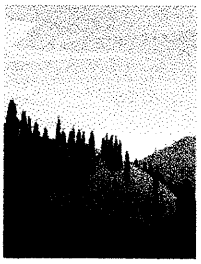
ATTACHMENT 3-1

VEGETATION INVENTORY

Mine # C/007/0039
File Incoming
Record # 0104
Doc. Date 8·22·05
Recd. Date 8·23·05

VEGETATION OF THE DEGAS BOREHOLE SITES: G-8, G-9, G-10 & REFERENCE AREAS

FOR THE DUGOUT CANYON MINE



Prepared by

MT. NEBO SCIENTIFIC, INC.
330 East 400 South, Suite 6
Springville, Utah 84663
(801) 489-6937

Patrick D. Collins, Ph.D.

for

CANYON FUEL COMPANY, LLC
Dugout Canyon Mine
P.O. Box 1029
Wellington, UT 84542

August 2005

TABLE OF CONTENTS

INTRODUCTION 1

METHODS 2

- Sampling Design and Transect/Quadrat Placement 2
- Cover and Composition 3
- Woody Species Density 3
- Sample Size & Adequacy 4
- Statistical Analyses 4
- Photographs 4
- Threatened & Endangered Plant Species 5
- Raw Data 5

RESULTS 5

- Borehole Site G-8 5
- Reference Area for G-8 6
- Borehole Site G-9 7
- Borehole Site G-10 8
- Reference Area for G9/G-10 9
- Threatened & Endangered Plant Species Survey 10

DISCUSSION 10

DATA SUMMARY TABLES 12

FIGURES 27

COLOR PHOTOGRAPHS 29

RAW DATA SET . . . . . Appendix

INTRODUCTION

As they have done in the recent past, Canyon Fuel Company has made plans to drill borehole sites as part of a de-gasification process to facilitate coal mining operations at the Dugout Canyon Mine. In order to develop the drill sites, a small amount of land has been proposed to be disturbed at each location. Each proposed borehole pad is approximately 200 ft. x 300 ft in size. The plant communities proposed for disturbance at each of these sites have been described and sampled with the results provided in this report. A sensitive plant species survey was also conducted at the sites.

Like the earlier developed degas borehole sites, and in an attempt to minimize disturbance to the native plant communities in the area, Canyon Fuel has planned construction of the proposed new sites in areas where previous disturbance has already been caused by logging or other activities.

Three (3) borehole sites were sampled along with two (2) Reference Areas that were chosen to represent future standards for final revegetation success. The Reference Areas were chosen for their similarities in geology, soils, slope, aspect, and plant community composition to the areas that are proposed for disturbance. In those cases where the proposed new disturbances exist in areas that were previously disturbed by other activities, attempts were made to choose the Reference Areas to represent those native plant communities that were present at the site prior to these perturbations. In one case an undisturbed plant community was chosen as the Reference Areas for two degas borehole sites that had been previously disturbed by the other activities.

METHODS

Methodologies used herein were performed in accordance with the guidelines supplied by the State of Utah, Division of Oil, Gas and Mining (DOGM). Quantitative and qualitative data were taken on the vegetation of the areas proposed for disturbance and their respective Reference Areas from July 5 - July 8, 2005.

Proposed drill sites were surveyed, mapped and staked in the field by Canyon Fuel prior to the field study. The Reference Areas chosen were approximately one acre in size and were marked in the field using a GPS instrument. The coordinates are given below.

GPS COORDINATES FOR DUGOUT CANYON MINE DE-GAS BOREHOLE SITES: G-8, G-9, G-10

Waypoint Name	Zone	Easting	Northing	Notes
DUGG08	12	0540393	4391816	Borehole Site G-8
DUGG09	12	0545046	4392133	Borehole Site G-9
DUGG10	12	0544894	4392045	Borehole Site G-10
DUG8RF	12	0540425	4391834	Reference Area for G-8
DUG9RF	12	0544946	4392087	Reference Area for G-9/G-10

Sampling Design and Transect/Quadrat Placement

Transect lines for vegetation sampling were placed randomly within the boundaries of the

proposed disturbed and Reference Areas. The sample boundaries included 100 ft outside the proposed drill site. The transect placement technique was employed with the goal to adequately sample a representative subset of the entire site as a whole. Once the transects were established, quadrat locations for sampling were chosen using random numbers from the transect lines with the objective to record data without preconceived bias.

Cover and Composition

Cover estimates were made using ocular methods with meter square quadrats. Species composition, cover by species, and relative frequencies were also assessed from the quadrats. Additional information recorded on the raw data sheets were: estimated precipitation, slope, exposure, grazing use, animal disturbance and other appropriate notes. Plant nomenclature follows "A Utah Flora" (Welsh et al., 2003).

Woody Species Density

Density of woody plant species for the proposed disturbed and Reference Areas were estimated using the point-quarter method. In this method, random points were placed on the sample sites and measured into four quarters. The distances to the nearest woody plant species were then recorded in each quarter. The average point-to-individual distance was equal to the square root of the mean area per individual. The number of individuals per acre was the end results of the calculations.

Sample Size & Adequacy

Sampling adequacy for cover and density was attempted by using the formula given below.

$$nMIN = \frac{t^2 s^2}{(dx)^2}$$

where,

nMIN	= minimum adequate sample
t	= appropriate confidence t-value
s	= standard deviation
x	= sample mean
d	= desired change from mean

With the values used for "t" and "d"above, the goal was to meet sample adequacy with 80% confidence within a 10% deviation from the true mean. In areas where sample viability was unnaturally high (e.g. previous disturbance sites), these parameters may have been too rigorous.

Statistical Analyses

Student's t-tests were employed to compare the total living cover and total woody species density of each proposed disturbed borehole site with their respective Reference Area.

Photographs

Color photographs of the sample areas were taken at the time of sampling and have been

submitted with this report.

Threatened & Endangered Plant Species

Prior to recording quantitative data on the plant communities, a sensitive plant species survey was conducted. To initiate the study, appropriate agencies were consulted (e.g. *Utah Natural Heritage Program*) and other sources were reviewed (sensitive species files at *Mt. Nebo Scientific, Inc.*) for potential plant species that are known to be rare, endemic, threatened, endangered or otherwise sensitive in the study area.

Raw Data

The raw data for cover have been summarized on a spreadsheet and were included in the Appendix of this report.

RESULTS

Borehole Site G-8

A rather unique habitat, Borehole Site G-8 was located near the spine of a ridge (see photographs of the sample sites). Some of the area had been disturbed by a road that dissects it.

Total living cover (overstory plus understory) was estimated at 34.25%. Over 52% of the understory cover was dominated by forb species, 29.75% were grasses, and 18.21% were woody species (Table 1). As a forb/grass dominated community, the most common two understory species were stemless wooly-base (*Hymenoxys acaulis*) and Salina wildrye (*Elymus salinus*). The dominant overstory species was ponderosa pine (*Pinus ponderosa*). For a list of the cover values by species, refer to Table 2.

Total woody species density was estimated at 797 individuals per acre (Table 3). The most common woody species by density were big sagebrush (*Artemisia tridentata*) and mountain mahogany (*Cercocarpus montanus*).

Reference Area for G-8

As mentioned above, mostly due to its location, the Borehole G-8 site was an area of unique habitat. Because of this, a comparable plant community to be used for future revegetation success standards was more of a challenge to locate. Therefore, possibly the most appropriate location for the Reference Area was on the same ridge spine and very close to the site proposed for construction of the borehole drill pad (see photographs of the sample sites). So close in fact, that depending on the final construction footprint, it is possible that the proposed disturbance may somewhat infringe on the Reference Area chosen. If this happens, a similar grass/forb community can be found south-south west of the Borehole G-8 site. Both areas – the proposed Reference Area and the alternative site just mentioned – are relatively small areas due to the physiognomic

nature of the site. To enlarge the chosen Reference Area would move it into mountain brush or conifer communities.

The total living cover for the G-8 Reference Area was 39.33%, 29.00% of which was understory cover (Table 4). Like the proposed disturbed area it was chosen to represent, forbs and grasses were the dominant lifeform in this area comprising 38.84% and 42.04%, respectively (Table 4). The most common grass species for cover and frequency values was Saline wildrye (Table 5). As shown on Table 5 several forbs species were encountered in the sample quadrats.

Woody species density measurements showed the community to have a total of 1,029 individuals per acre. Mountain mahogany and big sagebrush were the most common species in the density measurements (Table 6).

Borehole Site G-9

Borehole Site G-9 was an area previously disturbed by logging (see photographs of the sample sites). It was also the site of an old sawmill. Needless to say, the native plant community had been significantly altered from these early activities. The plant community prior to disturbance in this area was probably transitional between mountain brush and conifer communities.

The total living cover for Borehole Site G-9 was 35.85%, of which only 4.75% was comprised of overstory (Table 7). Forbs, many of them weedy exotics, comprised nearly half (48.29%) of the

understory cover. Grasses and woody species were nearly equally represented (Table 7). The most common species in this area by cover and frequency were hounds-tongue (*Cynoglossum officinale*) followed by bluegrass (*Poa pratensis*). For a list cover and frequency values for all species encountered in the quadrats for Borehole Site G-9, refer to Table 8.

Total density of woody species in the area was estimated at only 148 plants per acre (Table 9). Mountain snowberry, rabbitbrush (*Chrysothamnus nauseosus*) and big sagebrush had the greatest densities here.

Borehole Site G-10

Similar to the site described above, Borehole Site G-10 was the site of previous activities – mostly logging (see photographs of the sample sites). Prior to logging this site was also once dominated by plant species from the transitional zone between a mountain brush and confer communities.

Total living cover of Borehole Site G-10 was 37.10% with 5% of it being overstory species (Table 10). Grasses dominated the composition of the area at 37.83%, but was followed closely by woody species and forbs at 33.09% and 29.07%, respectively (Table 10). The dominant species of the understory cover were bluegrass, meadow goldenweed (*Haplopappus lanceolatus*) and Douglas fir (*Pseudotsuga menziesii*). For a list of the remainder of the species by cover and frequency in this area refer to Table 11.

Woody species density of Borehole Site G-10 was estimated at 1,101 plants per acre (Table 12) and was dominated by snowberry (*Symphoricarpos oreophilus*), broom snakeweed (*Gutierrezia sarothrae*) and Douglas fir (Table 12).

Reference Area for G-9/G10

A Reference Area for future standards of success was chosen in a native plant community. This community was the most likely habitat that existed prior to disturbances by logging and sawmill activities (see photographs of the sample sites). In other words, an undisturbed plant community transitional between mountain brush and confer was chosen to be the Reference Area for Borehole Sites G-9 and G-10.

Total living cover of this Reference Area was 46.75%, but 15.00% of this value was from overstory cover (Table 13). Also shown on Table 13, woody species dominated the composition here at 48.73%, followed by forbs (29.76%) and grasses (21.51%). The most common understory species were Salina wildrye, snowberry and Douglas Fir. The most common overstory species by far was Douglas Fir (Table 14).

The total number of plants per acre in the woody species density measurements was 1,149 and dominated by snowberry and broom snakeweed (Table 15).

Threatened & Endangered Plant Species Survey

State databases revealed only one potential sensitive species to be located in the vicinity of the proposed disturbed borehole sites. This plant was canyon vetch (*Hedysarum occidentale* var. *canone*). Each proposed disturbed area was surveyed in the field for canyon vetch (or any other unusual or sensitive plants). This survey was done prior to recording the quantitative data used to describe the major plant communities of the study areas. In addition, more searching for sensitive species was done during quantitative sampling of the areas.

No rare, endemic, threatened, endangered or otherwise sensitive species were found in the study areas.

DISCUSSION

Student's t-test suggest no significant difference in total living cover *or* woody species density when Borehole Site G-8 was compared with its Reference Area (Figs. 1 & 2). Similarly, when Borehole Site G-9 was compared with its Reference Area there was no significant difference in total living cover, however, density of woody species was significantly greater than the borehole site in this Reference Area.

Finally, the same statistical tests were employed to compare Borehole Site G-10 with its Reference Area. These tests also suggested no significant difference for total living cover and

woody species density.

Upon approval by the State of Utah, Division of Oil, Gas & Mining (DOGM), the proposed Reference Areas seem to be appropriate revegetation success standards for final reclamation that should occur once the degas borehole sites have completed their function.

Table 1: Site G-8 (Dugout Mine) - Total Cover, standard deviation and sample size.

TOTAL COVER	% Mean Cover	Standard Deviation	Sample Size
COVER			
Overstory	8.50	17.18	20
Understory	25.75	11.54	20
Litter	21.75	25.85	20
Bareground	29.50	25.66	20
Rock	23.00	24.60	20
Overstory + Understory	34.25	19.38	20
% COMPOSITION			
Trees & Shrubs	18.21	18.64	20
Forbs	52.04	28.67	20
Grasses	29.75	24.05	20

Table 2: Site G-8 (Dugout Mine) - Mean percent cover, standard deviation and percent frequency by species.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
Pinus ponderosa	7.75	17.21	20.00
Pseudotsuga menziesii	0.75	3.27	5.00
UNDERSTORY			
TREES & SHRUBS			
Amelanchier utahensis	0.25	1.09	5.00
Artemisia tridentata	0.75	1.79	15.00
Cercocarpus montanus	1.10	2.74	15.00
Chrysothamnus viscidiflorus	0.75	1.89	10.00
Pseudotsuga menziesii	1.25	4.44	10.00
Symphoricarpos oreophilus	0.50	2.18	5.00
FORBS			
Calochortis nuttalii	1.20	1.75	35.00
Castilleja sp.	0.25	1.09	5.00
Cirsium sp.	0.25	1.09	5.00
Cymopteris sp.	1.00	1.84	25.00
Erigeron sp.	1.75	5.54	15.00
Haplopappus lanceolatus	0.65	1.59	15.00
Hymenoxys acaulis	5.85	6.01	60.00
Machaeranthera grindelioides	0.20	0.60	10.00
Penstemon watsonii	1.00	3.39	10.00
Petrodoria pumila	0.25	1.09	5.00
Physaria chambersii	0.10	0.44	5.00
GRASSES			
Elymus salinus	6.65	7.09	70.00
Poa secunda	1.50	5.50	10.00
Stipa hymenoides	0.50	1.50	10.00

Table 3: Site G-8 (Dugout Mine) - Woody species densities.

Species	Individuals Per Acre
Amelanchier utahensis	39.85
Artemisia tridentata	278.96
Cercocarpus montanus	259.03
Pseudotsuga menziesii	149.44
Symphoricarpos oreophilus	69.74
TOTAL	797.03

Table 4: Reference Area for G-8 (Dugout Mine) - Total Cover, standard deviation and sample size.

TOTAL COVER	% Mean Cover	Standard Deviation	Sample Size
Overstory	10.33	19.36	15
Understory	29.00	11.86	15
Litter	41.33	25.26	15
Bareground	21.73	19.44	15
Rock	7.93	6.26	15
Overstory + Understory	39.33	16.42	15
% COMPOSITION			
Trees & Shrubs	19.11	21.16	15
Forbs	38.84	24.52	15
Grasses	42.04	21.59	15

Table 5: Reference Area for G-8 (Dugout Mine) - Mean percent cover, standard deviation and percent frequency by species.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
Pinus ponderosa	10.33	19.36	20.00
UNDERSTORY			
TREES & SHRUBS			
Artemisia tridentata	1.00	2.71	10.00
Cercocarpus montanus	1.33	2.21	20.00
Juniperus osteosperma	0.67	2.49	5.00
Pinus ponderosa	0.33	1.25	5.00
Pseudotsuga menziesii	1.47	4.98	10.00
Symphoricarpos oreophilus	0.33	1.25	5.00
FORBS			
Calochortis nuttalii	1.13	2.00	20.00
Cymopteris sp.	1.33	2.21	20.00
Erigeron sp.	1.53	2.58	30.00
Haplopappus lanceolatus	1.87	2.33	30.00
Hymenoxys acaulis	3.40	6.51	30.00
Linum lewsii	0.33	1.25	5.00
Machaeranthera grindelioides	1.67	2.98	20.00
Penstemon watsonii	0.33	1.25	5.00
Physaria chambersii	0.60	1.36	15.00
Steptanthus cordatus	0.20	0.75	5.00
GRASSES			
Elymus salinus	10.47	8.39	65.00
Poa secunda	0.33	1.25	5.00
Stipa hymenoides	0.67	1.70	10.00

Table 6: Reference Area for G-8 (Dugout Mine) - Woody species densities.

Species	Individuals Per Acre
Artemisia tridentata	240.02
Cercocarpus montanus	428.60
Juniperus osteosperma	17.14
Pinus ponderosa	34.29
Pinus edulis	34.29
Pseudotsuga menziesii	154.30
Symphoricarpos oreophilus	120.01
TOTAL	1028.64

Table 7: Site G-9 (Dugout Mine) - Total Cover, standard deviation and sample size.

TOTAL COVER	% Mean Cover	Standard Deviation	Sample Size
COVER			
Overstory	4.75	10.54	20
Understory	31.10	19.97	20
Litter	13.15	11.80	20
Bareground	45.75	21.17	20
Rock	10.00	14.37	20
Overstory + Understory	35.85	20.73	
% COMPOSITION			
Trees & Shrubs	25.40	35.46	20
Forbs	48.29	34.72	20
Grasses	26.31	29.27	20

Table 8: Site G-9 (Dugout Mine) - Mean percent cover, standard deviation and percent frequency by species.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
Pseudotsuga menziesii	4.75	10.54	20.00
UNDERSTORY			
TREES & SHRUBS			
Amelanchier utahensis	0.50	2.18	5.00
Cercocarpus montanus	1.25	3.83	10.00
Chrysothamnus viscidiflorus	0.35	1.53	5.00
Mahonia repens	2.50	7.83	15.00
Symphoricarpos oreophilus	2.15	4.66	30.00
FORBS			
Cirsium sp.	1.00	2.10	20.00
Cryptantha flavoculata	0.50	1.77	10.00
Cynoglossum officinale	10.80	13.54	60.00
Haplopappus lanceolatus	2.25	3.01	40.00
Machaeranthera grindelioides	0.15	0.65	5.00
GRASSES			
Bromus tectorum	1.15	2.57	20.00
Elymus salinus	1.25	3.11	15.00
Poa pratensis	7.00	13.82	35.00
Stipa hymenoides	0.25	1.09	5.00

Table 9: Site G-9 (Dugout Mine) - Woody species densities.

Species	Individuals Per Acre
Amelanchier utahensis	9.22
Artemisia tridentata	12.91
Cercocarpus montanus	9.22
Chrysothamnus nauseosus	22.13
Gutierrezia sarothrae	9.22
Populus tremuloides	3.69
Pseudotsuga menziesii	12.13
Symphoricarpos oreophilus	59.01
TOTAL	147.53

Table 10: Site G-10 (Dugout Mine) - Total Cover, standard deviation and sample size.

TOTAL COVER	% Mean Cover	Standard Deviation	Sample Size
COVER			
Overstory	5.00	12.14	20
Understory	32.10	13.72	20
Litter	22.15	21.06	20
Bareground	30.60	19.43	20
Rock	15.15	14.85	20
Overstory + Understory	37.10	21.33	
% COMPOSITION			
Trees & Shrubs	33.09	34.31	20
Forbs	29.07	22.45	20
Grasses	37.83	30.22	20

Table 11: Site G-10 (Dugout Mine) - Mean percent cover, standard deviation and percent frequency by species.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
Amelanchier utahensis	0.50	2.18	5.00
Pseudotsuga menziesii	4.50	12.13	15.00
UNDERSTORY			
TREES & SHRUBS			
Agropyron cristatum	0.25	1.09	5.00
Amelanchier utahensis	0.50	2.18	5.00
Artemisia tridentata	0.25	1.09	5.00
Chrysothamnus viscidiflorus	0.50	2.18	5.00
Gutierrezia sarothrae	1.25	3.11	15.00
Pseudotsuga menziesii	5.00	11.51	20.00
Symphoricarpos oreophilus	3.60	4.97	40.00
FORBS			
Cirsium sp.	0.15	0.65	5.00
Cryptantha flavoculata	0.35	1.15	10.00
Cynoglossum officinale	0.75	2.38	10.00
Hackelia patens	0.25	1.09	5.00
Haplopappus lanceolatus	6.65	6.49	65.00
Penstemon watsonii	0.90	2.21	15.00
Phlox longifolia	0.10	0.44	5.00
GRASSES			
Bromus tectorum	0.50	1.50	10.00
Elymus salinus	2.85	4.10	40.00
Poa pratensis	8.25	12.68	55.00

Table 12: Site G-10 (Dugout Mine) - Woody species densities.

Species	Individuals Per Acre
Acer grandidentatum	13.77
Amelanchier utahensis	41.30
Artemisia tridentata	137.68
Chrysothamnus nauseosus	27.54
Gutierrezia sarothrae	316.67
Juniperus osteosperma	13.77
Pachistima myrsinites	13.77
Pseudotsuga menziesii	206.52
Symphoricarpos oreophilus	330.44
TOTAL	1101.46

Table 13: Reference Area for G-9/G-10 (Dugout Mine) - Total Cover, standard deviation and sample size.

TOTAL COVER	% Mean Cover	Standard Deviation	Sample Size
COVER			
Overstory	15.00	22.47	20
Understory	31.75	16.83	20
Litter	10.00	6.12	20
Bareground	36.50	21.28	20
Rock	21.75	20.33	20
Overstory + Understory	46.75	28.78	
% COMPOSITION			
Trees & Shrubs	48.73	31.58	20
Forbs	29.76	28.01	20
Grasses	21.51	21.44	20

Table 14: Reference Area for G-9 & G-10 (Dugout Mine) - Mean percent cover, standard deviation and percent frequency by species.

	Mean Percent	Standard Deviation	Percent Frequency
OVERSTORY			
Amelanchier utahensis	1.75	5.31	10.00
Cercocarpus montanus	0.75	3.27	5.00
Pinus edulis	2.50	10.90	5.00
Pseudotsuga menziesii	10.00	21.51	20.00
UNDERSTORY			
TREES & SHRUBS			
Agropyron cristatum	0.25	1.09	5.00
Amelanchier utahensis	5.00	12.04	20.00
Artemisia tridentata	0.25	1.09	5.00
Cercocarpus montanus	0.50	1.50	10.00
Gutierrezia sarothrae	3.70	4.21	55.00
Pseudotsuga menziesii	4.25	10.99	20.00
Symphoricarpos oreophilus	4.75	9.93	30.00
FORBS			
Cryptantha flavoculata	0.75	1.61	20.00
Cynoglossum officinale	0.25	1.09	5.00
Eriogonum sp.	1.30	3.12	15.00
Haplopappus lanceolatus	3.50	4.54	55.00
Machaeranthera grindelioides	0.25	1.09	5.00
Oenothera caespitosa	0.25	1.09	5.00
GRASSES			
Elymus salinus	5.25	6.02	55.00
Poa pratensis	1.50	3.91	15.00

Table 15: Reference Area for G-9/G-10 (Dugout Mine) - Woody species densities.

Species	Individuals Per Acre
Amelanchier utahensis	114.86
Artemisia tridentata	14.36
Cercocarpus montanus	
Chrysothamnus nauseosus	28.71
Gutierrezia sarothrae	488.14
Juniperus osteosperma	14.36
Pachistima mysinities	28.71
Pseudotsuga menziesii	71.78
Symphoricarpos oreophilus	315.85
TOTAL	1148.55

FIG. 1. A statistical comparison (Student's t-tests) of the **total living cover** between the proposed disturbed borehole sites and their reference areas.

	$\bar{x}$	s	n	t	df	SL
Borehole Site G-8						
Proposed Disturbed:	34.25	19.38	20			
Reference Area:	39.33	16.42	15			
t-test				-0.818	33	N.S
Borehole Site G-9						
Proposed Disturbed:	35.85	20.73	20			
Reference Area:	46.75	28.78	20			
t-test				-1.374	38	N.S.
Borehole Site G-10						
Proposed Disturbed:	37.10	21.33	20			
Reference Area:	46.75	28.78	20			
t-test				1.205	38	N.S.

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
N.S.=Non-Significant

FIG. 2. A statistical comparison (Student's t-tests) of the **woody species density** between the proposed disturbed borehole sites and their reference areas.

	$\bar{x}$	s	n	t	df	SL
Borehole Site G-8						
Proposed Disturbed:	797.03	534.66	20			
Reference Area:	1028.64	646.85	15			
t-test				-1.159	33	p<.001
Borehole Site G-9						
Proposed Disturbed:	147.53	243.38	20			
Reference Area:	1148.55	1113.54	20			
t-test				-3.928	38	N.S.
Borehole Site G-10						
Proposed Disturbed:	1101.46	1294.93	20			
Reference Area:	1148.55	1113.54	20			
t-test				-0.123	38	N.S.

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
N.S.= Non-Significant

COLOR PHOTOGRAPHS
OF THE
STUDY AREAS

Borehole Site G-8

Reference Area for Site G-8

Borehole Site G-9

Borehole Site G-10

Reference Area for Site G-9/G10

APPENDIX

(Raw Data)

CANYON FUELS

Dugout Mine

Site G-8

Slope: 1-4 deg

Exposure: S-SW

Sample Date: 5-8 July 2005	1.00	2.00	3.00	4.00	5.00	6.00	7.00
OVERSTORY							
Pinus ponderosa	0.00	0.00	0.00	0.00	10.00	0.00	0.00
Pseudotsuga menziesii	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNDERSTORY							
SHRUBS							
Amelanchier utahenisis	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Artemisia tridentata	0.00	5.00	0.00	0.00	5.00	0.00	0.00
Cercocarpus montanus	5.00	0.00	7.00	0.00	0.00	0.00	0.00
Chrysothamnus viscidiflorus	0.00	0.00	0.00	0.00	0.00	0.00	5.00
Pseudotsuga menziesii	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Symphoricarpus oreophilus	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FORBS							
Calochortis nuttalii	3.00	0.00	3.00	0.00	0.00	0.00	3.00
Castelleja sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cirsium sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cymopteris sp.	0.00	0.00	0.00	0.00	0.00	0.00	5.00
Erigeron sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Haplopappus lanceolatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hymenoxys acaulus	12.00	20.00	7.00	10.00	15.00	10.00	0.00
Machaeranthera grindelioides	0.00	0.00	0.00	0.00	0.00	0.00	2.00
Penstemon watsonii	0.00	0.00	0.00	0.00	0.00	15.00	0.00
Petrodoria pumila	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Physaria chambersii	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES							
Elymus salinus	0.00	5.00	8.00	0.00	30.00	15.00	0.00
Poa secunda	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stipa hymenoides	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COVER							
Overstory	0.00	0.00	0.00	0.00	10.00	0.00	0.00
Understory	20.00	30.00	25.00	10.00	50.00	40.00	15.00
Litter	5.00	5.00	10.00	5.00	30.00	10.00	5.00
Bareground	15.00	15.00	50.00	80.00	15.00	10.00	15.00
Rock	60.00	50.00	15.00	5.00	5.00	40.00	65.00
% COMPOSITION							
Shrubs	25.00	16.67	28.00	0.00	10.00	0.00	33.33
Forbs	75.00	66.67	40.00	100.00	30.00	62.50	66.67
Grasses	0.00	16.67	32.00	0.00	60.00	37.50	0.00
Overstory + Understory	20.00	30.00	25.00	10.00	60.00	40.00	15.00

8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	0.00
0.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00
0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00	0.00	0.00	0.00	0.00	7.00	0.00	0.00	0.00	0.00
0.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00
0.00	0.00	2.00	0.00	0.00	3.00	5.00	5.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	5.00	3.00	0.00	5.00	2.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	5.00
5.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00
0.00	15.00	0.00	5.00	5.00	8.00	5.00	0.00	0.00	5.00
2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00
0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00	5.00	0.00	5.00	5.00	0.00	5.00	10.00	15.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	5.00	25.00	0.00	0.00
5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	0.00
25.00	45.00	20.00	20.00	15.00	25.00	30.00	45.00	30.00	15.00
5.00	10.00	5.00	5.00	5.00	5.00	10.00	20.00	65.00	15.00
60.00	15.00	10.00	5.00	65.00	65.00	55.00	30.00	3.00	65.00
10.00	30.00	65.00	70.00	15.00	5.00	5.00	5.00	2.00	5.00
12.00	44.44	0.00	50.00	0.00	28.00	16.67	0.00	50.00	0.00
28.00	44.44	75.00	25.00	66.67	72.00	50.00	22.22	0.00	100.00
60.00	11.11	25.00	25.00	33.33	0.00	33.33	77.78	50.00	0.00
25.00	60.00	20.00	20.00	15.00	25.00	30.00	45.00	80.00	15.00

CANYON FUELS
Dugout Mine
Site G-8
Slope: 1-4 deg
Exposure: S-SW
Sample Date: 5-8 July 2005

18.00	19.00	20.00	Mean	SDev	Freq	
						OVERSTORY
45.00	50.00	0.00	7.75	17.21	20.00	*Pinus ponderosa*
0.00	0.00	0.00	0.75	3.27	5.00	*Pseudotsuga menziesii*
						UNDERSTORY
						SHRUBS
0.00	5.00	0.00	0.25	1.09	5.00	Amelanchier utahenisis
0.00	0.00	0.00	0.75	1.79	15.00	*Artemisia tridentata*
0.00	0.00	0.00	1.10	2.74	15.00	*Cercocarpus montanus*
0.00	0.00	0.00	0.75	1.89	10.00	*Chrysothamnus viscidiflorus*
0.00	0.00	0.00	1.25	4.44	10.00	*Pseudotsuga menziesii*
0.00	0.00	0.00	0.50	2.18	5.00	*Symphoricarpus oreophilus*
						FORBS
0.00	0.00	0.00	1.20	1.75	35.00	*Calochortis nuttalii*
0.00	0.00	0.00	0.25	1.09	5.00	*Castelleja sp.*
5.00	0.00	0.00	0.25	1.09	5.00	*Cirsium sp.*
0.00	0.00	0.00	1.00	1.84	25.00	*Cymopteris sp.*
0.00	0.00	25.00	1.75	5.54	15.00	*Erigeron sp.*
0.00	0.00	0.00	0.65	1.59	15.00	*Haplopappus lanceolatus*
0.00	0.00	0.00	5.85	6.01	60.00	*Hymenoxys acaulus*
0.00	0.00	0.00	0.20	0.60	10.00	*Machaeranthera grindelioides*
0.00	0.00	0.00	1.00	3.39	10.00	*Penstemon watsonii*
0.00	0.00	0.00	0.25	1.09	5.00	*Petrodoria pumila*
0.00	0.00	0.00	0.10	0.44	5.00	*Physaria chambersii*
						GRASSES
10.00	5.00	5.00	6.65	7.09	70.00	*Elymus salinus*
0.00	0.00	0.00	1.50	5.50	10.00	*Poa secunda*
0.00	0.00	0.00	0.50	1.50	10.00	*Stipa hymenoides*
						COVER
45.00	50.00	0.00	8.50	17.18		Overstory
15.00	10.00	30.00	25.75	11.54		Understory
75.00	85.00	60.00	21.75	25.85		Litter
9.00	3.00	5.00	29.50	25.66		Bareground
1.00	2.00	5.00	23.00	24.60		Rock
						% COMPOSITION
0.00	50.00	0.00	18.21	18.64		Shrubs
33.33	0.00	83.33	52.04	28.67		Forbs
66.67	50.00	16.67	29.75	24.05		Grasses
60.00	60.00	30.00	34.25	19.38		Overstory + Understory

CANYON FUELS

Dugout Mine

Site G-8 **Reference Area**

Slope: 2-10 deg

Exposure: S-SW

Sample Date: 5-8 July 2005	1.00	2.00	3.00	4.00	5.00	6.00
OVERSTORY						
Pinus ponderosa	50.00	0.00	0.00	0.00	10.00	0.00
UNDERSTORY						
SHRUBS						
Artemisia tridentata	0.00	0.00	0.00	0.00	0.00	0.00
Cercocarpus montanus	0.00	0.00	0.00	0.00	0.00	0.00
Juniperus osteosperma	0.00	0.00	0.00	0.00	0.00	0.00
Pinus ponderosa	5.00	0.00	0.00	0.00	0.00	0.00
Pseudotsuga menziesii	2.00	0.00	0.00	20.00	0.00	0.00
Symphoricarpus oreophilus	5.00	0.00	0.00	0.00	0.00	0.00
FORBS						
Calochortis nuttalii	0.00	0.00	0.00	5.00	5.00	5.00
Cymopteris sp.	0.00	5.00	0.00	0.00	0.00	0.00
Erigeron sp.	3.00	0.00	2.00	2.00	3.00	10.00
Haplopappus lanceolatus	0.00	5.00	5.00	3.00	0.00	0.00
Hymenoxys acaulus	3.00	25.00	1.00	0.00	7.00	0.00
Linum lewsii	0.00	0.00	0.00	0.00	0.00	0.00
Machaeranthera grindelioides	0.00	5.00	5.00	0.00	0.00	0.00
Penstemon watsonii	0.00	0.00	0.00	0.00	0.00	0.00
Physaria chambersii	0.00	0.00	2.00	0.00	0.00	0.00
Steptanthus cordatus	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES						
Elymus salinus	7.00	0.00	0.00	5.00	10.00	35.00
Poa secunda	0.00	5.00	0.00	0.00	0.00	0.00
Stipa hymenoides	0.00	0.00	5.00	0.00	0.00	0.00
COVER						
Overstory	50.00	0.00	0.00	0.00	10.00	0.00
Understory	25.00	45.00	20.00	35.00	25.00	50.00
Litter	65.00	40.00	65.00	15.00	45.00	25.00
Bareground	5.00	10.00	10.00	45.00	15.00	15.00
Rock	5.00	5.00	5.00	5.00	15.00	10.00
% COMPOSITION						
Shrubs	48.00	0.00	0.00	57.14	0.00	0.00
Forbs	24.00	88.89	75.00	28.57	60.00	30.00
Grasses	28.00	11.11	25.00	14.29	40.00	70.00
Overstory + Understory	75.00	45.00	20.00	35.00	35.00	50.00

7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00
0.00	0.00	55.00	40.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	10.00	0.00	5.00	0.00	0.00
0.00	5.00	0.00	5.00	0.00	0.00	0.00	5.00	5.00
0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00
5.00	5.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	3.00	0.00	0.00	0.00
5.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	5.00	10.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00
0.00	0.00	0.00	0.00	5.00	10.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
0.00	0.00	0.00	0.00	0.00	5.00	0.00	2.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	0.00
10.00	10.00	10.00	5.00	20.00	15.00	15.00	10.00	5.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
0.00	0.00	55.00	40.00	0.00	0.00	0.00	0.00	0.00
20.00	35.00	10.00	15.00	35.00	35.00	35.00	40.00	10.00
55.00	45.00	85.00	80.00	55.00	10.00	15.00	15.00	5.00
20.00	10.00	4.00	3.00	9.00	30.00	45.00	30.00	75.00
5.00	10.00	1.00	2.00	1.00	25.00	5.00	15.00	10.00
0.00	42.86	0.00	33.33	28.57	0.00	14.29	12.50	50.00
50.00	28.57	0.00	33.33	14.29	57.14	42.86	50.00	0.00
50.00	28.57	100.00	33.33	57.14	42.86	42.86	37.50	50.00
20.00	35.00	65.00	55.00	35.00	35.00	35.00	40.00	10.00

CANYON FUELS
Dugout Mine
Site G-8 **Reference Area**
Slope: 2-10 deg
Exposure: S-SW
Sample Date: 5-8 July 2005

Mean	SDev	Freq	
			OVERSTORY
10.33	19.36	20.00	*Pinus ponderosa*
			UNDERSTORY
			SHRUBS
1.00	2.71	10.00	*Artemisia tridentata*
1.33	2.21	20.00	*Cercocarpus montanus*
0.67	2.49	5.00	*Juniperus osteosperma*
0.33	1.25	5.00	*Pinus ponderosa*
1.47	4.98	10.00	*Pseudotsuga menziesii*
0.33	1.25	5.00	*Symphoricarpus oreophilus*
			FORBS
1.13	2.00	20.00	*Calochortis nuttalii*
1.33	2.21	20.00	*Cymopteris sp.*
1.53	2.58	30.00	*Erigeron sp.*
1.87	2.33	30.00	*Haplopappus lanceolatus*
3.40	6.51	30.00	*Hymenoxys acaulus*
0.33	1.25	5.00	*Linum lewsii*
1.67	2.98	20.00	*Machaeranthera grindelioides*
0.33	1.25	5.00	*Penstemon watsonii*
0.60	1.36	15.00	*Physaria chambersii*
0.20	0.75	5.00	*Steptanthus cordatus*
			GRASSES
10.47	8.39	65.00	*Elymus salinus*
0.33	1.25	5.00	*Poa secunda*
0.67	1.70	10.00	*Stipa hymenoides*
			COVER
10.33	19.36		Overstory
29.00	11.86		Understory
41.33	25.26		Litter
21.73	19.44		Bareground
7.93	6.26		Rock
			% COMPOSITION
19.11	21.16		Shrubs
38.84	24.52		Forbs
42.04	21.59		Grasses
39.33	16.42		Overstory + Understory

CANYON FUELS

Dugout Mine

Site G-9

Slope: 3-18 deg

Exposure: S

Sample Date: 5-9 July 2005	1.00	2.00	3.00	4.00	5.00	6.00	7.00
OVERSTORY							
Pseudotsuga menziesii	0.00	0.00	0.00	0.00	0.00	0.00	0.00
UNDERSTORY							
SHRUBS							
Amelanchier utahenisis	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cercocarpus montanus	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chrysothamnus viscidiflorus	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mahonia repens	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Symphoricarpus oreophilus	3.00	0.00	0.00	0.00	0.00	0.00	0.00
FORBS							
Cirsium sp.	7.00	5.00	0.00	0.00	0.00	3.00	0.00
Cryptantha flavoculata	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cynoglossum officinale	10.00	55.00	0.00	20.00	10.00	7.00	10.00
Haplopappus lanceolatus	0.00	5.00	7.00	0.00	0.00	0.00	10.00
Machaeranthera grindelioides	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES							
Bromus tectorum	0.00	5.00	0.00	10.00	0.00	0.00	0.00
Elymus salinus	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poa pratensis	0.00	0.00	0.00	0.00	0.00	50.00	5.00
Stipa hymenoides	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COVER							
Overstory	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Understory	20.00	70.00	7.00	30.00	10.00	60.00	25.00
Litter	2.00	18.00	23.00	25.00	30.00	18.00	10.00
Bareground	60.00	10.00	65.00	40.00	55.00	20.00	60.00
Rock	18.00	2.00	5.00	5.00	5.00	2.00	5.00
% COMPOSITION							
Shrubs	15.00	0.00	0.00	0.00	0.00	0.00	0.00
Forbs	85.00	92.86	100.00	66.67	100.00	16.67	80.00
Grasses	0.00	7.14	0.00	33.33	0.00	83.33	20.00
Overstory + Understory	20.00	70.00	7.00	30.00	10.00	60.00	25.00

8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
0.00	0.00	0.00	0.00	0.00	0.00	25.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	15.00	0.00
0.00	0.00	7.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	35.00	0.00	10.00	0.00
0.00	0.00	0.00	20.00	2.00	0.00	5.00	0.00	0.00	5.00
0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	8.00	0.00	0.00	0.00	0.00	2.00
20.00	15.00	15.00	10.00	7.00	35.00	0.00	0.00	0.00	0.00
5.00	3.00	5.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
5.00	0.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
20.00	2.00	40.00	0.00	13.00	10.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	25.00	0.00	0.00	0.00
50.00	20.00	70.00	30.00	30.00	50.00	50.00	10.00	35.00	20.00
4.00	10.00	4.00	4.00	10.00	5.00	5.00	1.00	5.00	5.00
45.00	65.00	25.00	65.00	50.00	5.00	40.00	75.00	50.00	15.00
1.00	5.00	1.00	1.00	10.00	40.00	5.00	14.00	10.00	60.00
0.00	0.00	10.00	66.67	6.67	0.00	100.00	100.00	71.43	25.00
50.00	90.00	28.57	33.33	50.00	80.00	0.00	0.00	14.29	25.00
50.00	10.00	61.43	0.00	43.33	20.00	0.00	0.00	14.29	50.00
50.00	20.00	70.00	30.00	30.00	50.00	75.00	10.00	35.00	20.00

CANYON FUELS
Dugout Mine
Site G-9
Slope: 3-18 deg
Exposure: S
Sample Date: 5-9 July 2005

18.00	19.00	20.00	Mean	SDev	Freq	
						OVERSTORY
40.00	15.00	15.00	4.75	10.54	20.00	*Pseudotsuga menziesii*
						UNDERSTORY
						SHRUBS
0.00	0.00	0.00	0.50	2.18	5.00	Amelanchier utahenisis
0.00	0.00	0.00	1.25	3.83	10.00	*Cercocarpus montanus*
0.00	0.00	0.00	0.35	1.53	5.00	*Chrysothamnus viscidiflorus*
5.00	0.00	0.00	2.50	7.83	15.00	*Mahonia repens*
0.00	0.00	8.00	2.15	4.66	30.00	*Symphoricarpus oreophilus*
						FORBS
0.00	0.00	0.00	1.00	2.10	20.00	*Cirsium sp.*
0.00	0.00	0.00	0.50	1.77	10.00	*Cryptantha flavoculata*
0.00	0.00	2.00	10.80	13.54	60.00	*Cynoglossum officinale*
5.00	0.00	0.00	2.25	3.01	40.00	*Haplopappus lanceolatus*
0.00	0.00	0.00	0.15	0.65	5.00	*Machaeranthera grindelioides*
						GRASSES
0.00	0.00	0.00	1.15	2.57	20.00	*Bromus tectorum*
5.00	10.00	0.00	1.25	3.11	15.00	*Elymus salinus*
0.00	0.00	0.00	7.00	13.82	35.00	*Poa pratensis*
0.00	0.00	0.00	0.25	1.09	5.00	*Stipa hymenoides*
						COVER
40.00	15.00	15.00	4.75	10.54		Overstory
15.00	10.00	10.00	31.10	19.97		Understory
50.00	19.00	15.00	13.15	11.80		Litter
30.00	70.00	70.00	45.75	21.17		Bareground
5.00	1.00	5.00	10.00	14.37		Rock
						% COMPOSITION
33.33	0.00	80.00	25.40	35.46		Shrubs
33.33	0.00	20.00	48.29	34.72		Forbs
33.33	100.00	0.00	26.31	29.27		Grasses
55.00	25.00	25.00	35.85	20.73		Overstory + Understory

CANYON FUELS

Dugout Mine

Site G-10

Slope: 20 deg

Exposure: S

Sample Date: 5-9 July 2005	1.00	2.00	3.00	4.00	5.00	6.00	7.00
OVERSTORY							
Amelanchier utahenisis	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pseudotsuga menziesii	0.00	0.00	0.00	0.00	0.00	0.00	15.00
UNDERSTORY							
SHRUBS							
Agropyron cristatum	5.00	0.00	0.00	0.00	0.00	0.00	0.00
Amelanchier utahenisis	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Artemisia tridentata	0.00	0.00	5.00	0.00	0.00	0.00	0.00
Chrysothamnus viscidiflorus	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gutierrezia sarothrae	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pseudotsuga menziesii	0.00	0.00	0.00	25.00	0.00	0.00	0.00
Symphoricarpus oreophilus	0.00	10.00	0.00	10.00	2.00	0.00	5.00
FORBS							
Cirsium sp.	0.00	0.00	0.00	0.00	3.00	0.00	0.00
Cryptantha flavoculata	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cynoglossum officinale	10.00	5.00	0.00	0.00	0.00	0.00	0.00
Hackelia patens	5.00	0.00	0.00	0.00	0.00	0.00	0.00
Haplopappus lanceolatus	0.00	10.00	8.00	15.00	5.00	0.00	0.00
Penstemon watsonii	0.00	0.00	0.00	0.00	5.00	0.00	0.00
Phlox longifolia	0.00	0.00	2.00	0.00	0.00	0.00	0.00
GRASSES							
Bromus tectorum	5.00	5.00	0.00	0.00	0.00	0.00	0.00
Elymus salinus	0.00	0.00	5.00	0.00	0.00	0.00	0.00
Poa pratensis	15.00	5.00	25.00	10.00	10.00	15.00	55.00
COVER							
Overstory	0.00	0.00	0.00	0.00	0.00	0.00	15.00
Understory	40.00	35.00	45.00	60.00	25.00	15.00	60.00
Litter	10.00	5.00	10.00	5.00	60.00	10.00	30.00
Bareground	45.00	50.00	40.00	30.00	10.00	65.00	9.00
Rock	5.00	10.00	5.00	5.00	5.00	10.00	1.00
% COMPOSITION							
Shrubs	12.50	28.57	11.11	58.33	8.00	0.00	8.33
Forbs	37.50	42.86	22.22	25.00	52.00	0.00	0.00
Grasses	50.00	28.57	66.67	16.67	40.00	100.00	91.67
Overstory + Understory	40.00	35.00	45.00	60.00	25.00	15.00	75.00

8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	50.00	0.00	0.00	0.00	0.00	0.00	25.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	5.00	10.00	0.00	0.00
0.00	5.00	0.00	40.00	0.00	0.00	0.00	0.00	0.00	30.00
10.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	5.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	7.00	0.00	10.00	25.00	10.00	8.00	15.00	10.00
0.00	5.00	8.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	5.00	5.00	0.00	0.00	10.00	5.00	5.00	15.00	0.00
0.00	0.00	5.00	0.00	10.00	0.00	0.00	0.00	0.00	10.00
0.00	10.00	0.00	50.00	0.00	0.00	0.00	0.00	0.00	25.00
20.00	25.00	25.00	40.00	20.00	35.00	20.00	25.00	35.00	50.00
70.00	65.00	10.00	55.00	10.00	10.00	10.00	15.00	15.00	10.00
5.00	9.00	20.00	4.00	15.00	40.00	60.00	45.00	10.00	15.00
5.00	1.00	45.00	1.00	55.00	15.00	10.00	15.00	40.00	25.00
100.00	60.00	0.00	100.00	0.00	0.00	25.00	40.00	0.00	60.00
0.00	20.00	60.00	0.00	50.00	71.43	50.00	40.00	57.14	20.00
0.00	20.00	40.00	0.00	50.00	28.57	25.00	20.00	42.86	20.00
20.00	35.00	25.00	90.00	20.00	35.00	20.00	25.00	35.00	75.00

CANYON FUELS
Dugout Mine
Site G-10
Slope: 20 deg
Exposure: S
Sample Date: 5-9 July 2005

18.00	19.00	20.00	Mean	SDev	Freq	
						OVERSTORY
0.00	0.00	0.00	0.50	2.18	5.00	*Amelanchier utahenisis*
0.00	0.00	0.00	4.50	12.13	15.00	*Pseudotsuga menziesii*
						UNDERSTORY
						SHRUBS
0.00	0.00	0.00	0.25	1.09	5.00	*Agropyron cristatum*
0.00	0.00	0.00	0.50	2.18	5.00	*Amelanchier utahenisis*
0.00	0.00	0.00	0.25	1.09	5.00	*Artemisia tridentata*
0.00	0.00	10.00	0.50	2.18	5.00	*Chrysothamnus viscidiflorus*
10.00	0.00	0.00	1.25	3.11	15.00	*Gutierrezia sarothrae*
0.00	0.00	0.00	5.00	11.51	20.00	*Pseudotsuga menziesii*
15.00	0.00	10.00	3.60	4.97	40.00	*Symphoricarpus oreophilus*
						FORBS
0.00	0.00	0.00	0.15	0.65	5.00	*Cirsium sp.*
0.00	0.00	0.00	0.35	1.15	10.00	*Cryptantha flavoculata*
0.00	0.00	0.00	0.75	2.38	10.00	*Cynoglossum officinale*
0.00	0.00	0.00	0.25	1.09	5.00	*Hackelia patens*
5.00	0.00	5.00	6.65	6.49	65.00	*Haplopappus lanceolatus*
0.00	0.00	0.00	0.90	2.21	15.00	*Penstemon watsonii*
0.00	0.00	0.00	0.10	0.44	5.00	*Phlox longifolia*
						GRASSES
0.00	0.00	0.00	0.50	1.50	10.00	*Bromus tectorum*
0.00	7.00	0.00	2.85	4.10	40.00	*Elymus salinus*
0.00	0.00	5.00	8.25	12.68	55.00	*Poa pratensis*
						COVER
0.00	0.00	0.00	5.00	12.14		Overstory
30.00	7.00	30.00	32.10	13.72		Understory
10.00	23.00	10.00	22.15	21.06		Litter
45.00	50.00	45.00	30.60	19.43		Bareground
15.00	20.00	15.00	15.15	14.85		Rock
						% COMPOSITION
83.33	0.00	66.67	33.09	34.31		Shrubs
16.67	0.00	16.67	29.07	22.45		Forbs
0.00	100.00	16.67	37.83	30.22		Grasses
30.00	7.00	30.00	37.10	21.33		Overstory + Understory

CANYON FUELS
Dugout Mine
Site G-9, G-10 G-11 **Reference Area**
Conifer/ Mtn. Brush
Slope: 25 deg
Exposure: S

Sample Date: 5-9 July 2005	1.00	2.00	3.00	4.00	5.00	6.00	7.00
OVERSTORY							
Amelanchier utahenisis	0.00	0.00	0.00	0.00	0.00	20.00	0.00
Cercocarpus montanus	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pinus edulis	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pseudotsuga menziesii	0.00	25.00	0.00	0.00	0.00	0.00	0.00
UNDERSTORY							
SHRUBS							
Agropyron cristatum	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Amelanchier utahenisis	0.00	0.00	0.00	0.00	0.00	10.00	0.00
Artemisia tridentata	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cercocarpus montanus	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gutierrezia sarothrae	5.00	0.00	2.00	7.00	0.00	0.00	10.00
Pseudotsuga menziesii	0.00	25.00	0.00	0.00	0.00	0.00	0.00
Symphoricarpus oreophilus	0.00	5.00	0.00	0.00	0.00	0.00	0.00
FORBS							
Cryptantha flavoculata	5.00	2.00	0.00	5.00	3.00	0.00	0.00
Cynoglossum officinale	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eriogonum sp.	0.00	0.00	8.00	8.00	0.00	0.00	10.00
Haplopappus lanceolatus	5.00	3.00	0.00	5.00	7.00	5.00	0.00
Machaeranthera grindelioides	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oenothera caespitosa	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES							
Elymus salinus	10.00	5.00	0.00	0.00	10.00	5.00	5.00
Poa pratensis	0.00	0.00	0.00	0.00	15.00	0.00	0.00
COVER							
Overstory	0.00	25.00	0.00	0.00	0.00	20.00	0.00
Understory	25.00	40.00	10.00	25.00	35.00	20.00	25.00
Litter	10.00	10.00	5.00	5.00	25.00	15.00	5.00
Bareground	40.00	40.00	75.00	25.00	35.00	60.00	55.00
Rock	25.00	10.00	10.00	45.00	5.00	5.00	15.00
% COMPOSITION							
Shrubs	20.00	75.00	20.00	28.00	0.00	50.00	40.00
Forbs	40.00	12.50	80.00	72.00	28.57	25.00	40.00
Grasses	40.00	12.50	0.00	0.00	71.43	25.00	20.00
Overstory + Understory	25.00	65.00	10.00	25.00	35.00	40.00	25.00

8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00
0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	50.00	0.00	0.00	0.00
0.00	0.00	0.00	50.00	75.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	40.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	5.00	0.00
10.00	0.00	0.00	0.00	0.00	15.00	0.00	5.00	5.00	5.00
0.00	0.00	0.00	45.00	10.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	35.00	0.00	30.00	5.00	0.00	0.00	15.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	20.00	0.00	0.00	0.00	5.00	0.00	5.00	0.00	5.00
0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00
10.00	20.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	15.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	15.00	50.00	75.00	0.00	50.00	0.00	15.00	0.00
25.00	40.00	75.00	50.00	45.00	35.00	5.00	10.00	35.00	25.00
5.00	10.00	5.00	10.00	15.00	5.00	5.00	10.00	10.00	15.00
60.00	20.00	5.00	20.00	25.00	45.00	15.00	75.00	50.00	45.00
10.00	30.00	15.00	20.00	15.00	15.00	75.00	5.00	5.00	15.00
40.00	0.00	100.00	90.00	100.00	71.43	0.00	50.00	71.43	20.00
20.00	50.00	0.00	0.00	0.00	14.29	100.00	50.00	28.57	20.00
40.00	50.00	0.00	10.00	0.00	14.29	0.00	0.00	0.00	60.00
25.00	40.00	90.00	100.00	120.00	35.00	55.00	10.00	50.00	25.00

CANYON FUELS
Dugout Mine
Site G-9 & G-10 **Reference Are**
Conifer/ Mtn. Brush
Slope: 25 deg
Exposure: S
Sample Date: 5-9 July 2005

18.00	19.00	20.00	Mean	SDev	Freq	
						OVERSTORY
0.00	0.00	0.00	1.75	5.31	10.00	*Amelanchier utahenisis*
0.00	0.00	0.00	0.75	3.27	5.00	*Cercocarpus montanus*
0.00	0.00	0.00	2.50	10.90	5.00	*Pinus edulis*
0.00	0.00	50.00	10.00	21.51	20.00	*Pseudotsuga menziesii*
						UNDERSTORY
						SHRUBS
0.00	0.00	0.00	0.25	1.09	5.00	*Agropyron cristatum*
40.00	10.00	0.00	5.00	12.04	20.00	*Amelanchier utahenisis*
0.00	0.00	5.00	0.25	1.09	5.00	*Artemisia tridentata*
0.00	0.00	0.00	0.50	1.50	10.00	*Cercocarpus montanus*
5.00	5.00	0.00	3.70	4.21	55.00	*Gutierrezia sarothrae*
0.00	0.00	5.00	4.25	10.99	20.00	*Pseudotsuga menziesii*
0.00	5.00	0.00	4.75	9.93	30.00	*Symphoricarpus oreophilus*
						FORBS
0.00	0.00	0.00	0.75	1.61	20.00	*Cryptantha flavoculata*
0.00	0.00	0.00	0.25	1.09	5.00	*Cynoglossum officinale*
0.00	0.00	0.00	1.30	3.12	15.00	*Eriogonum sp.*
0.00	5.00	0.00	3.50	4.54	55.00	*Haplopappus lanceolatus*
0.00	0.00	0.00	0.25	1.09	5.00	*Machaeranthera grindelioides*
0.00	0.00	0.00	0.25	1.09	5.00	*Oenothera caespitosa*
						GRASSES
15.00	0.00	0.00	5.25	6.02	55.00	*Elymus salinus*
0.00	10.00	5.00	1.50	3.91	15.00	*Poa pratensis*
						COVER
0.00	0.00	50.00	15.00	22.47		Overstory
60.00	35.00	15.00	31.75	16.83		Understory
5.00	25.00	5.00	10.00	6.12		Litter
5.00	30.00	5.00	36.50	21.28		Bareground
30.00	10.00	75.00	21.75	20.33		Rock
						% COMPOSITION
75.00	57.14	66.67	48.73	31.58		Shrubs
0.00	14.29	0.00	29.76	28.01		Forbs
25.00	28.57	33.33	21.51	21.44		Grasses
60.00	35.00	65.00	46.75	28.78		Overstory + Understory