 1999, due to numerous off type plants, which reduced the number of seed fields to four.

5. Two seed fields (Indian ricegrass and alkali sacaton) were interseeded in 1999, to improve stands.

6. A new planting of bluebunch wheatgrass was planted in 2001, and had a good stand in 2002, but was not harvested. The original planting did produce seed in 2002. Both plantings were harvested in 2003, 2004, and 2005. The original eight rows were removed after the 2005 harvest. The planting now has 0.18 ac.

7. No Dinosaur personnel came to the plant center in 2006.

8. Seed crops were harvested from all seed production fields in 2006.

Table 1. A listing of seed from Dinosaur National Monument by species and year of harvest stored at the plant center.

SPECIES	YEAR	BULK	PLS
Alkali Sacaton	1999 harvest	99g	no test
	2000 2-harvests	2.40 lb	0.70 lb
	2001 " "	13.00 lb	1.50 lb
	2002 2-harvests	6.20 lb	4.50 lb
	2003 1-harvest	6.00 lb	2.40 lb
	2004-2 harvests	8.00 lb	2.26 lb
	2005-1 harvest	2.0 lb	0.08 lb
	2006-1 harvest	88.0g	no test
Basin wildrye	1997 (park collected)	10.69 lb	8.6 lb
	1999 harvest	29.00 lb	25.70 lb
	2000 "	5.50 lb	4.00 lb
	2001 "	10.80 lb	7.40 lb
	2002 "	25.00 lb	17.60 lb
	2003 "	52.00 lb	42.60 lb
	2004 "	43.00 lb	31.1 lb
	2005 "	37.0 lb	24.6 lb
	2006 "	74.0 lb	---
Bluebunch wheatgrass	1997 (park collected)	0.46 lb	no test
	1999 harvest lot 1	10.50 lb	8.40 lb
	lot 2	6.00 lb	3.60 lb
	2000 harvest	1.40 lb	0.80 lb
	2001 NO harvest	---	---
	2002 (old planting)	300g	215g
	2003 (both plantings)	32.00 lb	25.9 lb
	2004 (both plantings)	25.50 lb	21.62 lb
	2005 (both plantings)	13.0 lb	9.5 1b
	2006(2-planting only)	10.8 lb	---
Indian ricegrass	1997 (park collected)	8g	no test
	1999 harvest	1.24 lb	0.80 lb
	2000 "	0.97 lb	0.30 lb
	2001 "	0.95 lb	0.50 lb
	2002 "	3.60 lb	1.15 lb
	2003 "	8.00 lb	3.60 lb
	2004 "	10.00 lb	3.8 lb
	2005 "	12.0 lb	4.8 lb
	2006 "	5.6 lb	---

Project 08S239
Annual Report – December 2006
By: Steve Parr

BRYCE CANYON NATIONAL PARK
COOPERATIVE AGREEMENT

Project 08S239
Annual Report 2006

INTRODUCTION - Upper Colorado Environmental Plant Center (UCEPC) signed an Interagency Agreement with Bryce Canyon National Park, USDA Natural Resources Conservation Service, and NPS Denver Service Center in January 2004. The agreement, as amended in 2005, called for the production of slender wheatgrass, *Elymus trachycaulus*, through 2006. A second amendment, also signed in 2005, called for the production of 7000 grass seedlings and 100 shrub seedlings for additional revegetation needs.

OBJECTIVE - The intent of the amendments to the agreement is for UCEPC to produce seed and plants of native, indigenous species for revegetation purposes on disturbances within Bryce Canyon National Park through 2007.

ACTIVITIES – In 2006, two plant deliveries and one seed shipment were made to Bryce Canyon for restoration work in the park. As called for in the agreement, containerized production of 7,000 plugs of three species was initiated in May, and two deliveries were made in order to provide stock that was appropriately rooted for transplanting. Plugs of slender wheatgrass and needle-and-thread were delivered to the park in July. In September, Indian ricegrass plugs were delivered to Green River, Utah, where Bryce Canyon personnel met UCEPC half way for the second plant shipment. In all, 7950 plugs were delivered. In addition, 343 pounds of seed of nodding brome and slender wheatgrass were shipped to the park in September. Propagation of several species of shrubs is being conducted in the greenhouse for delivery to the park in 2007.

The field of slender wheatgrass produced 267 clean pounds of seed in 2006. A third amendment will be needed to continue production of slender wheatgrass in 2007 and beyond. We will remove the 0.5 acre planted August 12, 1998, and the 0.8 of an acre that was planted September 5, 2000. The 1.2 acres that were planted August 13, 2004, will continue in production if a new amendment is completed in 2007.

PLANT PRODUCTION – Seed of seven species was received by UCEPC for cleaning and propagation as called for in Amendment 2. The table below identifies the amount of seed received and cleaned seed quantities by species.

Species	**Collected Weight**	**Clean Weight**
Antelope bitterbrush	34.4 g	19 g
Black sagebrush	104.0 g	7 g
Indian ricegrass	169.7 g	54 g
Long flowered rabbitbrush	1.1 g	Too small of quantity to clean
Needle and thread	576.9 g	238 g
Parry's rabbitbrush	4.4 g	< 1 g

Yellow rabbitbrush	0.9 g	Too small of quantity to clean

The targeted production quantities for the above species were identified by the amendment. Slender wheatgrass, which has been field produced at UCEPC, was easily produced for the containerized production target of 3500 plugs. At half the amount of slender wheatgrass, a target of 1750 each of needle and thread and Indian ricegrass were identified for revegetation needs with live plants for a total of 7000 grass plugs. As suspected, there was considerable dormancy in the Indian ricegrass seed that had been collected by Bryce personnel in 2005. Thirty grams of 54 grams were used in the first germination attempts with less than 1% germination. Our germination trials also included one trial with scarified seed. However, 86 grams of some old Bryce Indian ricegrass seed was on inventory at UCEPC from an agreement in 1990. This seed was used in an attempt to produce the 1750 targeted Indian ricegrass plugs. While the total Indian ricegrass number delivered was nearly 500 plants short of the target amount, slender wheatgrass and needle and thread were delivered in quantities exceeding the target amounts by nearly 1000 and 400 live plants respectively. In all, 950 plants above target were delivered to Bryce Canyon for revegetation work. For production of the 100 targeted shrubs, approximately 40 black sage, 40 antelope bitterbrush, and 20 rabbitbrush plants were identified for large container production. Shrub production by species is being altered because of germination success of the cleaned species. Germination efforts have been conducted on each of the collected species.

Live Plant Production		
Species	**Target Quantities**	**Delivered Quantities**
Slender wheatgrass	3500	4520
Needle and thread	1750	2158
Indian ricegrass	1750	1255
Totals	**7000**	**7950**

SEED PRODUCTION -The following quantities of seed have been produced for Bryce Canyon:

Species	**Scientific Name**	**Seed Production**		**Fiscal Year**
Nodding brome	*Bromus anomalus*	185 lb	49 PLS	1999
		34 lb	9 PLS	2000
		Field plowed		2001
		2.4 lb	1 PLS	2002
		50 lb	33 PLS	2003
		138 lb	83 PLS	2004
		Field plowed		2005
Slender wheatgrass	*Elymus trachycaulus*	30.5 lb	28 PLS	1999
		103 lb	78 PLS	2000
		246 lb	211 PLS	2001
		149 lb	120 PLS	2002
		240 lb	213 PLS	2003

398 lb	232 PLS	2004
189 lb	117 PLS	2005
267 lb	230 PLS	2006

Total Seed Inventory

8 bulk pounds of slender wheatgrass	2004 seed lot
9 bulk pounds of slender wheatgrass	2005 seed lot
267 bulk pounds of slender wheatgrass	2006 seed lot

DISCUSSION – A third amendment between UCEPC and Bryce Canyon will direct activities for field production of slender wheatgrass through 2008 and containerized production of a minimum of three shrub species for park uses. The containerized shrubs will be delivered to the park in the fall of 2007.

Project 08S240
Annual Report 2006
By: Steve Parr

GRAND TETON NATIONAL PARK
COOPERATIVE AGREEMENT

INTRODUCTION - This report covers the activities related to the cooperative agreement between Upper Colorado Environmental Plant Center (UCEPC) and Grand Teton National Park. The fully executed agreement, Interagency Agreement 1211-01-002, was formally signed in September of 2001. The agreement called for the production of five grass species through fiscal year 2005 for revegetation uses within Grand Teton National Park. One production year was added for a single species, slender wheatgrass, for 2006.

ACTIVITIES - Correspondence between Steve Parr, UCEPC Manager, and Kelly McCloskey, Grand Teton Ecologist, identified a remedy for production shortcomings both in terms of fields not being established on schedule for targeted materials and for the loss of production of bluebunch wheatgrass in 2005. As discussed with Kelly, the bluebunch wheatgrass field was very infected with downy brome. The infestation was so great, that it was viewed as a total production loss. There simply was no solution to harvest a reasonably good crop without contamination in 2005.

Two options for "credit production" were presented to Kelly for consideration. One option would have enabled UCEPC to use the herbicide "Plateau" on an experimental basis to control cheatgrass in the bluebunch field and to determine its effect on slender wheatgrass. UCEPC would have harvested 1.1 acres of basin wildrye and, if the herbicide trial was effective, harvest 0.45 acres each of the two treated fields for total harvest of 2 acres. The second option was for UCEPC to plant 1 acre of slender wheatgrass in 2005 and harvest it in 2006. This was the option that was selected. On August 23, 1 acre of slender wheatgrass was planted in UCEPC Field 18. This field produced 21 clean pounds of seed in 2006.

One seed shipment of 238 pounds was made to Grand Teton National Park on September 20, 2006, that included grass seed from four species that was previously produced by UCEPC and one species that was collected by Grand Teton personnel and cleaned by UCEPC for park uses.

Project COPMC-S-0307CR
Annual Report 2006
By: Manuel Rosales

GREAT SAND DUNES NATIONAL MONUMENT AND PRESERVE COOPERATIVE AGREEMENT

INTRODUCTION - This report covers the activities of Upper Colorado Environmental Plant Center (UCEPC) for 2006, as they relate to Interagency Project Number IA1211-03-001 for the production of seed materials for Great Sand Dunes National Monument and Preserve. This agreement was signed into effect in February of 2003, and calls for the production of two materials (Blue grama and Indian ricegrass) through 2005 for revegetation uses within the monument. In addition, an amendment to the above interagency agreement was signed in 2004. The amendment stipulates that UCEPC will establish two-tenths of an acre seed increase of ring muhly. In 2006, a second amendment was added to the agreement. The second amendment provides for an extension of the agreement through 2008 and reimbursement to UCEPC for cost incurred in FY06.

ACTIVITIES – The re-plantings of blue grama and ring muhly done in 2005 germinated well and were progressing very well during the growing season of 2005, however, during the winter of 2005-2006, ring muhly and blue grama suffered severe winter damage by frost heaving to the point that we thought we had lost them. Most plants were uplifted from the ground (see attached pictures), However, despite their bad appearance, both plantings survived and produced some seed (see Results). In addition, six more rows of blue grama were replanted on August 2, 2006.

The 0.5 acre field of Indian ricegrass is progressing well. Because of excellent plant vigor, the Indian ricegrass was harvested twice this year.

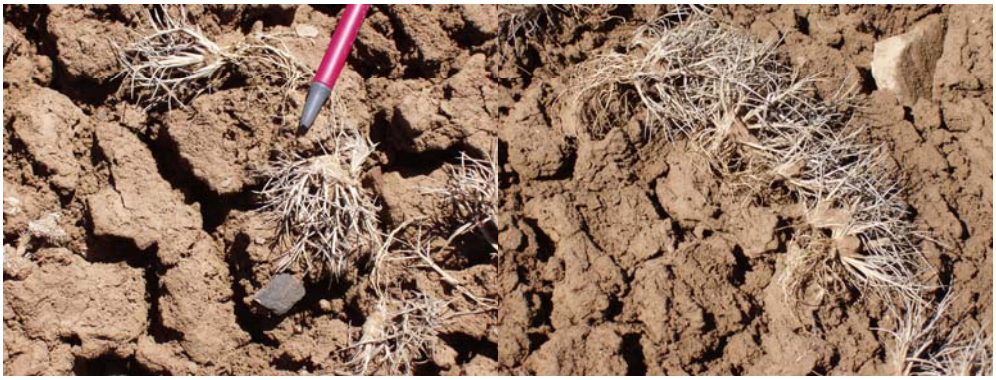
On July 12, 2006, Fred Bunch, Phyllis Bovin, Ola Bovin, Jessica Hendrix and Russ Hass were at UCEPC to visit the production fields for the Great Sand Dunes National Monument and Preserve. Park personnel were pleased with the production fields.

On November 16, 2006, a mixture of 18.1 pounds of pure live seed of Indian ricegrass (all the seed harvested in 2006) and 10.9 pounds of pure live seed of ‘San Luis’ slender wheatgrass were delivered to the park to re-vegetate a four acre field. In addition, 25 straw bales of ‘San Luis’ slender wheatgrass were delivered, along with the seed for use in the revegetation project

RESULTS – Despite the damage incurred during the winter, we were able to harvest and clean 20 pounds of blue grama, 14 grams of ring muhly, and 31 pounds of Indian ricegrass for the 2006 growing season.

Seed from Indian ricegrass and blue grama collected at the park and sent for cleaning at UCEPC during 2006, resulted in 4.2 pounds of clean seed for Indian ricegrass and **no seed** for blue grama (seed heads were empty or had immature seed).

Blue grama & ring muhly on September 25, 2005



Blue grama & ring muhly on April 12, 2006

Blue grama & ring muhly on August/September, 2006

Indian Ricegrass May 16, 2006

Indian ricegrass June 2006

Photos by Manuel Rosales

Project COPMC-S-0308-CR
Annual Report - December 2006

ROCKY MOUNTAIN NATIONAL PARK
COOPERATIVE AGREEMENT

INTRODUCTION - Upper Colorado Environmental Plant Center (UCEPC), Rocky Mountain National Park (ROMO), and the USDA Natural Resources Conservation Service (NRCS), signed a cooperative plant materials agreement (IA Project No. 1211-03003) in June 2003. In September 2006, the agreement was amended to continue production of the same plant materials through 2008. This agreement, as amended, involves seed production of four forbs and four grass species for revegetation of the Bear Lake Road Project. The Bear Lake road project involves widening Bear Lake Road by two feet for ten miles, adding pullouts and retaining walls, widening switchbacks, and expanding some of the parking lots. This will amount to 20 acres of disturbance with an elevation change of 1,500 feet. The first of two phases was completed in December 2005. Seed production of the same species has been identified for use in the second phase with the potential addition of more species in 2008.

Bear Lake Road Revegetation Project

Common Name	Scientific Name	Symbol	Accession
Grasses			
Blue grama	*Bouteloua gracilis*	BOGR	9070991
Junegrass	*Koeleria macrantha*	KOCR	9070962
Mountain muhly	*Muhlenbergia montana*	MOMU	9070957
Needle and thread	*Stipa comata*	STCO	9070977
Forbs/Legumes			
Fringed sage	*Artemisia frigida*	ARFR	9070993
Hairy goldenaster	*Heterotheca villosa*	HEVI	9070992
Purple locoweed	*Oxytropis lambertii*	OXLA	9070989
Spreading golden bean	*Thermopsis divericarpa*	THDI	9070990

ACTIVITIES - This year, each of the eight materials were harvested for use in the revegetation of the Bear Lake Road construction project. Three forbs, hairy goldenaster, purple locoweed, and fringed sage all produced at or near their productive potential based on three years of production. A fourth forb, golden spreading bean, did not produce appreciable seed quantities. However, 142 clean grams were hand harvested in July. There were three nights of freezing temperatures recorded from May 29 - May 31. We believe this dramatically affected seed formation and set as the plants were just blooming at the time. The four grasses produced a little over 50 clean pounds of seed, with blue grama producing the most at 28.5 pounds this year. Small quantities of seed were harvested from needle-and-thread, and in its first production year, prairie Junegrass. However, also in its first production year, the field of mountain muhly produced 20.5 clean pounds of seed.

Lambert's locoweed continues to be a good producing species. This year, UCEPC harvested 15 clean pounds of seed from the 0.5 acre field. Also productive in volume in 2006 was hairy goldenaster with a little over 60 clean pounds harvested and 7 pounds of fringed sage.

On April 25, staff from UCEPC, Rocky Mountain National Park and National Park Service, Denver Service Center, met at the Visitor Center in Estes Park to discuss the project. A review of accomplishments, field status and future revegetation needs were identified, and it was concluded that a visit by park personnel to UCEPC would be beneficial to determine the status of the fields and future production needs.

On July 24, Rocky Mountain National Park personnel visited UCEPC to inspect the production fields and to view first hand the seed handling and storage facilities at UCEPC. After the tour, it was mutually determined that it would be best for Rocky Mountain National Park to pick up all the seed that had been produced under previous agreement as well as some that had been collected in the park so the seed would be on hand and available for use on various park projects. In all, 46 separate seed lots were picked up by Jeff Connor and Laura Wheatley for use in Rocky Mountain National Park. UCEPC also provided three production years of oatgrass, two years of sulphur buckwheat and one year's production of Rydberg's penstemon to the park free gratis. These were materials that UCEPC produced without compensation for potential cooperative release with Rocky Mountain National Park. Clearance for cooperation in plant releases by the National Park Service has yet to be approved. After the meeting in April and the visit to UCEPC, the amendment to the agreement was initiated and signed.

Because of the necessity to use the harvested seed for revegetation in the fall of 2006, Rocky Mountain National Park requested that UCEPC clean all the harvested products and have them tested via the tetrazolium method in order to expedite the delivery of the seed to the park for planting. Two species, fringed sage and mountain muhly, had not been harvested at the time of revegetation planting at Rocky Mountain National Park. The 2006 harvested seed of these two species remains on inventory. The other six species of 2006 harvested seed was cleaned, tested and delivered to Rocky Mountain National Park staff in person on September 15, 2006. In all, a little over 109 pounds of clean seed were delivered.

Production Fields and Goaled Production Quantities
The following table includes actual seeded(s) or transplanted(t) plot size at UCEPC with germplasm received from Rocky Mountain National Park.

Common Name	Scientific Name	Goaled PLS Amt	Proposed Acres	Planted Acres
Grasses				
Blue grama	*Bouteloua gracilis*	12.6	1.0	1.2 (t)
Junegrass	*Koeleria macrantha*	4.5	0.2	0.20 (t)
Mountain muhly	*Muhlenbergia montana*	6.2	0.5	0.5 (s) (t)
Needle and thread	*Hesperostipa comata*	12.9	0.5	0.5 (t)
Forbs/Legumes				
Fringed sage	*Artemisia frigida*	1.7	0.02	0.02(t)
Hairy golden aster	*Heterotheca villosa*	11.4	1.0-1.5	0.8 (s) (t)
Purple locoweed	*Oxytropis lambertii*	5.9	1.0*	0.5 (s) (t)
Spreading golden bean	*Thermopsis divericarpa*	86.5	2.0	2.0 (s)
	Total:	141.7lb	6.22*	5.72

*Purple locoweed was to have been planted in a spaced planting occupying 1 acre. UCEPC, with agreement and assistance from Russ Haas, planted 0.5 acres in solid rows instead. This accounts for the difference in Proposed Acres and Planted Acres.

RESULTS – Seed harvest was conducted for eight Rocky Mountain National Park materials in 2006. Seed production was better than expected for blue grama and mountain muhly, but less than expected for needle and thread and prairie Junegrass. Forb harvests were about as good as might be expected with the exception of a lack of harvestable golden banner seed.

SPECIES	**Blue grama**			
Field Establishment	August 27, 2003	Approx. 15,000 transplants	Transplanter	1.2 acres
	June 9, 2004	Approx. 4,000 transplants	Hand transplant	Interplanted
	August 1, 2005	5,500	Hand transplant	Interplanted
Harvest	October 7, 2004	7 lb bulk	Hand harvest	
Harvest	September 2, 2005	10.4 lb bulk	Large combine	
Harvest	August 8 and 17, 2006	28.5 lb bulk	Hege and by hand	
Shipments	October 5, 2005	2,549 g and 10.4 lb		
	September 15, 2006	28.5 lb		
SPECIES	**Fringed sage**			
Field Establishment	September 4, 2003	600 transplants	Transplanter	0.02 acres
Harvest	September 10, 2004	3.5 lb bulk	Hand harvest	
Harvest	October 18, 2005	1.8 lb bulk	Hege combine	
Harvest	September 18, 2006	7.6 lb	Hege combine	
Shipment	October 5, 2005	3.5 lb bulk		
SPECIES	**Golden aster**			
Field Establishment	May 29, 2003	203 PLS g	Planet Junior	0.8 acres
	August 5, 2005	2,000 transplants	Hand transplant	Interplanted
Harvest	September 1, 2005	20.5 lb bulk	Hege combine	
Harvest	August 7, 2006	60.6 lb	Hege combine	
Shipments	October 5, 2005	20.5 lb bulk		
	September 15, 2006	60.6 lb bulk		
SPECIES	**Mountain muhly**			
Field Establishment	May 28, 2003	59 PLS g	Planet Junior	0.5 acres
	August 3, 2005	2,500 transplants	Hand transplant	Interplanted
Harvest	October 21, 2004	29 g	Hand harvest	
Harvest	October 17, 2005	443 g	Hand harvest	
Harvest	September 19, 2006	20.5 lb	Hege combine	
Shipment	October 5, 2005	70 g		
SPECIES	**Needle and thread**			
Field Establishment	September 4, 2003	600 transplants	Transplanter	.07 acres*
	September 14, 2004	4,000 transplants	Transplanter	0.20 acres
	June 30, 2005	5,500 transplants	Transplanter	0.30 acres
Harvest	June 30, 2005	14 g	Hand harvest	
Harvest	June 22, 2006	2.1 lb		
Shipments	October 5, 2005	1,080 g		
	September 15, 2006	2.1 lb		
SPECIES	**Prairie Junegrass**			

Field Establishment	May 29, 2003	28 g	Planet Junior	0.2 acres*
	September 15, 2004	4,000 transplants	Transplanter	0.2 acres
Harvest	July 12, 2006	3.5 lb	Hege combine	
Shipment	September 15, 2006	3.5 lb		
SPECIES	**Purple locoweed**			
Field Establishment	May 28, 2003	203 g	Planet Junior	0.5 acres
	May 2004	100 g	Hoe	Interplanted
	September 15, 2005	45 transplants	Hand transplant	Interplanted
Harvest	July 14, 2005	5.8 lb bulk	Hege combine	
Harvest	July 6, 2006	15 lb bulk	Hege combine	
Shipments	October 5, 2005	290 g and 5.8 lb		
	September 15, 2006	15 lb		
SPECIES	**Golden Banner**			
Field Establishment	May 28, 2003	11.7 lb planted	Planet Junior	2.0 acres
Harvest	July 7, 2004	2.5 lb bulk	Hand harvest	
Harvest	July 18-19, 2005	21 lb bulk	Hege and hand	
Harvest	July 13, 2006	142 grams bulk	Hand	
Shipments	October 5, 2005	23.4 lb bulk		
	September 15, 2006	142 grams		

The table above provides a complete recap of the activities conducted by UCEPC as outlined in the cooperative agreement. Six of the eight contract materials have taken two or more years to establish. Three materials took three years of supplemental planting while three other products took two years of plug transplanting to establish fully productive fields. In fact, in 2005, over 15,000 transplants were produced and interplanted into five different production fields to increase production for 2006 and beyond.

CONCLUSION – This year signifies the first year of the two year amended agreement. Overall, the results for 2006 suggest some optimism for the production potential of the eight crops UCEPC is producing for RMNP. Seven of the eight crops produced substantially more seed than any previous year. Golden banner produced only grams of seed in 2006, but the plants in the field look fine with reasonable vigor, height and color that indicates something else was a major factor in the limited seed from this product in 2006. All eight species will be grown again in 2007 unless observations in the spring of 2007 indicate otherwise. In addition, cooperative efforts have been made with Colorado State University Extension entomologist Bob Hammon to locate some alkali bees near the golden banner field to insure the presence of suitable pollinators.

Interest in two additional materials for seed increase has been expressed by Rocky Mountain National Park personnel. The two species are bottlebrush squirreltail and pearly everlasting. If funding for the project continues and an additional amendment is made to extend the agreement, seed collection will be conducted in 2007 for seed field establishment of these two species.

UPPER COLORADO ENVIRONMENTAL PLANT CENTER

WEATHER SUMMARY FOR 2006

Prepared by Dr. Gary L. Noller

PRECIPITATION

In 2006, we measured 17.36 inches of precipitation at the plant center (Table 1). The longtime average is 16.19 inches, which we exceeded by 7.2 percent. The second consecutive year that we have exceeded the longtime average was 2006 (Table 1). There were three consecutive months (August – 3.00 inches, September – 2.86, and October – 3.49) with substantially above average precipitation. During these months 53.9 percent of the precipitation for the year was recorded. Since 1975, 2006 was the first year with three consecutive months each receiving more than 2.50 inches of precipitation. In addition, five months (April – 0.76 inch, May – 0.49, June - 0.03, November – 0.79, and December – 0.69) were dry. In this five month period only 15.9 percent of the precipitation for the year was received. June 2006 was the second driest month since 1975.

SNOW

Snowfall in 2006 measured 80.0 inches (Table 2). However, snow represented only 32.4 percent of the total precipitation for the year, when considering the times only snow was recorded and not when snow and rain occurred together in the same event.

GROWING SEASON

In 2006, the frost-free growing season measured 106 days. This represents the period from May 31 to September 18. Precipitation during this important period measured 5.37 inches and represents only 30.9 percent of the total for the year. This period includes June, the second driest month recorded since 1975.

TEMPERATURES

Temperatures in 2006 were in general mild without extremes of heat or cold. Lows below 0 degrees F (Fahrenheit) were recorded on 16 recording dates and highs failed to reach 32 degrees F, or above, on only 10 recording dates (Table 2). A maximum temperature of 85 degrees F, or above, was recorded on 43 recording dates. The highest average monthly maximum temperature (88.5 F) was recorded in July and the lowest average monthly minimum (7.3 F) was recorded in December.

Table 1. Monthly and Total Yearly Precipitation in Inches

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Longtime Avg. Over 50 Yrs.	**1.15**	**1.00**	**1.50**	**1.56**	**1.45**	**1.06**	**1.51**	**1.82**	**1.43**	**1.49**	**1.10**	**1.12**	**16.19**
1976 *	0.47	0.74	1.37	1.25	1.44	1.43	2.03	1.18	1.14	0.37	0.11	0.17	**11.70**
1977 *	0.37	0.49	0.74	0.70	1.11	0.25	1.76	3.04	0.66	0.82	0.74	0.63	**11.31**
1978 +	1.58	0.82	1.69	1.77	1.32	0.30	0.44	0.72	1.25	0.14	1.31	1.47	**12.81**
1979 +	0.82	0.89	0.97	1.19	3.25	0.49	0.54	1.05	0.34	1.20	1.15	0.24	**12.13**
1980 +	1.63	1.75	1.74	0.67	2.36	0.01	2.22	1.53	0.38	1.58	0.63	0.13	**14.63**
1981 +	0.24	0.46	1.56	0.27	3.15	1.58	3.50	0.99	0.61	4.47	0.79	1.40	**19.02**
1982 +	0.78	0.32	0.56	0.59	1.79	0.04	1.64	2.81	2.91	1.81	0.97	0.62	**14.84**
1983 +	0.50	1.32	0.84	0.98	2.29	2.52	1.83	1.05	0.75	1.83	1.90	3.00	**18.81**
1984 +	0.70	0.24	1.62	2.00	0.93	4.22	2.20	3.24	1.65	2.78	0.34	0.71	**20.63**
1985 +	1.13	0.45	1.49	2.80	1.70	1.65	1.77	0.48	1.39	3.10	2.27	0.83	**19.06**
1986 +	0.65	1.76	1.48	1.44	0.73	1.16	3.45	1.99	2.36	1.70	1.65	0.57	**18.94**
1987 +	0.67	1.10	1.51	0.76	2.63	0.90	1.72	3.22	0.50	1.15	1.31	1.20	**16.67**
1988 +	1.31	0.82	1.26	1.23	1.45	0.50	0.79	3.39	2.52	0.17	1.69	0.99	**16.12**
1989 +	1.24	1.75	0.96	1.10	0.54	0.91	1.16	1.49	1.50	0.66	0.62	0.39	**12.32**
1990 +	0.28	1.27	0.46	1.28	1.29	0.93	1.29	0.41	2.18	2.12	0.82	0.55	**12.88**
1991 +	1.28	0.35	1.98	1.48	0.75	1.16	3.54	2.13	1.30	2.25	1.65	0.70	**18.57**
1992 +	0.52	1.09	1.45	1.37	3.03	1.10	3.28	1.21	1.20	0.57	2.85	0.73	**18.40**
1993 +	1.27	1.07	1.91	2.32	2.11	1.08	0.31	1.14	0.52	1.63	1.31	0.50	**15.17**
1994 +	0.32	0.62	0.66	1.50	0.82	0.89	0.41	1.08	1.64	1.65	1.55	0.75	**11.89**
1995 +	0.83	0.84	0.99	2.87	5.72	2.40	1.68	1.29	2.11	2.17	0.95	0.94	**22.79**
1996 +	1.98	2.01	0.57	1.36	1.46	1.12	0.86	0.86	2.13	2.21	2.34	1.38	**18.28**
1997 +	2.04	0.72	0.34	3.04	1.82	1.05	1.02	2.93	5.42	2.37	0.76	0.61	**22.12**
1998 +	0.79	1.20	1.87	1.65	0.45	3.58	1.79	0.64	0.87	1.63	1.03	0.92	**16.42**
1999 +	0.99	0.73	0.59	3.57	2.24	1.09	2.60	1.49	0.89	0.70	0.50	1.08	**16.47**

* From the National Oceanic and Atmospheric Administrations Climatic Summary of the United States.

\+ From the weather instruments located at the UCEPC.

Note: Some precipitation was not recorded in Oct. 2003.

Table 1. Monthly and Total Yearly Precipitation in Inches

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Longtime Avg. Over 50 Yrs.	**1.15**	**1.00**	**1.50**	**1.56**	**1.45**	**1.06**	**1.51**	**1.82**	**1.43**	**1.49**	**1.10**	**1.12**	**16.19**
2000 +	0.84	0.99	1.98	0.69	1.32	0.78	0.54	2.98	2.38	0.90	1.30	0.74	**15.44**
2001 +	0.49	1.03	0.45	0.53	1.53	0.79	0.78	1.56	0.92	1.57	0.91	0.70	**11.26**
2002 +	0.92	0.18	0.96	0.41	0.09	0.81	1.31	1.19	1.93	1.77	0.81	0.63	**11.01**
2003 +	0.72	1.41	0.98	1.30	1.71	1.77	0.52	0.65	1.31	0.04	0.77	1.37	**12.55**
2004 +	0.21	0.50	0.53	2.23	0.97	1.05	1.29	1.17	1.99	1.09	1.58	0.62	**13.23**
2005 +	1.61	0.97	1.26	1.76	1.51	3.55	0.58	1.83	1.74	2.56	1.60	0.93	**19.90**
2006 +	0.87	1.05	1.70	0.76	0.49	0.03	1.63	3.00	2.86	3.49	0.79	0.69	**17.36**

* From the National Oceanic and Atmospheric Administrations Climatic Summary of the United States.

\+ From the weather instruments located at the UCEPC.

Note: Some precipitation was not recorded in Oct. 2003.

Table 2. Weather Data

2006	Precip.	% of Total	Snow Inches	Recording Dates * With Precip.	Below 0ºF	High Less Than 32ºF	High 85ºF or Above	Avg. Min. Temp. Fah.	Avg. Max. Temp. Fah.
Jan	0.87	5.0	12.5	11	5	0	0	9.1	41.9
Feb	1.05	6.0	10.0	6	5	1	0	4.9	43.6
Mar	1.70	9.8	19.0	11	1	0	0	18.0	48.0
Apr	0.76	4.4	3.5	8	0	0	0	27.5	63.3
May	0.49	2.8	0.0	6	0	0	2	34.7	74.3
Jun	0.03	0.2	0.0	1	0	0	15	44.4	86.5
Jul	1.63	9.4	0.0	10	0	0	15	52.4	88.5
Aug	3.00	17.2	0.0	10	0	0	10	48.1	83.2
Sep	2.86	16.5	0.0	8	0	0	1	37.6	71.9
Oct	3.49	20.1	7.0	13	0	0	0	28.3	58.6
Nov	0.79	4.6	13.0	5	1	2	0	15.7	49.2
Dec	0.69	4.0	15.0	7	4	7	0	7.3	36.2
Total	17.36	-	80.0	96	16	10	43	-	-

* Weather instruments are not read on weekends.

Bottlebrush squirreltail
Wapiti

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