BRYSON WASH FIRE: CTU3

MONITORING SUMMARY and FUNDING REQUEST

Fiscal Year of Fire	2006
Fire Containment Date	7/01/06
Fire Size	855
BLM Acres Burned	855
ES Plan Total Planned Costs	$102,600 *(Actual = $120,884)*
ES Acres Treated	424
BAR Plan Total Planned Costs	N/A
BAR Acres Treated	N/A
State/Field Office	Utah – Moab Field Office
Contact Person	Brian Keating
Area Code/Phone Number	(435)259-2194

1) MONITORING SUMMARY (End of 3rd year)

Emergency Stabilization Treatments

Treatment 1:

ES Treatment		Unit	# Units	Cost/Unit	Total Cost	Degree of Success
S-16	Monitoring	*acres*	424	$7.07	$3,000	Fully Successful
Objective: Vegetative monitoring of the treatment area to determine the success and/or failure of the stabilization treatments. Monitoring objectives for FY2009 included monitoring of the germination and establishment of both seeded and invasive species within macroplots established in FY2007. In addition, a third year final monitoring report will be completed and submitted as required by ES&R policy.						
Implementation Monitoring: Monitoring activities include reading and data collection of existing monitoring plots throughout the treatment area.						
Effectiveness Monitoring: Monitoring will include the interpretation of collected data to determine the establishment rate of seeded grasses as well as the amount (cover and frequency) of invasive species to the project area.						

Monitoring Results**:**

For fiscal year 2009, cover and frequency data and repeat photography were collected on the three macroplots that were established in FY2007. Data analysis has been completed and observations indicate that seeded species have germinated with reasonable establishment while cheatgrass establishment is relatively low. Functional group cover and frequency data for the three macroplots are shown below (Fig. 1 and 2). The "preferred" functional groups include both seeded and non-weedy naturally occurring plants but may not have significant wildlife value. Preferred grasses and forbs have generally achieved the objective thresholds for frequency and cover. Only the seeded grasses have achieved the objective threshold for frequency. With both cover and frequency, the seeded forbs and shrubs have shown limited response but this may be a result of shrubs needing more than three years to establish. Cheatgrass cover is less than the objective threshold in all three macroplots but is greatest in the non-seeded areas suggesting that the treatments have had a beneficial effect in reducing cheatgrass cover throughout the project area.

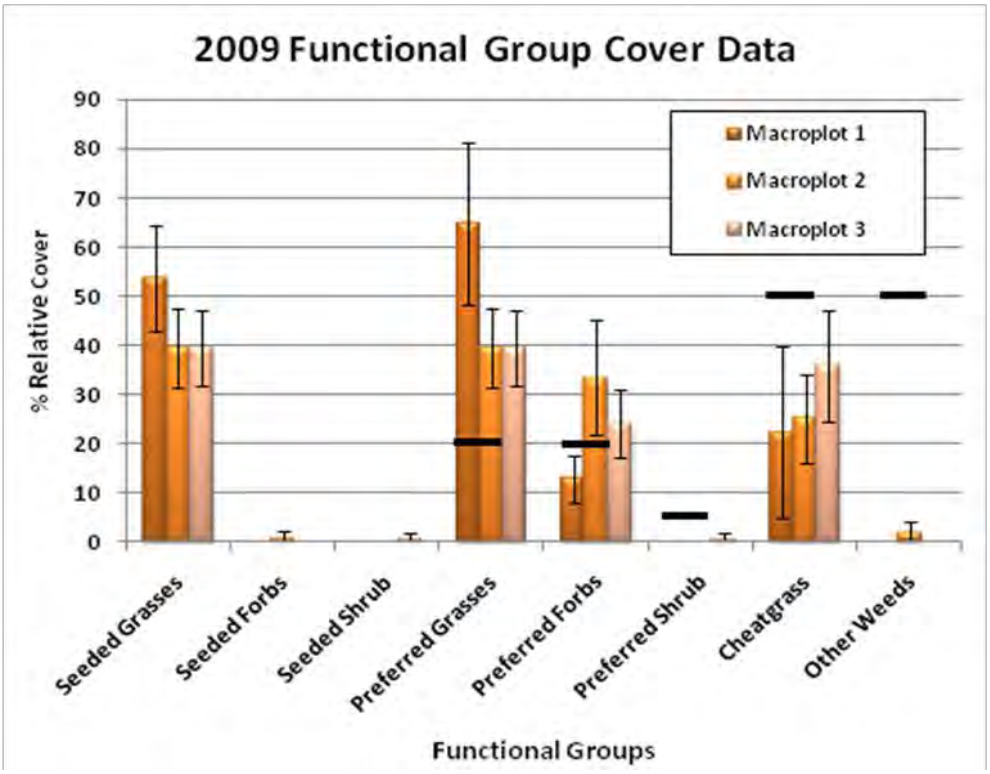


Figure 1. Relative Percent Cover of Functional Groups in 2009. Black lines show objective thresholds and error bars show 90% confidence interval.

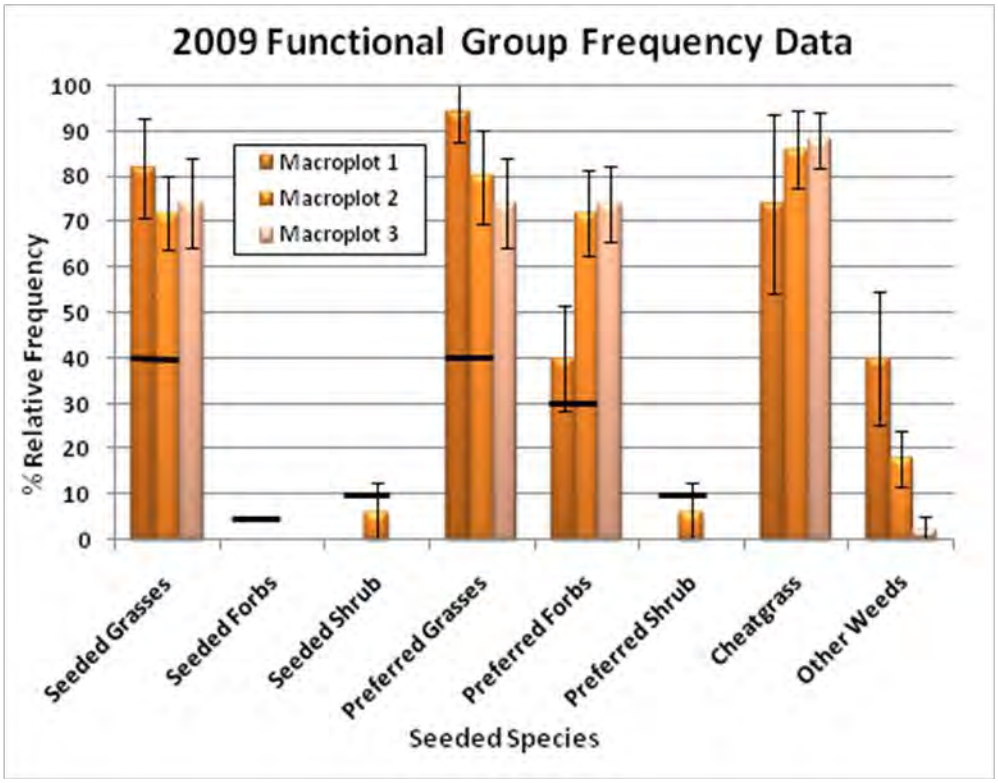


Figure 2. Relative Frequency of Functional Groups in 2009. Black lines show objective thresholds and error bars show 90% confidence interval.

2) END OF THIRD-YEAR CLOSEOUT SUMMARY

The Bryson Wash fire consumed 856 acres of BLM managed lands in Grand County, Utah approximately 2 miles north of the I-70 corridor and 3 miles west of the Utah/Colorado state line in June, 2006. The affected area falls within the BLM Moab Field Office and is located in an area dominated by a mix of native grasses and forbs with a cheatgrass component. Due to the proximity of the fire to the I-70 corridor, high wind erosion probabilities, wildlife habitat and concerns with noxious weeds, an interdisciplinary team determined that post-fire rehab was warranted. The fire rehabilitation plan identified 424 acres to be drill seeded with a mix of native and non-native grasses, forbs and shrubs. Costs associated with the Bryson Wash Fire Rehabilitation Project over the three year life span of the project total approximately $120,884 ($8,500 for initial ID team and final plans; $9,000 for archeology survey; $59,613 for seed/processing; $21,200 for drill seeding contract and drill maintenance; $10,000 for monitoring/data analysis, $10,436 for labor/vehicles and $2,135 for misc. supplies and materials).

A monitoring plan was developed for the project with the goal of determining the success of the drill seeding treatment. Three macroplots were established (two in the treated area and one as a control plot in a non-treatment area) utilizing 100' linear transects. Frequency was measured through a nested frequency frame and cover was measured through the use of line-point intercept methodology. In addition, photopoints were established at each macroplot and data was collect at each site pre-treatment, post-treatment and three growing seasons following treatment. Monitoring results after three growing seasons indicate that the management objective for cover as it relates to vegetative recovery was partially met and fully met as it relates to treatment effectiveness. The management objective for frequency as it relates to vegetative recovery was fully met for preferred grasses and forbs but not for shrubs while treatment effectiveness was met only for seeded grasses. Other conclusions reached as a result of monitoring data collected indicate that natural vegetation recruitment for forbs played an important role in achieving objectives and that while preferred shrub objectives may have not be met, this may be a function of a longer time frame needed for the establishment of seeded shrub species. Lastly, monitoring result indicate that the seeding treatment had a positive effect on reducing cheatgrass cover in the treated areas as compared to the control plot.

Lessons learned from the Bryson Wash Fire Rehabilitation Project include practical applications as they relate to treatment implementation as well as adjustments to how future monitoring objectives are defined and methodology applied. Overall, the project was successful at meeting the defined objectives and provided valuable data that will be incorporated into future fire rehabilitation and vegetative restoration projects.

NOTE: See attachment for full monitoring summary report

3) REQUEST FOR NEXT YEAR'S FUNDING (2822)

Not applicable

4) REQUEST FOR FOLLOWING YEAR REHABILITION FUNDING (2881)

Not applicable

Prepared by: Brian Keating
Date: September 10, 2009

United States Department of the Interior
Bureau of Land Management

September, 2009

Bryson Wash Emergency Stabilization and Rehabilitation Monitoring Report

T. 18 S., R. 25 E., Secs. 22, 23, 26, 27

U.S. Department of the Interior
Bureau of Land Management
Moab Field Office
82 East Dogwood Ave.
Moab, Utah 84532
Phone: 435-259-2188
FAX: 435-259-2162

Table of Contents

Executive Summary *1*

I. Introduction *2*

II. Disturbance History *3*

III. Description of Ecological Model *3*

IV. Treatment *4*

V. Management Objectives *5*

A. Defined Objectives **5**

Year 1 Objectives 5

Year 2 Objectives 5

Year 3 Objectives 6

VI. Monitoring Design *6*

A. Sampling Objective **6**

B. Sampling Design **7**

C. Field Measurement Protocols **8**

D. Timing of Monitoring **8**

E. Monitoring Location **9**

F. Intended Data Analysis Approach **9**

VII. Data Sheet Example *9*

VIII. Management Implications of Potential Results *9*

IX. Summary of Results *10*

X. Interpretation of Results *20*

A. Objectives **20**

B. Other Results **20**

XI. Management Recommendations *21*

A. Change in Management **21**

B. Change in Monitoring **21**

XII. References *23*

XIII. Authors and Reviewers *23*

Appendix B - Data Sheets *25*

Appendix C – Repeat Photography *26*

Executive Summary

The Bryson Wash fire consumed 856 acres of BLM managed lands in Grand County, Utah approximately 2 miles north of the I-70 corridor and 3 miles west of the Utah/Colorado state line in June, 2006. The affected area falls within the BLM Moab Field Office and is located in an area dominated by a mix of native grasses and forbs with a cheatgrass component. Due to the proximity of the fire to the I-70 corridor, high wind erosion probabilities, wildlife habitat and concerns with noxious weeds, an interdisciplinary team determined that post-fire rehab was warranted. The fire rehabilitation plan identified 424 acres to be drill seeded with a mix of native and non-native grasses, forbs and shrubs. Costs associated with the Bryson Wash Fire Rehabilitation Project over the three year life span of the project total approximately $120,884 ($8,500 for initial ID team and final plans; $9,000 for archeology survey; $59,613 for seed/processing; $21,200 for drill seeding contract and drill maintenance; $10,000 for monitoring/data analysis; $10,436 for labor/vehicles and $2,135 for misc. supplies and materials).

A monitoring plan was developed for the project with the goal of determining the success of the drill seeding treatment. Three macroplots were established (two in the treated area and one as a control plot in a non-treatment area) utilizing 100' linear transects. Frequency was measured through a nested frequency frame and cover was measured through the use of line-point intercept methodology. In addition, photopoints were established at each macroplot and data was collect at each site pre-treatment, post-treatment and three growing seasons following treatment. Monitoring results after three growing seasons indicate that the management objective for cover as it relates to vegetative recovery was partially met and fully met as it relates to treatment effectiveness. The management objective for frequency as it relates to vegetative recovery was fully met for preferred grasses and forbs but not for shrubs while treatment effectiveness was met only for seeded grasses. Other conclusions reached as a result of monitoring data collected indicate that natural vegetation recruitment for forbs played an important role in achieving objectives and that while preferred shrub objectives may have not be met, this may be a function of a longer time frame needed for the establishment of seeded shrub species. Lastly, monitoring result indicate that the seeding treatment had a positive effect on reducing cheatgrass cover in the treated areas as compared to the control plot.

Lessons learned from the Bryson Wash Fire Rehabilitation Project include practical applications as they relate to treatment implementation as well as adjustments to how future monitoring objectives are defined and methodology applied. Overall, the project was successful at meeting the defined objectives and provided valuable data that will be incorporated into future fire rehabilitation and vegetative restoration projects.

I. Introduction

The Bureau of Land Management, Moab Field Office, Moab Fire District, conducted stabilization activities on approximately 424 acres of public land in the Harley Dome area, approximately two miles north of the I-70 corridor and three miles west of the Utah/Colorado border in Grand County, Utah (Appendix A). The stabilization consisted of mechanical drill seeding of a portion of the burn area implemented in October of 2006.

A wildland fire moved through this area at the end of June, 2006, blackening approximately 856 acres (Fig. 1). The fire occurred primarily on flat terrain in grasslands that had been invaded by cheatgrass (*Bromus tectorum*), halogeton (*Halogeton glomeratus*), Russian thistle (*Salsola kali*), and various mustards although native species like Indian ricegrass (*Achnatherum hymenoides*), sand dropseed (*Sporobolus cryptandrus*), needleandthread (*Heterostipa comata*), and scarlet globemallow (*Sphaeralcea coccinea*) were still present in many areas. The soils in this area are drought-intolerant, with high wind erosion potential. Because this area has experienced dust blowouts in the past, the loss of vegetative cover from the fire increased the probability of detrimental impacts to public safety during high wind events because of the close proximity of the burn to the I-70 corridor.

Figure 1. Bryson Wash Burn

The area of the burn is within antelope fawning habitat, although treatment activity was not conducted during the fawning period (May 15th through June 15th). The burn area is also potential white-tailed prairie dog habitat, a Utah Species of Concern. No active colonies were mapped in the Bryson Wash area during the 2002 surveys, and there have been no documented sightings of this species at this time. Since the fire, the project area has been utilized as hunting grounds by raptors (Fig. 2) and nesting sites are apparently located nearby. The proposed stabilization project would support habitat improvement goals benefiting both prairie dogs and raptor habitat through the reduction of invasive species and the establishment of desired perennial grasses.

Figure 2. Ferruginous Hawk in the Bryson burn.

In analyzing treatment alternatives, an interdisciplinary team determined that mechanical drill seeding of the portions of the burned area was the most effective treatment to successfully prevent soil erosion and dust events while at the same time improving habitat conditions and preventing the further invasion and spread of weed species. The area was considered to be in Condition Class III (CC3), Fire Regime II prior to the wildland fire. In CC3 areas, fire regimes and vegetation attributes have been substantially altered from their natural/historical range and the risk of losing key ecosystem components from wildland fire is high. The goal of the seeding treatment was to stabilize soils, manage the spread of invasive species, and move the area toward Condition Class I (CC1), where fire regimes are within the natural/historical range and the risk of losing key ecosystem components is low. In subsequent years, as a result of this stabilization treatment, damaged soils should become more stable in high wind events, and should support the vegetative composition, structure, and patterns representative of a functional grassland ecosystem.

The goal of this monitoring project is to evaluate the effectiveness of the drill seeding treatment. This monitoring project was undertaken to establish success levels, determine potential treatment adjustments, and to document results for future ES&R treatment considerations.

II. Disturbance History

The Bryson Wash ESR project area has a fire recurrence interval of approximately 10 years. Fire history records show that two fires have overlapped the area within the last 20 years (Appendix A). The Harley Fire (1986) overlaps the Bryson's eastern border while the Westwater II Fire (1994) overlaps approximately 85% of the Bryson Fire footprint.

The San Arroyo grazing allotment, in which this project is located, has been historically grazed by sheep in the fall, winter, and spring. In 2006, a livestock conversion was enacted converting the allotment to cattle.

Historic sheep grazing in the fall, winter, and spring contributes to the decline of sagebrush. Additionally, burning of this plant community tends to decrease sagebrush. It is believed that repeated burning and fall/winter sheep grazing may have resulted in the elimination of sagebrush on this site.

III. Description of Ecological Model

According to the soil survey, the natural climax community is represented by a cover of 30% grasses, 5% forbs, and 25% shrubs. Within the climax community, the shrub component is dominated by Wyoming Big Sagebrush while the grass component is dominated by Indian Ricegrass. Interestingly, no sagebrush was found on this site but patches of Indian Ricegrass remain.

Historic sheep grazing in this area was heavy year-round beginning around 1900 and likely contributed to the significant decline in Wyoming Big Sagebrush, Winterfat, and other shrubs. Additionally, regional drought conditions and cheatgrass invasion may have reduced the fire return interval. Fire history records over the last 24 years show that the fire return interval for this area is approximately 10-12 years. The short fire return interval favors the perpetuation of annual grasslands and continued suppression of perennials and slower growing shrub species.

IV. Treatment

The treatment areas (Appendix A) were seeded during the period of October 8-20, 2006. The seed used in the mix is shown in Table 1. The cover photo shows the methodology which included a tractor and two three-box drills pulled in tandem. A "whirly-seeder" can be seen on the back of the tractor and was used to spread the Winterfat and Galleta seed. This was necessary because the Winterfat seed was too "fluffy" to flow through the tubes of the drill seeder and caused them to plug up constantly. Approximately 424 acres of the Bryson burn area was treated in this manner with the majority of seed applied within SSURGO Map Unit 2 (Hansen, 1989).

SSURGO Map Unit 2 corresponds to Barx Fine Sandy Loam soils and the Semidesert Loam (Wyoming Big Sagebrush) range site (Hansen, 1989). Approximately 10% of this Map Unit are very deep, stony soils that occur in concave areas along drainageways supporting pinyon and Utah Juniper, and 10% moderately deep, loamy soils that are on ridgetops and support Wyoming big sagebrush and fourwing saltbush (Soil Survey). Macroplot one is located within sparse pinyon and Utah Juniper in a concave area and had a sampled cover of rock fragments of 19.6% prior to the drill seeding. Macroplot 2 occurred in the deeper loamy soils with a rock fragment cover of 1.2%.

Table 1. Bryson Wash ESR Seed Mix.

Common Name	Scientific Name	Lbs/Acre	# Viable Seeds/ft^2
Siberian Wheatgrass	*Agropyron fragile*	0.94	4.06
Sand Dropseed	*Sporobolus cryptandrus*	0.35	38.98
Fourwing Saltbush	*Atriplex canescens*	2.36	1.06
Thickspike Wheatgrass	*Elymus lanceolatus*	1.42	4.19
Indian Ricegrass	*Achnatherum hymenoides*	2.59	10.40
Gooseberryleaf Globemallow	*Sphaeralcea grossularifolia*	0.12	1.12
Galleta Grass	*Pleuraphis jamesii*	0.61	1.5
Purple Beeplant	*Cleome serrulata*	0.94	1.35
Winterfat	*Kraschenikovia lanata*	1.65	1.68
Small Burnet	*Sanguisorba minor*	1.53	1.58
	Total	**12.51**	**65.49**

V. Management Objectives

The following objectives were defined in the final Bryson Emergency Stabilization Plan. These first two years had defined density objectives and were not quantified because of the prevalence of rhizomatous species that could not be captured using density. *This was a shortcoming of the monitoring plan*. Year three objectives will be adopted for a determination of success.

A. Defined Objectives

Year 1 and 2 objectives will not include the seeded shrubs. Lessons from the Rattle Fire Complex ES&R Monitoring Project indicate that the first two years are dominated by grasses and forbs. Shrubs began to emerge after year two and therefore shrub objectives will not be defined until year three. Grass and forb germination is expected to be high in the first growing season but many of the seedlings will not establish and persist into the second and third growing season. The target threshold objectives are designed around this ecological trend.

Year 1 Objectives

Vegetation Objective:
Obtain average densities of seeded grasses of 10 plants/m^2 and seeded forbs of 5 plants/m^2 by the end of the first growing season following seeding within all soil types of the Bryson Wash ES&R treatment area.

Soil Stability Objective:
Soil stability test values from the burned sites will vary by only one stability class from the unburned sites within similar soil types of the Bryson Wash ES&R treatment area by the end of the first growing season.

Year 2 Objectives

Vegetation Objective:
Obtain average densities of seeded grasses of 5 plants/m^2 and seeded forbs of 3 plants/m^2 by the end of the second growing season following seeding within all soil types of the Bryson Wash ES&R treatment area.

Soil Stability Objective:
Soil stability test values from the burned sites are at the same stability class ranking as the unburned sites within similar soil types of the Bryson Wash ES&R treatment area by the end of the second growing season.

Year 3 Objectives

Year 3 objectives are combined with overall vegetation treatment monitoring objectives for the Bryson Wash fire rehabilitation project:

- **Management Cover Objective for Overall Vegetative Recovery**
  Obtain relative vegetative cover values for preferred lifeforms of 20% for grasses, 20% for forbs and 5% shrubs within the Bryson Wash burn site by the year 2010.

- **Management Frequency Objectives for Overall Vegetative Recovery**
  Obtain frequency values for preferred life forms (native species) of 40% for grasses, 30% for forbs, and 10% for shrubs by the year 2010 for the Bryson Wash burn area.

- **Management Cover Objective for Treatment Effectiveness**
  Limit the relative vegetative cover of annual weeds to 50% for cheatgrass (*Bromus tectorum*), Russian annual wheatgrass (*Eremopyrum tricetum*), halogeton (*Halogeton glomeratus),* redstem stork's Bill (*Erodium cicutarium)* and Russian thistle (*Salsola kali)* within the Bryson Wash burn area by the year 2010.

- **Management Frequency Objectives For Treatment Effectiveness**
  Obtain relative frequency values for the seeded species of 40% for perennial grasses, 5% for forbs, and 10% for woody species within the burn area by the year 2010.

- **Management Soil Stability Objective for Overall Recovery/Treatment Effectiveness**
  Soil stability test values from the burned sites are at the same stability class ranking as the unburned sites within similar soil types of the Bryson Wash ES&R treatment area by the end of the second growing season.

VI. Monitoring Design

A. Sampling Objective

- **Sampling Objective for Cover**
  I want to be 90% confident that the estimated cover values I obtain are within 20% of the estimated true value.

- **Sampling Objective for Frequency**
  I want to be 90% confident that the estimated frequency values that I obtain are within 20% of the estimated true value.

- **Sampling Objective for Density**
  I want to be 90% confident that the estimated density values that I obtain are within 20% of the estimated true value.

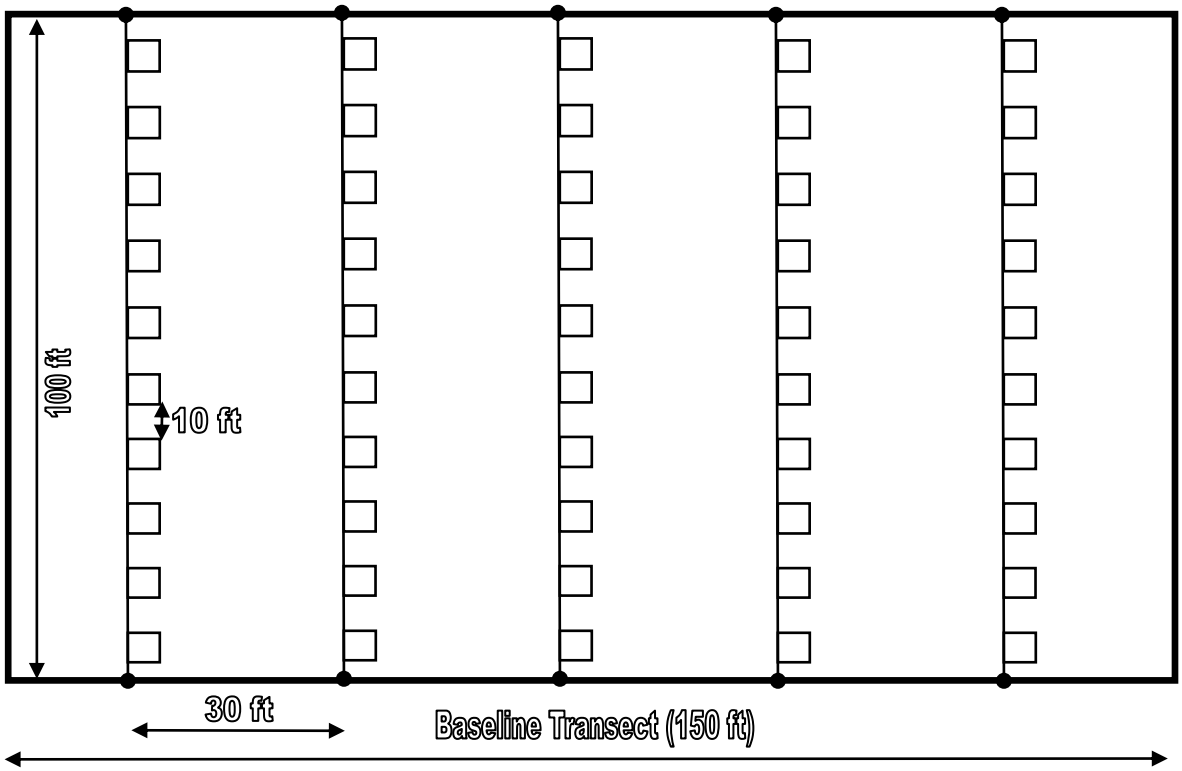


Figure 3. Macroplot Layout. Lines with dots are subtransects and squares are nested frequency sampling frame locations. Cover points not shown but include 50 pts/subtransect.

B. Sampling Design

A two-stage sampling design was employed in the Bryson Wash ESR project for quantifying vegetative response and treatment effectiveness. In other words, subtransects or macroplots can be analyzed as the sample unit. Sampling was stratified by SSURGO soil map unit. All macroplots are randomly located in SSURGO Soil Map unit 2 because this was the predominant soil type treated.

Macroplots were subsampled by collecting data on five 100' subtransects. Subtransects were systematically located 30' apart within the macroplot with an initial random start between 0-28' (Fig. 3). Quantitative response variables measured at each subtransect include line-point intercept cover and nested frequency. Line-point intercept cover included 50 pts per transect and measured only the first hit for all grass, forb, shrub vegetation. Nested frequency frames included 10 frames per transect and measured all grass, forb, and shrub frequency. Density was not utilized as planned because of the prevalence of rhizomatous species for which individual counting units could not be defined.

C. Field Measurement Protocols

The baseline transect, at each plot location, is monumented with a T-post at the start and a 2' piece of rebar at the end. GPS locations for these monuments were collected using a Trimble GeoXT and differentially corrected to achieve maximum positional accuracy. A 150' tape measure is stretched between the two markers and 100' subtransect tapes are extended perpendicularly to this (Fig. 3).

Figure 4. Nested Frequency Sampling Frame.

Frequency was measured using a nested frequency frame with quadrat sizes of 24" x 24", 12" x 12", 6" x 6", and 3" x 3" (Fig. 4). The quadrat sizes were selected to be consistent with data collected by the range program in the Monticello Field Office. The sampling frame was placed 10 times along each subtransect every 10 feet starting at the 5 ft mark. All species rooted with greater than 50% of the plant base occurring within one of the nested quadrats were tallied. Refer to Measuring and Monitoring Plant Populations (Elzinga et al, 1998) for more information on nested frequency.

Cover was measured using the line-point intercept method (Bonham, 1989; Elzinga et al, 1998) using a pin flag. Cover points are a systematically placed, every two feet, along the subtransect starting at the two foot mark on the tape for a total of 50 points per subtransect. Only the top canopy hit was recorded for each point for all plants.

Repeat photography was taken at each of the plots. The T-posts are monumented with the ribbed side of the T-post pointing True North (i.e. no declination adjustment). This results in the three flanged edges pointing in the three other cardinal directions. Using the T-post as a guide or "tripod", by resting the camera on top, photographs were taken for each cardinal direction. Additional photographs were taken of plants present in the area.

D. Timing of Monitoring

Monitoring occurred prior to treatment and the first three growing seasons following treatment (Table 2).

Table 2. Bryson Wash Sample Events.

Monitoring Status	Macroplot 1	Macroplot 2	Macroplot 3
Pre Treatment	09/29/2006	10/12/2006	11/22/2006
1st Growing Season	04/27/2007	05/07/2007	04/28/2007
2nd Growing Season	07/30/2008	07/29/2008	07/30/2008
3rd Growing Season	06/03/2009	06/04/2009	06/04/2009

E. Monitoring Location

Monitoring occurred within the Bryson Wash burn perimeter. The Bryson Wash burn is accessed by driving North from Moab, Utah along highway 191 to Crescent Junction. At Crescent Junction travel eastbound along Interstate 70 until you reach Exit 224. From there use the inset on the attached map (Appendix A) to navigate to the burn.

Three macroplots were sampled within SSURGO Soil Map unit 2. One of the three plots was an untreated control plot.

Table 3. Bryson Wash Macroplot Locations.

Macroplot	Northing (m)	Easting (m)	Elevation (m)
Macroplot 1 Start	4341912.6	660414.6	1508
Macroplot 1 End	4341897.9	660458.0	1508
Macroplot 2 Start	4342081.5	662294.0	1460
Macroplot 2 End	4352084.2	662247.1	1460
Macroplot 3 Start	4342933.3	660903.6	1471
Macroplot 3 End	Unknown	Unknown	1471

F. Intended Data Analysis Approach

Summary statistics will be calculated on the frequency and cover data. Simple means, proportions, standard deviations, standard errors, and confidence intervals will be calculated and compared to objectives. A T-test may be used to compare different treatment means in an attempt to find significant differences in the measured variables. T-values will be used instead of Z-values because of the small sample size.

VII. Data Sheet Example

See Appendix B.

VIII. Management Implications of Potential Results

The results of the monitoring program may show either treatment success or failure. If the results of this monitoring project show that the drill seeding treatment was unsuccessful in meeting objectives then several considerations need to be addressed.

First, the objectives need to be evaluated to determine if they were reasonable given the soil type, precipitation zone, range/ecological site, fire severity, timeframe and type of treatment. If, in hindsight, they are deemed unrealistic then future projects may still be implemented and successful within the framework of an altered set of objectives. If the

objectives are deemed appropriate in a post-hoc consideration than future drill seedings under similar conditions should not be implemented.

Second, if monitoring data show that certain species exhibited greater levels of germination, establishment, and persistence over others and that increasing seeding rates of these species might meet objectives, than future projects may be successful with an altered seed mix.

Third, the monitoring data may show treatment failure in certain areas where implementation of the seeding was the cause of failure. In other words, seeding may have been successful in certain areas but not in others due to an implementation failure of not applying seed uniformly throughout the project area. In this case reapplication of the seed in these areas may be performed.

IX. Summary of Results

See Table 4 below for a key to the species codes and functional groups. Only the 24"x 24" frequency quadrat was analyzed.

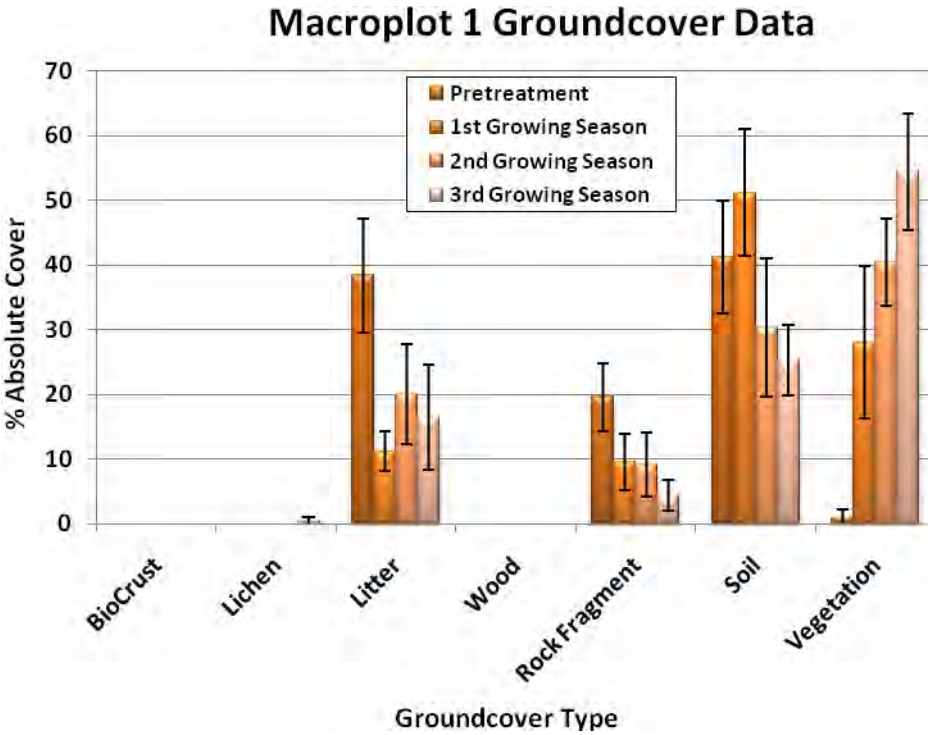


Figure 5. Absolute Percent Cover of Ground Cover Types in Macroplot 1. Error bars show 90% confidence intervals.

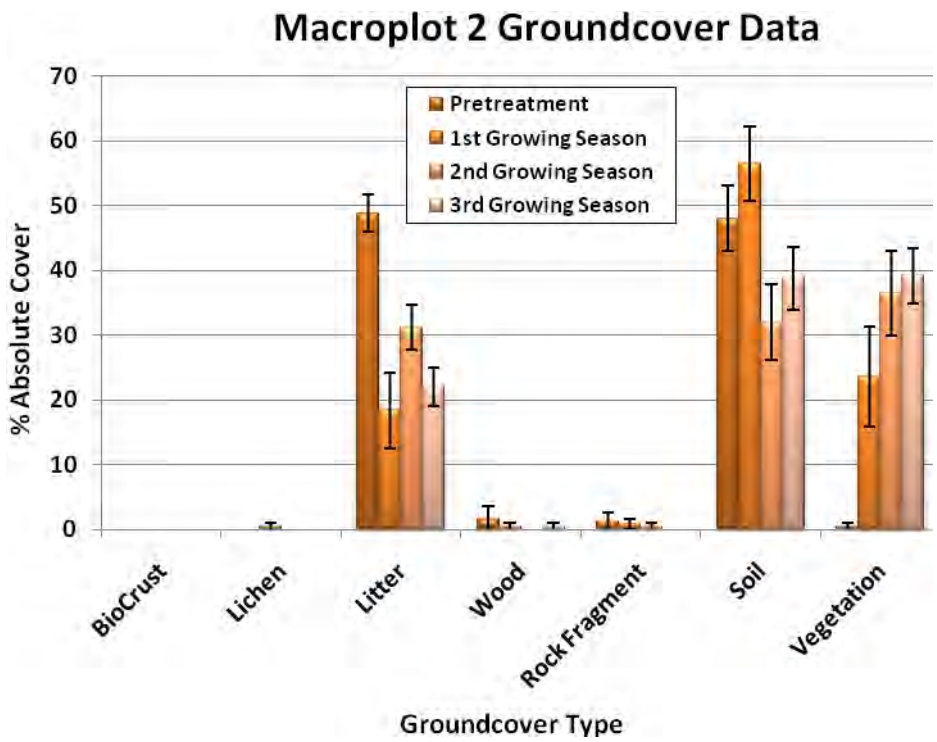


Figure 6. Absolute Percent Cover of Ground Cover Types in Macroplot 2. Error bars show 90% confidence intervals.

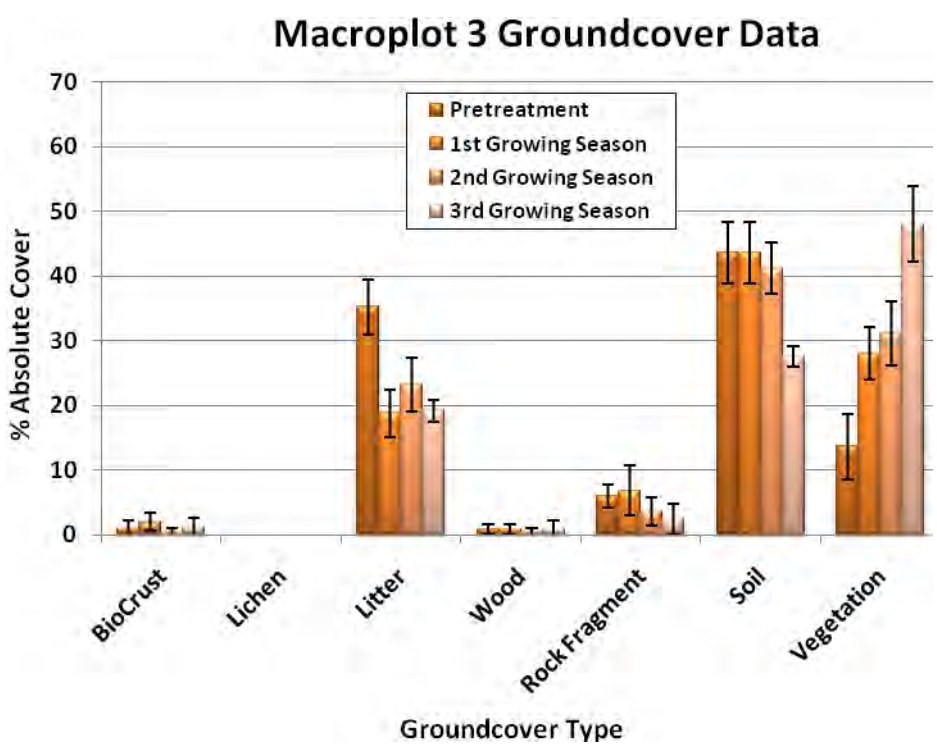


Figure 7. Absolute Percent Cover of Ground Cover Types in Macroplot 3 (Control). Error bars show 90% confidence intervals.

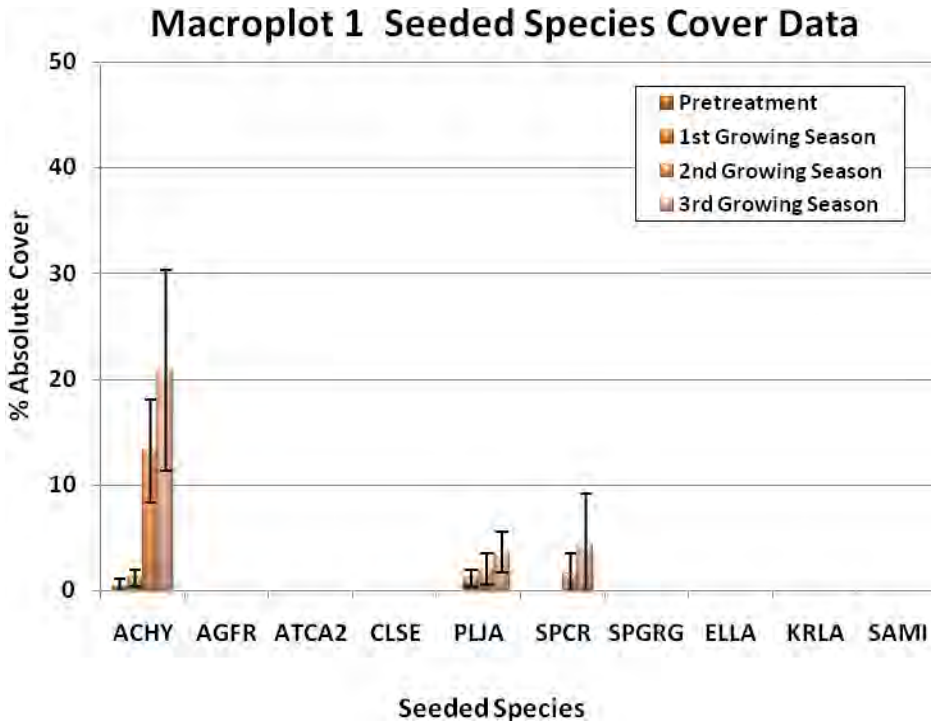


Figure 8. Absolute Percent Cover of Seeded Species in Macroplot 1. Error bars show 90% confidence intervals.

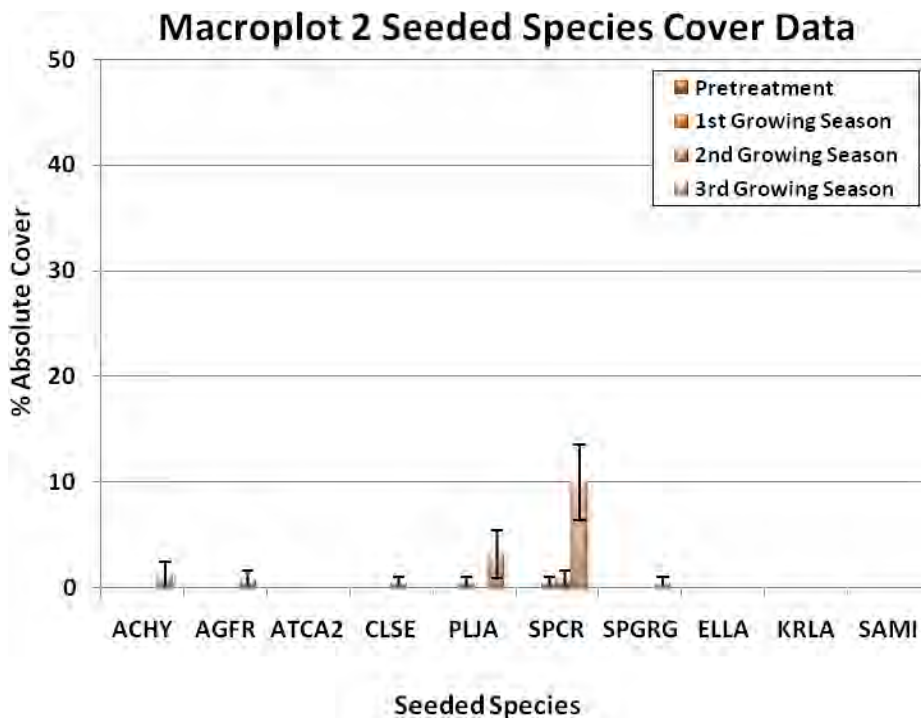


Figure 9. Absolute Percent Cover of Seeded Species in Macroplot 2. Error bars show 90% confidence intervals.

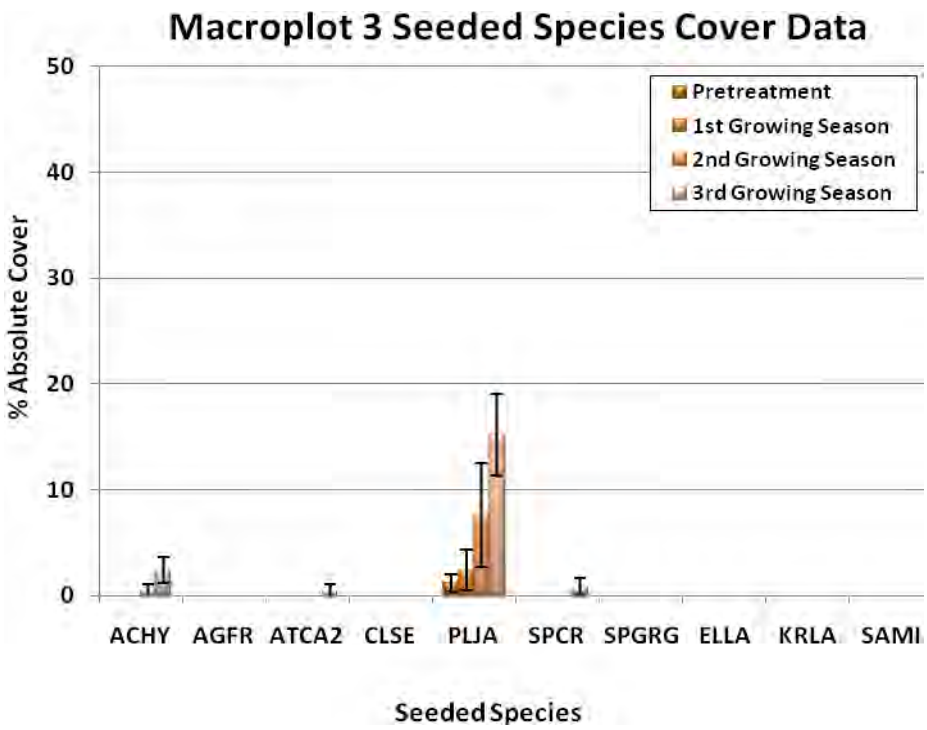


Figure 10. Absolute Percent Cover of Seeded Species in Macroplot 3(Control). Error bars show 90% confidence intervals.

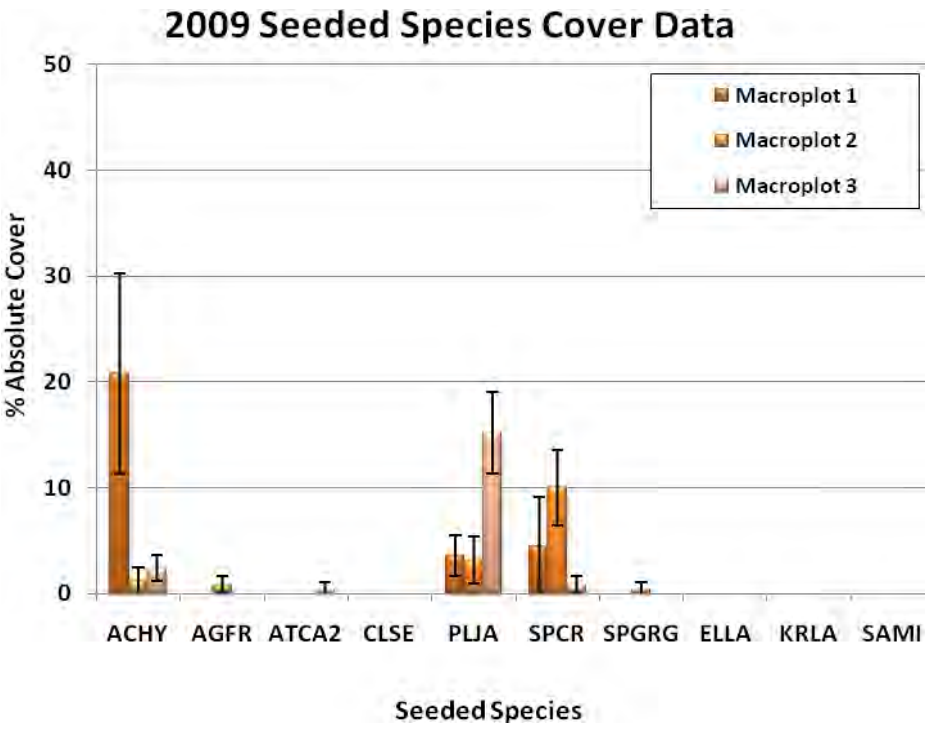


Figure 11. Absolute Percent Cover of Seeded Species in 2009. Error bars show 90% confidence intervals.

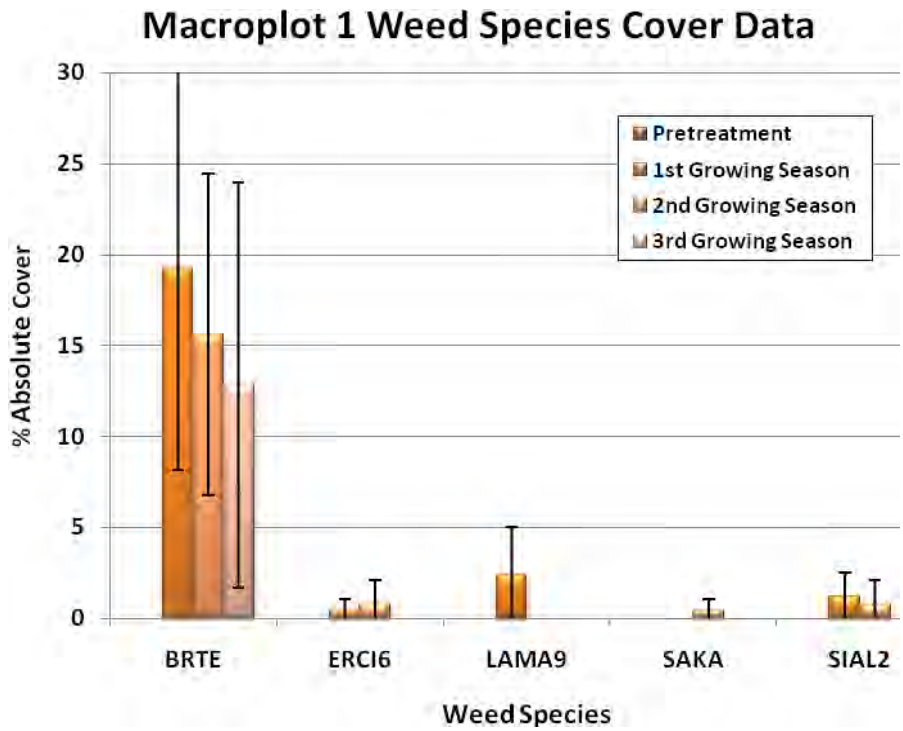


Figure 12. Absolute Percent Cover of Weed Species in Macroplot 1. Error bars show 90% confidence intervals.

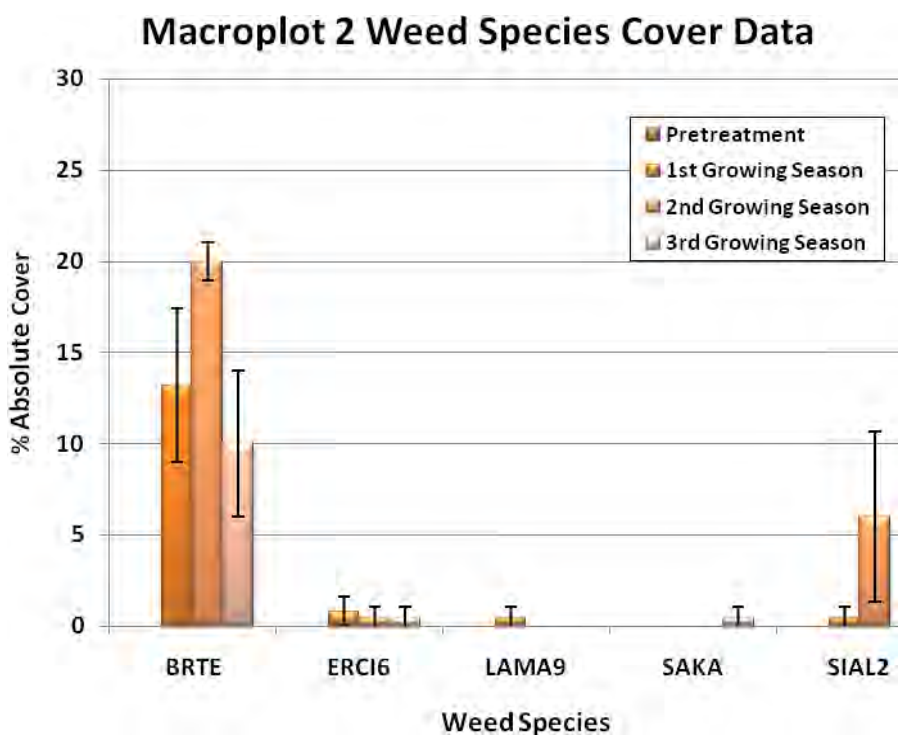


Figure 13. Absolute Percent Cover of Weed Species in Macroplot 2. Error bars show 90% confidence interval.

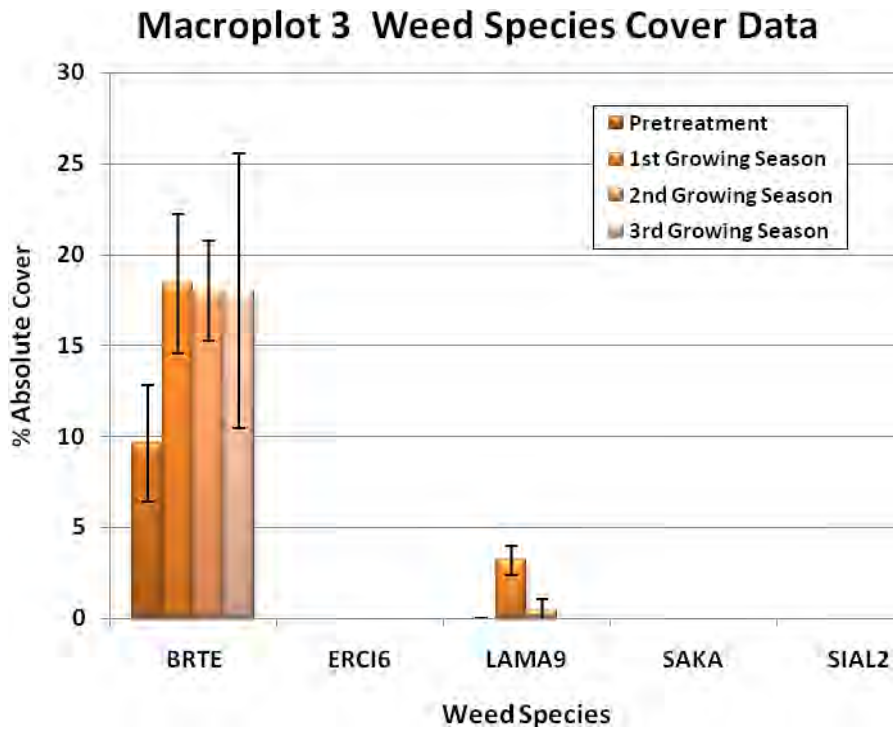


Figure 14. Absolute Percent Cover of Weed Species in Macroplot 3(Control). Error bars show 90% confidence interval.

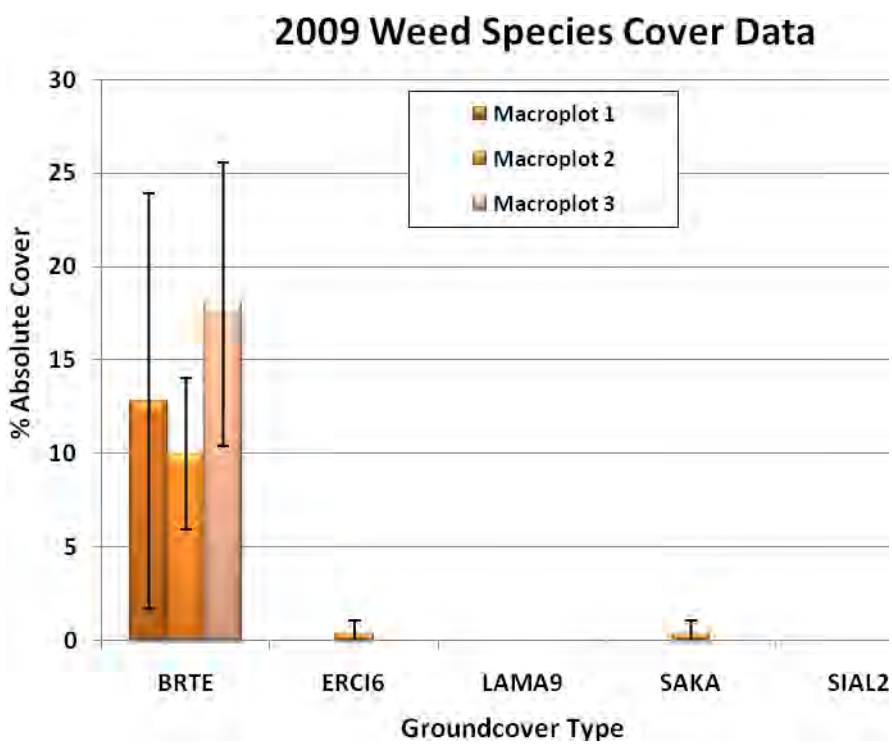


Figure 15. Absolute Percent Cover of Weed Species in 2009. Error bars show 90% confidence interval.

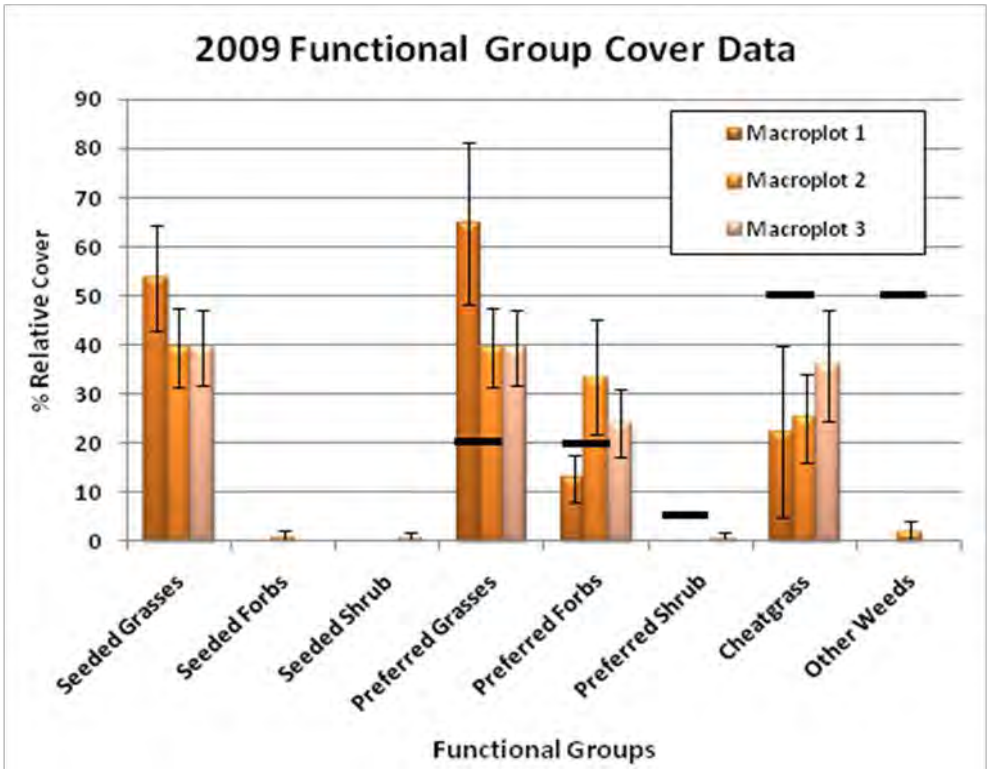


Figure 16. Relative Percent Cover of Functional Groups in 2009. Black lines show objective thresholds and error bars show 90% confidence interval.

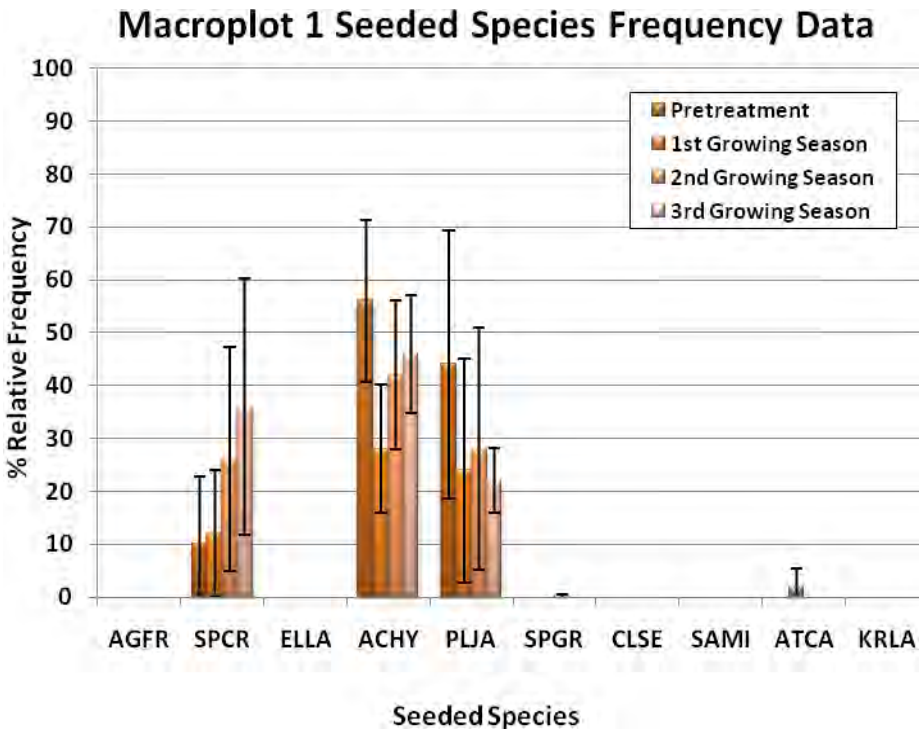


Figure 17. Relative Frequency of Seeded Species in Macroplot 1. Error bars show 90% confidence interval.

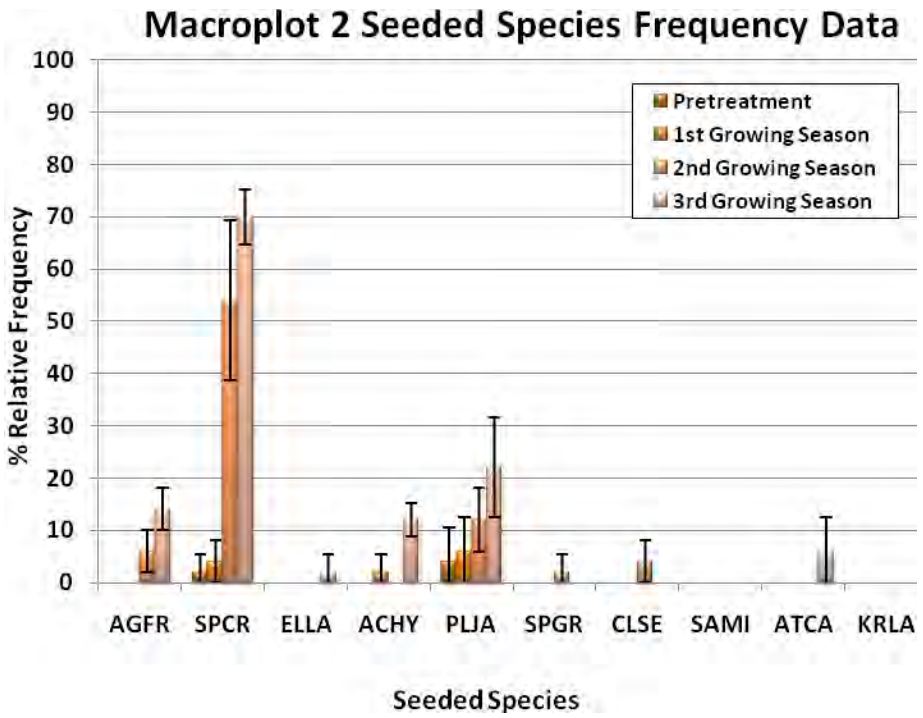


Figure 18. Relative Frequency of Seeded Species in Macroplot 2. Error bars show 90% confidence interval.

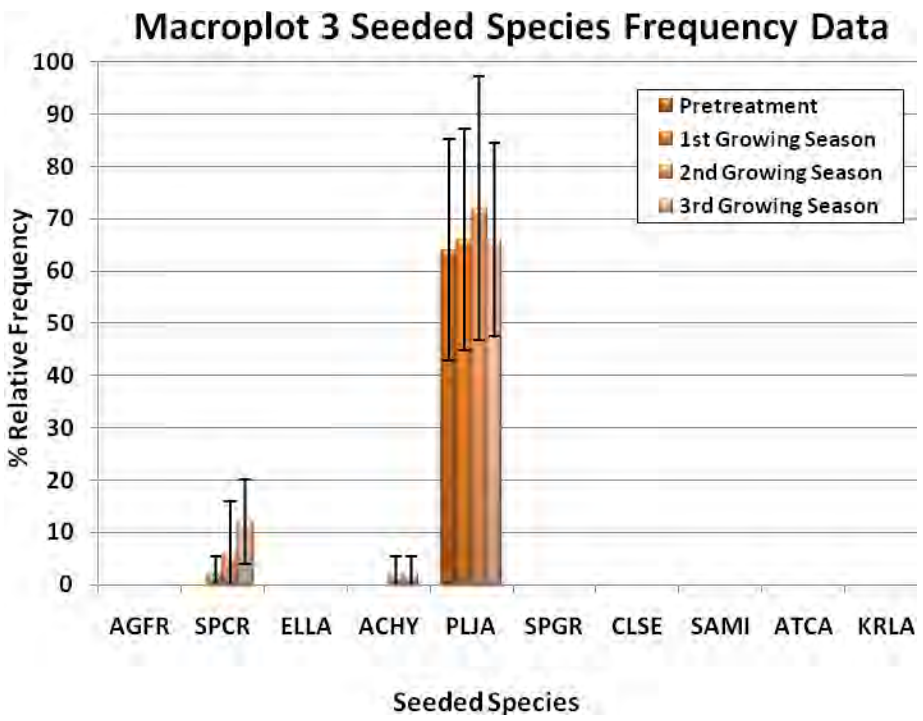


Figure 19. Relative Frequency of Seeded Species in Macroplot 3 (Control). Error bars show 90% confidence interval.

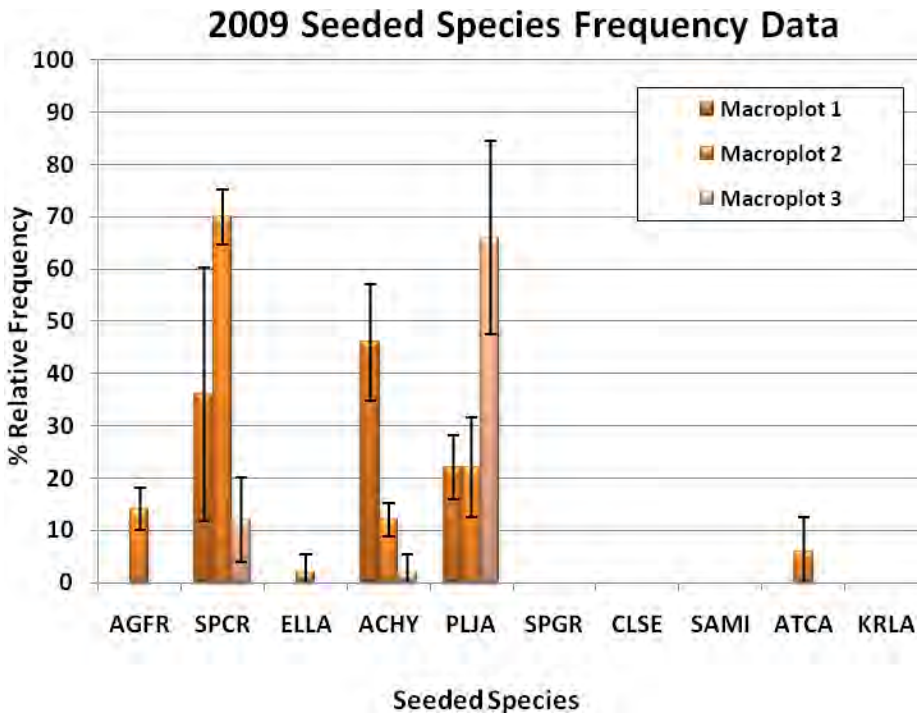


Figure 20. Relative Frequency of Seeded Species in2009. Error bars show 90% confidence interval.

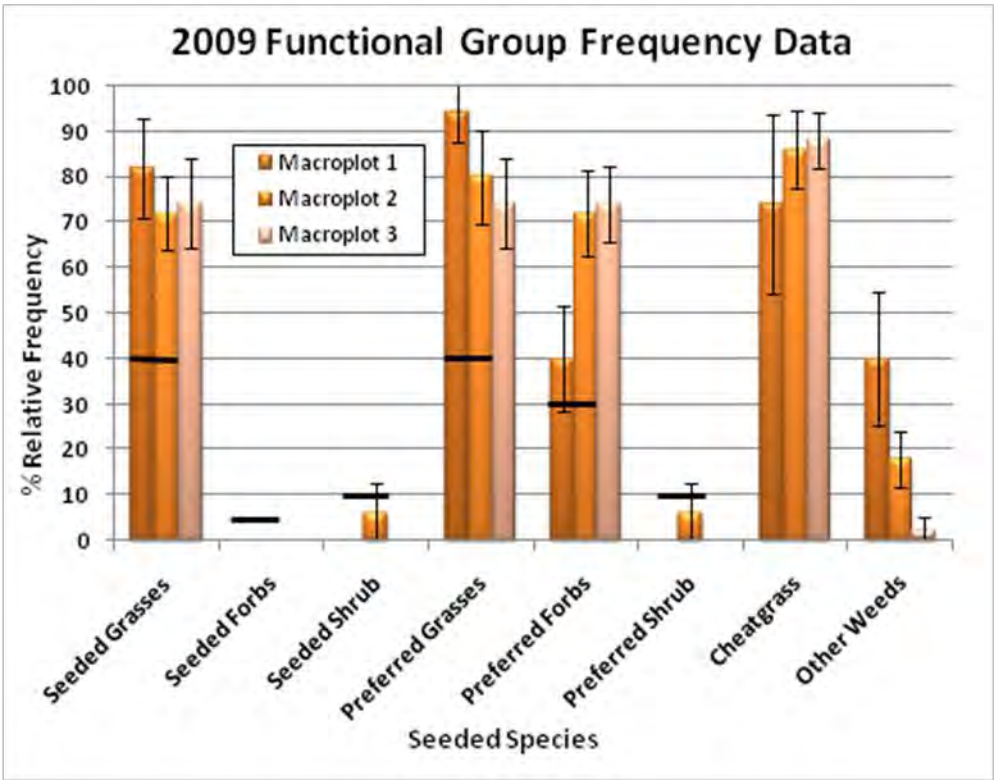


Figure 21. Relative Frequency of Functional Groups in 2009. Black lines show objective thresholds and error bars show 90% confidence interval.

Table 4. Key to Species Codes and Functional Groups

Species Code	Common Name	Scientific Name	Functional Group	
AGFR	Siberian Wheatgrass	*Agropyron fragile*	**Seeded Grasses**	**Preferred Grasses**
SPCR	Sand Dropseed	*Sporobolus cryptandrus*		
ELLA	Thickspike Wheatgrass	*Elymus lanceolatus*		
ACHY	Indian Ricegrass	*Achnatherum hymenoides*		
PLJA	Galleta Grass	*Pleuraphis jamesii*		
HECO26	Needleandthread grass	*Heterostipa comata*		
VUOC	Winterfat	*Kraschenikovia lanata*		
BRY_008	Unknown Perennial grass			
SPGR	Gooseberryleaf Globemallow	*Sphaeralcea grossularifolia*	**Seeded Forbs**	**Preferred Forbs**
CLSE	Purple Beeplant	*Cleome serrulata*		
SAMI	Small Burnet	*Sanguisorba minor*		
CHER2	Rose Heath	*Chaetopappa ericoides*		
DEPI	Tansymustard	Descurainia pinnata		
GUSA2	Broom Snakeweed	Gutierrezia sarothrae		
PLPA2	Wolly Plantain	Plantago patigonica		
SPCO	Scarlet Globemallow	Spharalcea coccinea		
ARPU2	Beautiful Rockcress	Arabis pulchra		
LEPID	Pepperweed	Lepidium spp.		
LYGRA	Showy Rushpink	Lygodesmia grandiflora		
ATCA	Fourwing Saltbush	*Atriplex canescens*	**Seeded Shrubs**	**Preferred Shrubs**
KRLA	Winterfat	*Krascheninnikovia lanata*		
SAVE4	Greasewood	*Sarcobatus vermiculatus*		
BRTE	Cheatgrass	*Bromus tectorum*		**Weeds**
RATE	Burr Buttercup	*Ranunculus testiculatus*		
SAKA	Russian Thistle	*Salsola kali*		
SIAL2	Tall Tumblemustard	*Sisymbrium altissimum*		
ERCI6	Redstem Stork's Bill	*Erodium cicutarium*		
LAMA9	Margined Sticktight	*Lappula marginata*		

X. Interpretation of Results

The results of this monitoring program indicate that there is a high degree of variability across the project area despite all the macroplots falling within one soil map unit. The two treated macroplots (i.e. macroplot 1 and 2) and the untreated control (i.e. macroplot 3) show different vegetative responses (Fig. 5-21). As stated in the Treatment section, Macroplot 1 occurs in a portion of the soil map unit with very deep stony soils while Macroplot 2 is considerably less stony. Although within the same soil map unit, this difference in soils may underlie the different vegetative response. In future projects, increasing the sample size (i.e. number of macroplots) would help to improve our ability to draw conclusions about the success of these treatments.

A. Objectives

The *Management Cover Objective for Overall Vegetative Recovery* was partially met (Fig. 16). All macroplots, including the control, had relative cover values of preferred grasses greater than the 20% threshold. The preferred forb portion of this objective was met within macroplot 2 and in macroplot 3 (control) indicating that natural vegetation recruitment was likely responsible for establishing forbs and not the seeding treatment. The preferred shrub objective was not met within any macroplot. This is likely due to the longer timelines typically required for shrub recruitment, establishment and growth.

The *Management Frequency Objective for Overall Vegetative Recovery* was met for preferred grasses and preferred forbs but not for preferred shrubs (Fig. 21). The control plot also reached this level of vegetative recovery indicating that the seeding treatment, while augmenting the native recovery, is not solely responsible for meeting these objectives.

The *Management Cover Objective for Treatment Effectiveness* focused on limiting the relative cover of annual weeds to less than 50% (Fig. 16). This objective was met by all macroplots including the control. However, the control plot has 10-12% greater Cheatgrass cover than do the seeded plots. It is the opinion of this author, that under unseeded conditions the relative cover of Cheatgrass would be less than 50% but the seeding has had an ecological, if not statistical, effect on reducing Cheatgrass cover. Other weed cover is negligible on the site.

The *Management Frequency Objective For Treatment Effectiveness* was met only for seeded grasses. However, the control plot also met the objective through native regeneration. Seeded forbs and shrubs did not perform well and this portion of the objective was not met.

B. Other Results

The following bullets represent some other conclusions that can be drawn from this monitoring project:

- Diversity of desirable species higher in seeded areas (Fig. 17-20)
- SPCR, PLJA, AGFR and ACHY are establishing (Fig. 17-20).
- SPCR very successful; ACHY successful (Fig. 20)
- Different species did better on different sites (Fig. 11).
- Seeded forbs and seeded shrubs failed (Fig. 8-11, 16-21).
- Drill seeding reduced frequency of remnant seeded species where they survived in relative abundance (i.e. macroplot 1) (Fig.17) but increased them in areas of low abundance (Fig. 18).
- Drill seeding increased amount of other weed frequency although cover was reduced by year 3 (Fig.12-15, 21).

XI. Management Recommendations

A. Change in Management

No change in management is recommended at this time.

B. Change in Monitoring

The Bryson ESR monitoring project was successful in providing a basic quantitative understanding of the treatment effectiveness of the drill seeding. Important aspects to the monitoring plan included the incorporation of quantitative methods, random sampling, soil stratification and control plots. However, several changes to future ESR monitoring programs are recommended to increase sampling efficiency, statistical rigor, and to bring the Canyon Country Fuels ESR program in line with the national monitoring standardization effort.

Sampling efficiency could be improved by decreasing the subsampling intensity within each macroplot. In this project, five subtransects were sampled within each macroplot and a reduction to three subtransects is recommended. The Rattle Fire Complex Remote Sensing Report (Bissonette and White, 2008) showed that subsampling intensity could be reduced to three or four subtransects with satisfactory results in generating the cheatgrass cover regression model created for that project. A notable difference between the Rattle ESR project and the Bryson Wash ESR project is that the diversity was far greater within Rattle. The use of three subtransects per plot in the lower plant diversity system of the Bryson Wash ESR project seems further justified.

Statistical rigor would be increased by increasing the number of macroplots to better capture the variability within the Bryson ESR project. This is a common issue for land management agencies due to the limited time and money available for monitoring the large number of projects. However, increasing the number of macroplots per strata to four is recommended. A reduction in the amount of subsampling, as mentioned previously, will provide a cost savings that can be used to increase the number of macroplots on the landscape.

ESR project monitoring has been criticized by the Government Accountability Office (GAO) because the methods currently employed throughout the Department of Interior (DOI) are dissimilar and do not often establish treatment success/failure. There has been considerable thought and effort applied to establishing a common approach to monitoring ESR projects (Wirth and Pyke, 2007a) to address these shortcomings. Monitoring ESR projects will follow the methodology outlined by Wirth and Pyke (2007b) with a small modification. Seeded rhizomatous species are often not easily quantified using density because defining an individual is problematic. Therefore, the density quadrat will be used as a frequency frame and frequency collect for seeded rhizomatous species.

XII. References

Bissonette, G.J., White, M.A. 2008. Rattle Fire Complex Emergency Stabilization and Rehabilitation Remote Sensing Report. Bureau of Land Management, Moab Field Office. 23 p.

Bonham, C.D. 1989. Measurements for terrestrial vegetation. John Wiley and Sons, New York. 338 p.

Elzinga, C.L., Salzer, D.W., and Willoughby, J.W. 1998. Measuring and Monitoring Plant Populations. USDI Bureau of Land Management Technical Reference 1730-1. 492 p.

Hansen, D. T. 1989. Soil Survey of Grand County, Utah. Natural Resource Conservation Service, United States Department of Agriculture.

Wirth, T.A., Pyke, D.A., 2007a. Monitoring Post-fire Vegetation Rehabilitation Projects-A Common Approach for Non-forested Ecosystems: U.S. Geological Survey Scientific Investigations Report 2006-5048, P. 36.

Wirth, T.A., Pyke, D.A., 2007b. Standardized Emergency Stabilization and Rehabilitation Monitoring Protocols. **U.S. Department of Interior, U.S. Geological Survey Forest and Rangeland Ecosystem Science Center.** http://fresc.usgs.gov/research/esrmonitoring/Links.htm.

XIII. Authors and Reviewers

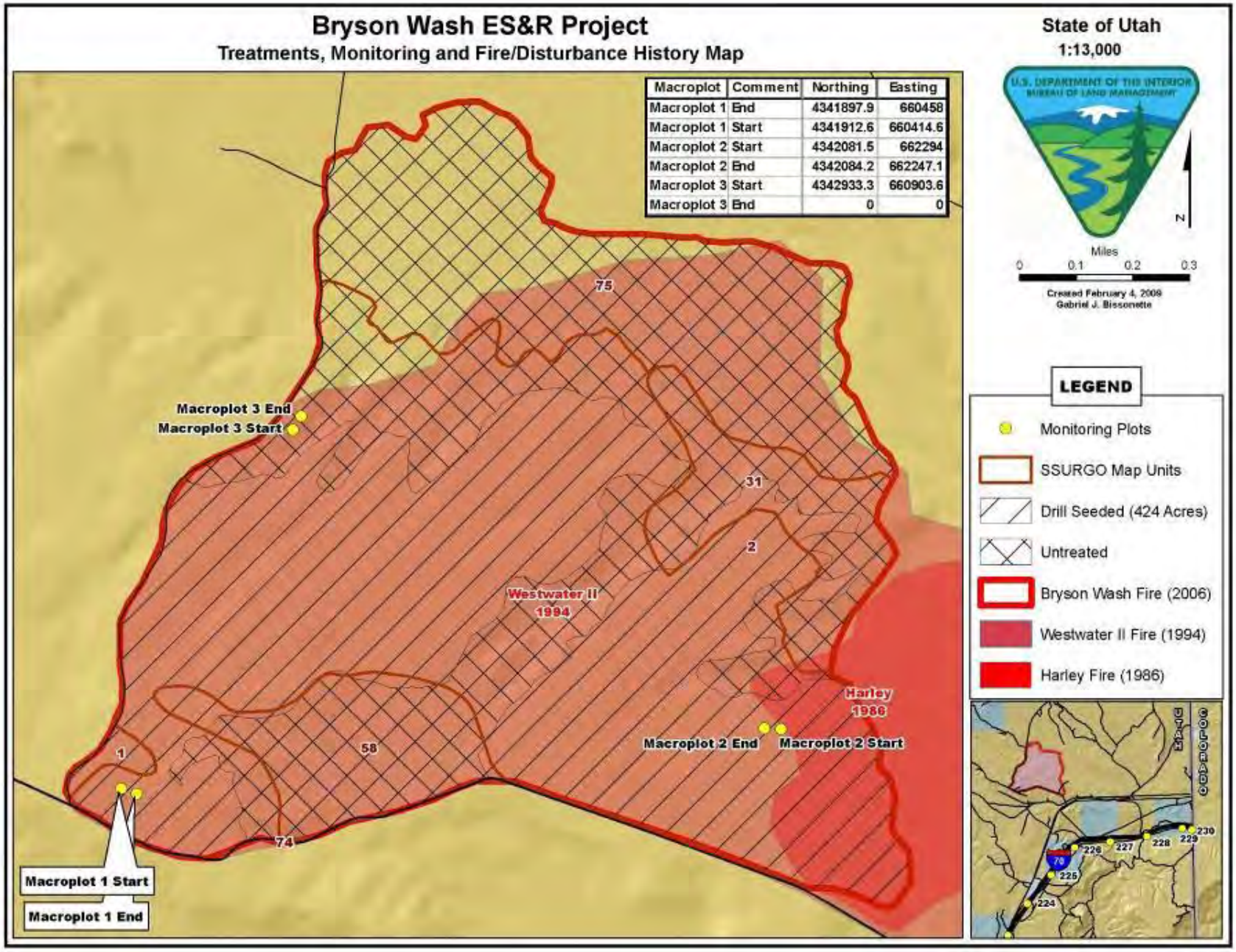
Gabriel J. Bissonette:
GIS Specialist/Monitoring, BLM-Canyon Country Fire Zone, Author

Kate Juenger:
Planning Coordinator, BLM-Canyon Country Fire Zone, Author

Glenn Fischer:
SCA Intern, Author

Brian Keating:
Fuels Specialist/ES&R Lead, BLM-Canyon Country Fire Zone, Reviewer

Appendix A - Project Map



Macroplot	Comment	Northing	Easting
Macroplot 1	End	4341897.9	660458
Macroplot 1	Start	4341912.6	660414.6
Macroplot 2	Start	4342081.5	662294
Macroplot 2	End	4342084.2	662247.1
Macroplot 3	Start	4342933.3	660903.6
Macroplot 3	End	0	0

Appendix B - Data Sheets

UTM:

Nested Frequency

Study Site:	Date:	Examiner:	Recorder:
Main Transect Location & Length:	Number of quadrats: 10 on each subtransect		Quadrat size: 24" x 24"
Sub Transect Location & Length:	Sampling Interval:		
Design: random systematic	Subtransects read on	of baseline	Quadrats read on: of subtransect

Transect #:	Located at:	Random Quadrats start at:	Quadrat Interval:	Transect #:	Located at:	Quadrat Random Start at:	Quadrat Interval:

	Quadrats										Quadrats									
Plant Species, Soil Crust, Etc.	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10

Appendix C – Repeat Photography

Bryson Wash ESR Macroplot 1 North - 9/29/2006 (Pre-treatment)

Bryson Wash ESR Macroplot 1 North – 11/22/2006 (Post-treatment)

Bryson Wash ESR Macroplot 1 North – 4/26/2007 (1st Growing Season)

Bryson Wash ESR Macroplot 1 North – 7/30/2008 (2nd Growing Season)

Bryson Wash ESR Macroplot 1 North – 6/03/2009 (3rd Growing Season)

Bryson Wash ESR Macroplot 1 South - 9/29/2006 (Pre-treatment)

Bryson Wash ESR Macroplot 1 South – 11/22/2006 (Post-treatment)

Bryson Wash ESR Macroplot 1 South – 4/26/2007 (1st Growing Season)

Bryson Wash ESR Macroplot 1 South – 7/30/2008 (2nd Growing Season)

Bryson Wash ESR Macroplot 1 South – 6/3/2009 (3rd Growing Season)

Bryson Wash ESR Macroplot 1 East - 9/29/2006 (Pre-treatment)

Bryson Wash ESR Macroplot 1 East – 11/22/2006 (Post-treatment)

Bryson Wash ESR Macroplot 1 East – 4/26/2007 (1st Growing Season)

Bryson Wash ESR Macroplot 1 East – 7/30/2008 (2nd Growing Season)

Bryson Wash ESR Macroplot 1 East – 6/3/2009 (3rd Growing Season)

Bryson Wash ESR Macroplot 1 West - 9/29/2006 (Pre-treatment)

Bryson Wash ESR Macroplot 1 West – 11/22/2006 (Post-treatment)

Bryson Wash ESR Macroplot 1 West – 4/26/2007 (1st Growing Season)

Bryson Wash ESR Macroplot 1 West – 7/30/2008 (2nd Growing Season)

Bryson Wash ESR Macroplot 1 West – 6/3/2009 (3rd Growing Season)

Bryson Wash ESR Macroplot 2 North - 10/12/2006 (Pre-treatment)

Bryson Wash ESR Macroplot 2 North - 11/22/2006 (Post-treatment)

Bryson Wash ESR Macroplot 2 North - 5/7/2007 (1st Growing Season)

Bryson Wash ESR Macroplot 2 North - 7/29/2008 (2nd Growing Season)

Bryson Wash ESR Macroplot 2 North - 6/4/2009 (3rd Growing Season)

Bryson Wash ESR Macroplot 2 South - 10/12/2006 (Pre-treatment)

Bryson Wash ESR Macroplot 2 South - 11/22/2006 (Post-treatment)

Bryson Wash ESR Macroplot 2 South - 5/7/2007 (1st Growing Season)

Bryson Wash ESR Macroplot 2 South - 7/29/2008 (2nd Growing Season)

Bryson Wash ESR Macroplot 2 South - 6/4/2009 (3rd Growing Season)

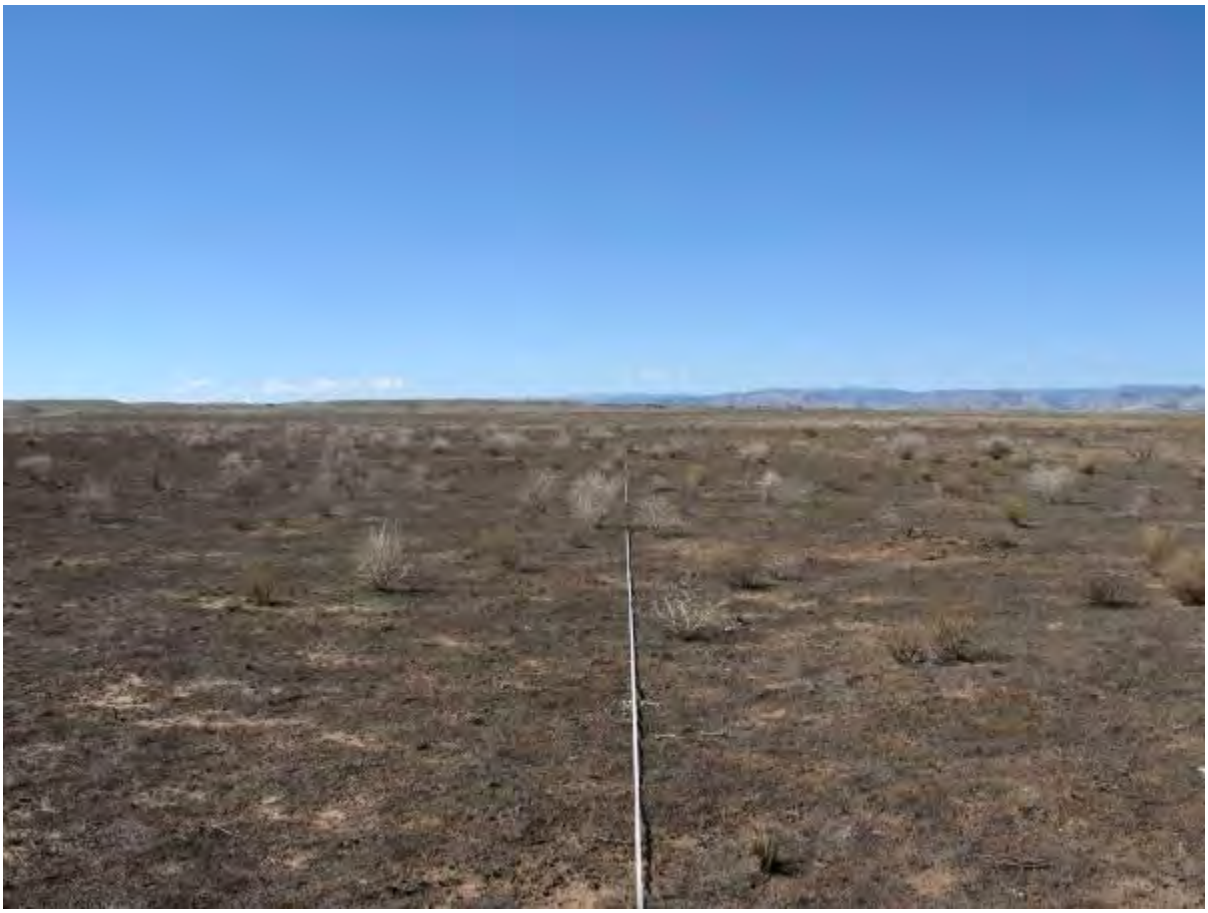
Bryson Wash ESR Macroplot 2 East - 10/12/2006 (Pre-treatment)

Bryson Wash ESR Macroplot 2 East - 11/22/2006 (Post-treatment)

Bryson Wash ESR Macroplot 2 East - 5/7/2007 (1st Growing Season)

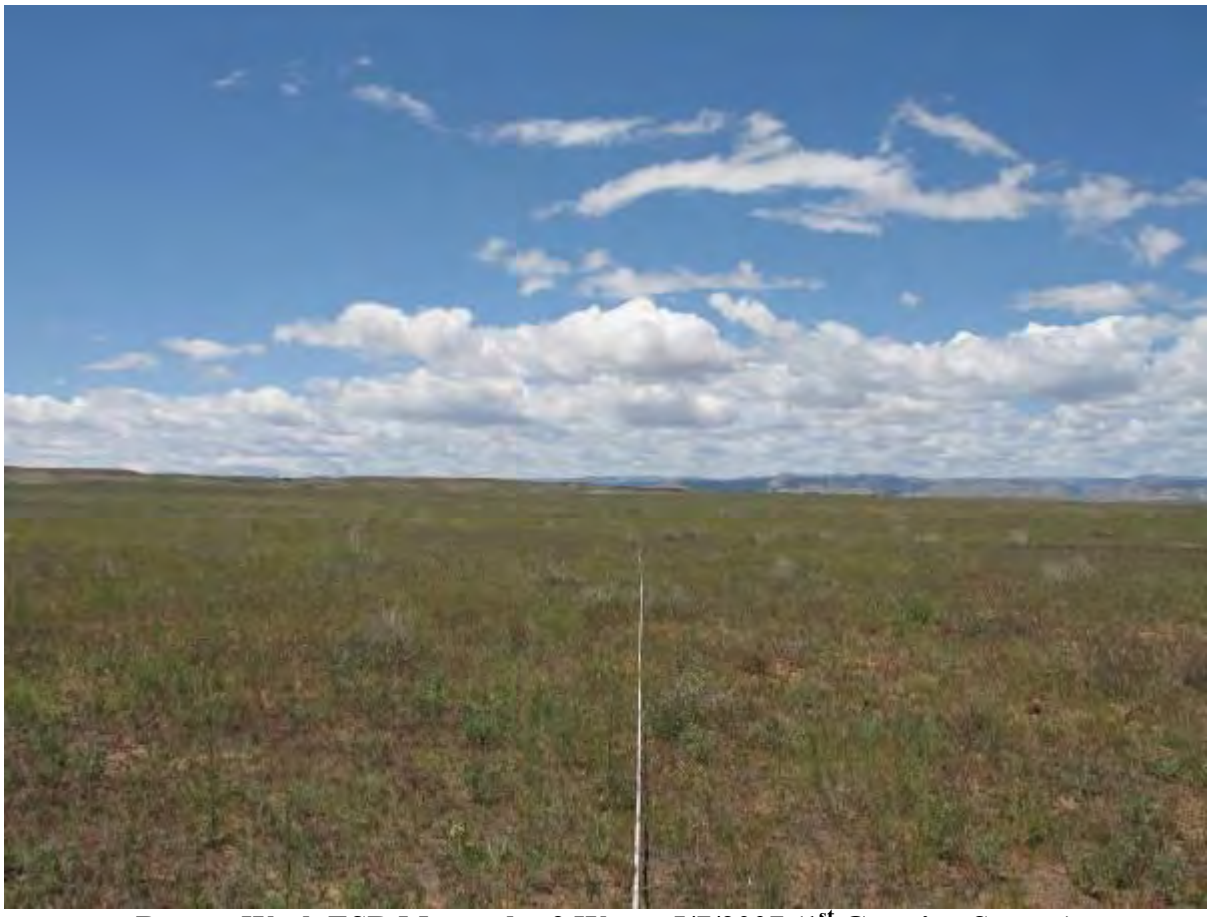
Bryson Wash ESR Macroplot 2 East - 7/29/2008 (2nd Growing Season)

Bryson Wash ESR Macroplot 2 East - 6/4/2009 (3rd Growing Season)



Bryson Wash ESR Macroplot 2 West - 10/12/2006 (Pre-treatment)

Bryson Wash ESR Macroplot 2 West - 11/22/2006 (Post-treatment)



Bryson Wash ESR Macroplot 2 West - 5/7/2007 (1st Growing Season)

Bryson Wash ESR Macroplot 2 West - 7/29/2008 (2nd Growing Season)

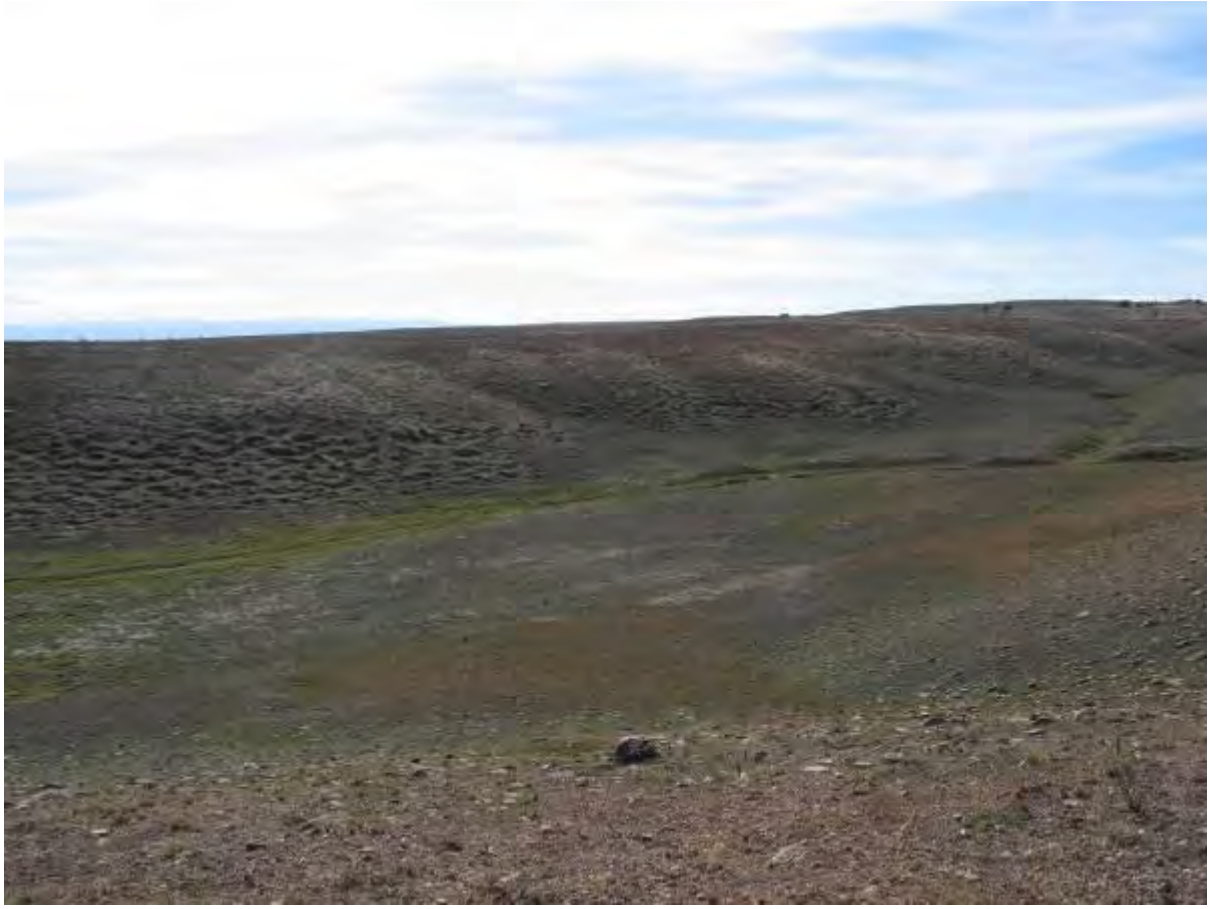
Bryson Wash ESR Macroplot 2 West - 6/4/2009 (3rd Growing Season)

Bryson Wash ESR Macroplot 3 (Control) North - 11/22/2006

Bryson Wash ESR Macroplot 3 (Control) North - 4/27/2007 (1st Growing Season)

Bryson Wash ESR Macroplot 3 (Control) North - 7/30/2008 (2nd Growing Season)

Bryson Wash ESR Macroplot 3 (Control) North - 6/4/2009 (3rd Growing Season)



Bryson Wash ESR Macroplot 3 (Control) South - 11/22/2006

Bryson Wash ESR Macroplot 3 (Control) South - 4/27/2007 (1st Growing Season)

Bryson Wash ESR Macroplot 3 (Control) South - 7/30/2008 (2nd Growing Season)

Bryson Wash ESR Macroplot 3 (Control) South - 6/4/2009 (3rd Growing Season)

Bryson Wash ESR Macroplot 3 (Control) East - 11/22/2006

Bryson Wash ESR Macroplot 3 (Control) East - 4/27/2007 (1st Growing Season)

Bryson Wash ESR Macroplot 3 (Control) East - 7/30/2008 (2nd Growing Season)

Bryson Wash ESR Macroplot 3 (Control) East - 6/4/2009 (3rd Growing Season)

Bryson Wash ESR Macroplot 3 (Control) West - 11/22/2006

Bryson Wash ESR Macroplot 3 (Control) West - 4/27/2007 (1st Growing Season)

Bryson Wash ESR Macroplot 3 (Control) West - 7/30/2008 (2nd Growing Season)

Bryson Wash ESR Macroplot 3 (Control) West - 6/4/2009 (3rd Growing Season)