VEGETATION SAMPLING AT THE HORIZON COAL MINE SITE

1995

Prepared by

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January 1996

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VEGETATION SAMPLING
AT THE
HORIZON COAL MINE SITE

(1995)

SCOPE

The purpose of this report is to provide quantitative and qualitative data for the vegetation in an area that has been disturbed by previous mining activity. Methodologies follow those in accordance with the State of Utah, Division of Oil, Gas & Mining (DOGM).

INTRODUCTION

General Site Description

The study area lies between 7,500 and 7,700 ft elevation and is the site of previous mining activities that were abandoned in the early 1950s. Old mining structures, building remains and waste can be observed at the site. Consequently, much of the vegetation in the immediate area has been disturbed and is dominated by weedy or early successional plant species (see photographs). Revegetation efforts were apparently not implemented when early mining ended. A variety of activities associated with the early mining operations has produced varying degrees of disturbances to the native vegetation in the area. In an earlier study by *MT. NEBO SCIENTIFIC, INC.* (1991) these disturbance types were classified from "slightly disturbed" to "severely disturbed" and sampled separately.

Previous disturbance and those areas proposed for future disturbance lies in the bottoms and side slopes of drainages (see vegetation sample map). These areas result in several solar exposures, slope angles, soils types and vegetation communities. Because of this and other physiognomic features, the area is transitional between several native plant communities including oak/maple, aspen/fir, Salina wildrye, riparian, chokecherry and sagebrush/grass.

METHODS

Quantitative and qualitative data were taken on the vegetation of the previous disturbed areas of the Horizon Coal Mine site. Sampling was conducted on August 31, 1995.

Transect and Quadrat Placement

Transect lines for sampling were placed randomly in several disturbed areas at the site (see vegetation sample map). The data from all transect lines were combined to obtain average values of the disturbed areas as a whole. Random/regular placement of sampling quadrats were designed to provide unbiased accuracy of the data compiled. Once the transect lines were placed, regular points were then marked on them. From these marks, a random number dictated the direction and distance to place the quadrats at right angles from the transect lines.

Cover and Composition

Cover estimates were made using ocular methods with meter square quadrats. Species composition was also assessed from the quadrat data. 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. 1993).

Frequency

Frequency of a given species was the relative number of times that it occurred in the square meter quadrats.

Woody Species Density

Density of woody plant species of the areas were made using belt transects. These 5 ft by 50 ft transects were placed randomly throughout the study areas. Total number of individuals by species were counted in each of the belt transects. The average number was then calculated followed by the number of individuals per acre.

Sample Adequacy

Sampling adequacy for cover and woody species density was achieved using formulas from Snedocor and Cochran (1980), insuring that 80% of the samples were within 10% of the true mean for the shrub communities of the area. The following formula was used:

$$nmin = \left[\frac{1.28\ (s)}{x\ (.1)}\right]^2$$

where,

nmin = minimum adequate sample
s = standard deviation
x = sample mean
.1 = confidence interval

All sample means, standard deviations, and sample sizes were included in this report to enable the reviewers to apply further statistical tests if desired.

Vegetation Sample Map

A general location map showing the sample transect lines has been included in this report.

Photographs

Color photographs of the sample areas were taken at the time of sampling and have been submitted with this report.

Raw Data

The raw data have been summarized on spreadsheets and have been included in the Appendix of the report.

RESULTS

The total living cover for all disturbed areas combined was estimated to be 48.35% (Table 1). Most of the living cover was comprised of woody species (59.37%) followed by grasses (25.33%) and forbs (15.30%).

The most common plant by far was rubber rabbitbrush (*Chrysothamnus nauseosus*) which constituted 21.75% of the living cover and was present in 87.30% of the quadrats (Table 2). The next most common plant was Salina wildrye (*Elymus salinus*) comprising only 5.50% of the cover. Several forb species were present in the sample quadrats but each were less than 2% cover.

Woody species densities were also recorded in each area. The total density of the disturbed plant communities combined was 7,503 individuals per acre. Rubber rabbitbrush again dominated this parameter at 5,565 individuals per acre or 74.17% of the total (Table 3). Big sagebrush (*Artemisia tridentata*) and broom snakeweed (*Gutierrezia sarothrae*) were the next most common woody species by density.

Because sample methodologies were similar to previous studies in the area, results can be compared easily.

TABLE 1: Total cover and composition summary for all disturbed areas of the Horizon Coal Mine Site (1995).

TOTAL COVER	% MEAN COVER	STANDARD DEVIATION	SAMPLE SIZE
Living Cover	48.35	16.18	40
Litter	8.50	7.00	40
Bareground	21.50	12.85	40
Rock	21.63	19.28	40
COMPOSITION			
Shrubs	59.37	26.87	40
Forbs	15.30	23.40	40
Grasses	25.33	23.83	40

TABLE 2: Species cover and frequency summary for all disturbed areas of the Horizon Coal Mine Site (1995).

SPECIES	% MEAN COVER	STANDARD DEVIATION	SAMPLE SIZE	RELATIVE FREQUENCY
TREES & SHRUBS				
Artemisia tridentata	4.63	10.02	40	25.00
Chrysothamnus nauseosus	21.75	15.59	40	87.30
Gutierrezia sarothrae	0.38	1.73	40	5.00
Rosa woodsii	1.38	7.83	40	5.00
Symphoricarpos oreophilus	2.00	4.00	40	25.00
FORBS				
Achillea millefolium	0.50	1.87	40	7.50
Artemisia dracunculus	1.13	2.37	40	20.00
Aster foliaceus	1.13	3.06	40	15.00
Cynoglossum officinale	0.13	0.78	40	2.50
Epilobium halleanum	0.13	0.78	40	2.50
Eriogonum sp.	0.13	0.78	40	2.50
Machaeranthera canescens	0.75	2.11	40	12.50
Rumux crispus	0.13	0.78	40	2.50
Salsola pestifer	0.13	0.78	40	2.50
Sphaeralcea coccinea	1.38	4.18	40	12.50
Viguiera multiflora	0.13	0.78	40	2.50
GRASSES				
Bromus tectorum	3.00	7.40	40	20.00
Elymus trachycaulus	0.63	2.00	40	10.00
Elymus salinus	5.50	11.50	40	27.50
Elymus spicatus	0.88	3.52	40	7.50
Hordeum jubatum	0.25	1.09	40	5.00
Poa fendleriana	2.13	4.46	40	22.50
Poa pratensis	0.25	1.09	40	5.00

TABLE 3: Woody species densities of all disturbed areas of the Horizon Coal Mine Site (1995).

	NUMBER/ACRE
Artemisia tridentata	794.97
Chrysothamnus nauseosus	5564.79
Chrysothamnus viscidiflorus	10.89
Gutierrezia sarothrae	609.84
Ribes cereum	10.89
Rosa woodsii	98.01
Symphoricarpos oreophilus	413.82
TOTAL	7503.21

COLOR PHOTOGRAPHS

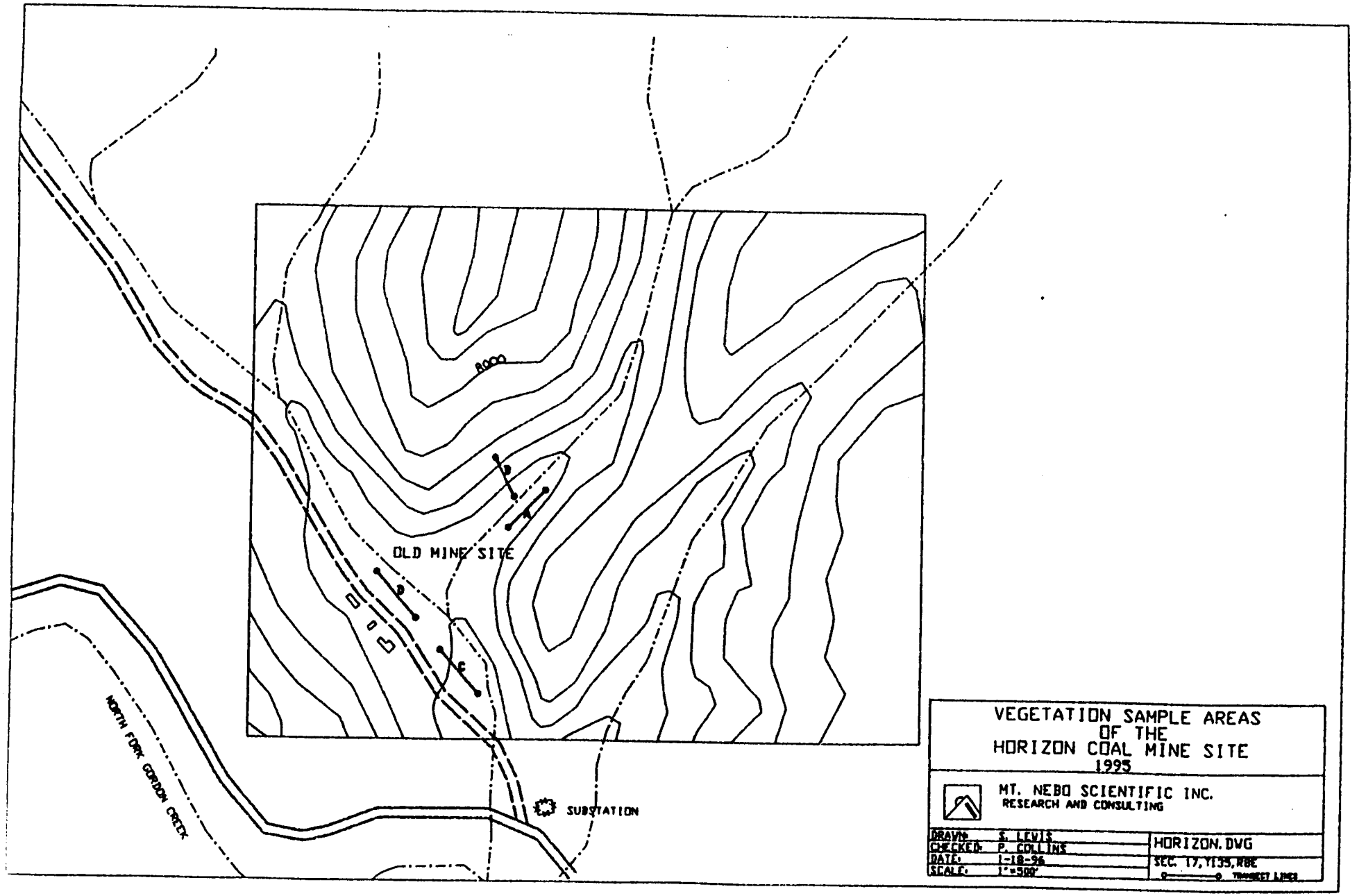
Sample Area "A"

Sample Area "B"

Sample Area "C"

Sample Area "D"

SAMPLE MAP


VEGETATION SAMPLE AREAS
OF THE
HORIZON COAL MINE SITE
1995
MT. NEBO SCIENTIFIC INC.
RESEARCH AND CONSULTING
DRAWN: S. LEVIS
CHECKED: P. COLLINS
DATE: 1-18-96
SCALE: 1"=500'
HORIZON.DWG
SEC. 17, T13S, R8E
TRANSECT LINES
OLD MINE SITE
SUBSTATION
NORTH FORK GORDON CREEK
A
B
C
D
E
F

APPENDIX

(RAW DATA)

EARTHFAX
Blueblaze Mine
Exposure: Variable
Slope: 0 - 3 deg
Area:

A = Severly Disturbed (1-10)

Sample Date: 30 Aug 1995	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
TREES & SHRUBS										
Chrysothamnus nauseosus	45.00	0.00	0.00	0.00	0.00	0.00	10.00	5.00	15.00	5.00
Artemisia tridentata	0.00	0.00	20.00	0.00	0.00	0.00	5.00	10.00	0.00	0.00
Symphoricarpos oreophilus	0.00	0.00	0.00	0.00	5.00	15.00	5.00	0.00	15.00	10.00
Gutierrezia sarothrae	0.00	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00
Rosa woodsii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FORBS										
Aster foliaceus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00
Macheranthera canescens	0.00	0.00	5.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
Artemisia dracunculus	5.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00
Eriogonum sp.	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Salsola pestifer	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Epolobium halleanum	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00
Viguiera multiflora	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rumex crispus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cynoglossum officinale	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Achillea millefolium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sphaeralcea coccinea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GRASSES										
Bromus tectorum	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	30.00
Elymus salinus	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	25.00	15.00
Elymus spicatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hordeum jubatum	0.00	0.00	0.00	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	0.00	0.00	0.00	0.00	0.00
Elymus trachycaulus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poa fendleriana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COVER										
Total Living Cover	50.00	10.00	25.00	15.00	15.00	20.00	30.00	25.00	55.00	60.00
Litter	10.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	10.00	10.00
Bareground	30.00	10.00	10.00	10.00	55.00	20.00	25.00	20.00	5.00	25.00
Rock	10.00	75.00	60.00	70.00	25.00	55.00	40.00	50.00	30.00	5.00
% COMPOSITION										
Shrubs	90.00	0.00	80.00	0.00	33.33	75.00	100.00	60.00	54.55	25.00
Forbs	10.00	100.00	20.00	100.00	0.00	0.00	0.00	40.00	0.00	0.00
Grasses	0.00	0.00	0.00	0.00	66.67	25.00	0.00	0.00	45.45	75.00

B = Slightly Disturbed (11-20)

11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00	24.00
5.00	45.00	5.00	20.00	10.00	25.00	10.00	15.00	15.00	10.00	40.00	35.00	20.00	50.00
0.00	0.00	0.00	20.00	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	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	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	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	5.00	0.00	0.00	5.00	0.00	0.00	5.00	0.00
10.00	5.00	5.00	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	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	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	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	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
25.00	5.00	25.00	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	35.00	45.00	35.00	10.00	30.00	5.00	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	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	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	0.00	0.00	0.00	0.00	0.00	0.00	10.00	10.00	10.00
40.00	65.00	50.00	45.00	50.00	70.00	55.00	35.00	45.00	35.00	60.00	50.00	45.00	60.00
5.00	5.00	10.00	45.00	10.00	20.00	10.00	5.00	15.00	20.00	10.00	5.00	5.00	5.00
45.00	25.00	30.00	5.00	5.00	5.00	10.00	10.00	5.00	20.00	5.00	20.00	30.00	10.00
10.00	5.00	10.00	5.00	35.00	5.00	25.00	50.00	35.00	25.00	25.00	25.00	20.00	25.00
12.50	69.23	10.00	88.89	30.00	35.71	18.18	57.14	33.33	57.14	75.00	70.00	44.44	83.33
25.00	7.69	40.00	0.00	0.00	0.00	18.18	14.29	0.00	28.57	16.67	10.00	22.22	0.00
62.50	23.08	50.00	11.11	70.00	64.29	63.64	28.57	66.67	14.29	8.33	20.00	33.33	16.67

C = Disturbed (21 - 30)

D = Disturbed (31 - 40)

25.00	26.00	27.00	28.00	29.00	30.00	31.00	32.00	33.00	34.00	35.00	36.00	37.00
30.00	35.00	30.00	35.00	40.00	10.00	30.00	55.00	40.00	20.00	25.00	30.00	15.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00	25.00	15.00	20.00
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	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	0.00
0.00	5.00	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	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	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	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	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	10.00	15.00
5.00	0.00	10.00	15.00	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
0.00	0.00	0.00	0.00	0.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	5.00	5.00	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	5.00	10.00	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	5.00	5.00	5.00	0.00	0.00	0.00	10.00	0.00
35.00	50.00	50.00	60.00	55.00	65.00	55.00	70.00	50.00	70.00	60.00	65.00	55.00
5.00	5.00	5.00	10.00	5.00	5.00	10.00	5.00	5.00	5.00	5.00	5.00	5.00
50.00	25.00	20.00	15.00	35.00	25.00	30.00	20.00	40.00	20.00	30.00	25.00	35.00
10.00	20.00	25.00	15.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
85.71	70.00	60.00	58.33	72.73	92.31	54.55	78.57	80.00	100.00	83.33	69.23	72.73
0.00	10.00	20.00	0.00	0.00	0.00	0.00	0.00	20.00	0.00	16.67	15.38	27.27
14.29	20.00	20.00	41.67	27.27	7.69	45.45	21.43	0.00	0.00	0.00	15.38	0.00

EARTHFAX
Blueblaze Mine
Exposure: Variable
Slope: 0 - 3 deg
Area:
Sample Date: 30 Aug 1995

38.00	39.00	40.00	Mean	SDev	Freq	
						TREES & SHRUBS
35.00	40.00	15.00	21.75	15.59	87.50	Chrysothamnus nauseosus
0.00	10.00	0.00	4.63	10.02	25.00	Artemisia tridentata
0.00	5.00	10.00	2.00	4.00	25.00	Symphoricarpos oreophilus
0.00	0.00	0.00	0.38	1.73	5.00	Gutierrezia sarothrae
0.00	0.00	5.00	1.38	7.83	5.00	Rosa woodsii
						FORBS
15.00	0.00	0.00	1.13	3.06	15.00	Aster foliaceus
0.00	0.00	0.00	0.75	2.11	12.50	Macheranthera canescens
0.00	0.00	0.00	1.13	2.37	20.00	Artemisia dracunculus
0.00	0.00	0.00	0.13	0.78	2.50	Eriogonum sp.
0.00	0.00	0.00	0.13	0.78	2.50	Salsola pestifer
0.00	0.00	0.00	0.13	0.78	2.50	Epolobium halleanum
0.00	0.00	0.00	0.13	0.78	2.50	Viguiera multiflora
0.00	0.00	0.00	0.13	0.78	2.50	Rumex cripus
0.00	0.00	0.00	0.13	0.78	2.50	Cynoglossum officinale
0.00	0.00	0.00	0.50	1.87	7.50	Achillea millefolium
20.00	0.00	0.00	1.38	4.18	12.50	Sphaeralcea coccinea
						GRASSES
0.00	0.00	0.00	3.00	7.40	20.00	Bromus tectorum
0.00	0.00	0.00	5.50	11.50	27.50	Elymus salinus
0.00	0.00	0.00	0.88	3.52	7.50	Elymus spicatus
0.00	0.00	0.00	0.25	1.09	5.00	Hordeum jubatum
0.00	0.00	0.00	0.25	1.09	5.00	Poa pratensis
0.00	0.00	0.00	0.63	2.00	10.00	Elymus trachycaulus
0.00	10.00	20.00	2.13	4.46	22.50	Poa fendleriana
						COVER
70.00	65.00	50.00	48.38	16.18		Total Living Cover
10.00	10.00	10.00	8.50	7.00		Litter
5.00	15.00	35.00	21.50	12.85		Bareground
15.00	10.00	5.00	21.63	19.28		Rock
						% COMPOSITION
50.00	84.62	60.00	59.37	26.87		Shrubs
50.00	0.00	0.00	15.30	23.40		Forbs
0.00	15.38	40.00	25.33	23.83		Grasses