SWRHL - 52

RANGE SURVEY, AREA 18, NEVADA TEST SITE

by
Kenneth W. Brown and Benjamin J. Mason

Bioenvironmental Research
Southwestern Radiological Health Laboratory

Department of Health, Education, and Welfare
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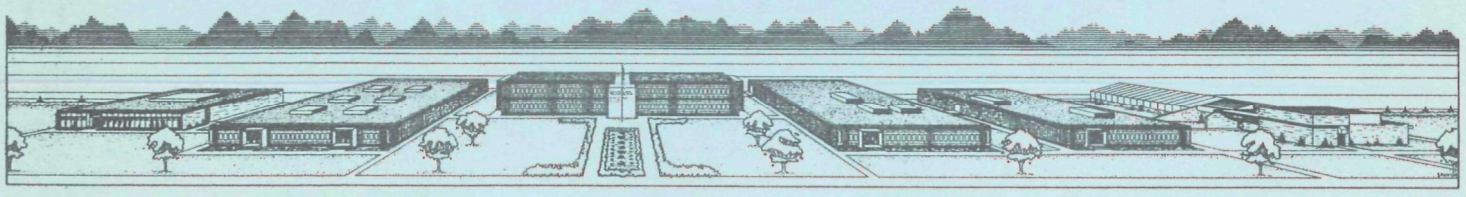

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INTRODUCTION

A herd of beef cattle has been maintained on the Nevada Test Site for approximately 11 years. This herd, which numbers between 50 and 70 animals, was originally established in 1957 by the Atomic Energy Commission to provide background information regarding various claims, complaints, and inquiries from local off-site livestock ranchers.

On 1 June 1964, the U. S. Atomic Energy Commission transferred the responsibilities of this beef herd to the U. S. Public Health Service. In addition to managing the beef herd, the P. H. S. collects information concerning the uptake and retention of radionuclides in the tissues of these animals.[1]

During the last four years, considerable research has been conducted concerning the uptake and retention of radionuclides in various tissues of these ruminant animals. However, little or no information concerning the grazing habitats of these animals during this period is available.

In August of 1966, a project was initiated by the Agrology Section to characterize the vegetational environment of these cattle. This project was designed to identify the plant communities, to map species and their distribution on the grazing site, and to establish the percentage ground cover and the percentage species composition in the designated plant communities.

A detailed study of this nature for a portion of the Nevada Test Site, coupled with the ingesta study being carried on by the Animal Investigation Program and the University of Nevada at Reno, would allow a more accurate prediction of what plant species the beef cattle utilize.

STUDY AREA

The area surveyed lies predominantly in Townships 9 and 10 South, Range 50 and 51 East, in Area 18 of the Nevada Test Site. The boundaries of the study area are Buckboard Mesa to the west, the Pahute Mesa foothills to the north and Ammonia Tank Mesa to the east. The southern boundary is approximately 1½ miles south of the Area 18 air strip. The total area encompasses approximately 13,630 acres. The topography of the area is variable. The valley washes, lying at about 4,800 feet elevation, are interrupted by numerous ridges rising to 6,200 feet elevation. Much of the area, especially to the north, occurs on alluvial fans originating from the Pahute Mesa front. Approximately 1,500 acres of the climax vegetation on these fans were burned off during a range fire on June 19, 1959.[2] (See Appendix I.)

There are no records of climatic conditions in this immediate area. However, the study area can be classified as being semiarid. Precipitation, from 4 to 12 inches per year, tends to be more abundant in the non-growing seasons. Rains are at times localized, therefore, monthly rainfall may vary considerably from year to year. Snow commonly falls during the winter, but does not remain on the ground for long periods.

Temperatures in the study area can be classified as being extreme. Seasonal temperature fluctuations commonly vary between 10^{o} F. and 100^{o} F.

This area, until recent years, was used primarily for atmospheric nuclear testing. Three testing sites are noted to be within the boundaries. All three were part of the Department of Defense's Operation Storax.

These atmospheric tests were named and detonated as follows:

1. Little Feller II, July 7, 1962.
2. Johnny Boy, July 11, 1962.
3. Little Feller I, July 17, 1962.

There is notable vegetation damage in the immediate vicinity of each of the detonation sites, particularly north of Johnny Boy. Prior to 1962 numerous atmospheric tests were conducted around the periphery of the study area, primarily, on the southern and western edges.

METHODS

The ocular reconnaissance method of surveying vegetation was used to satisfy all of the required objectives.[3] This method is a standard procedure for surveying vegetation of a homogenous nature. It is particularly useful in establishing percentage ground cover and percentage species composition in a given range vegetation type.

The procedures involve the use of line transects, in which species are tabulated as they occur along a line. The method is rapid and gives accurate information, providing the vegetation has the same growth form and the same average crown diameter throughout. It is particularly useful in dense stands of scrubby vegetation, which would be very difficult to sample by other methods.

Ten 100-foot cross transects and 223 one hundred-foot transects were established within the study area. A 100-foot steel tape measure was used. The tape was suspended 2 inches above the crown height of the vegetation by the use of precut wooden stakes driven into the ground at points 100 feet apart. Sampling points were located at 1-inch intervals along this tape. A species was considered present if it was touched by a line dropped perpendicular from the tape at the sampling point.

During the survey, a total of 291,600 points were sampled in the study area. The data was recorded on range write-up sheets. (See Appendix II.)

The transects were established in vegetation stands that were considered to be most representative of the particular area under consideration. A minimum of two transects was established within the boundaries of these vegetation stands. This procedure was beneficial in that it gave a more complete picture of the individual stand by having two or more sampling locations.

The transects were identified by a consecutive numbering system from B-1 through B-233. They are also identified by a numbering system delineating the plant community and a lettering system identifying the dominant species within the community. The numbering system delineating plant communities are standard Bureau of Land Management numbering symbols. There are a total of 18 different numbers for 18 different plant communities; however, only four numbers were used in this range survey.

1 - Grass	Perennial grasses predominate and determine the aspect, although forbs and shrubs may be present.
4 - Sagebrush	Includes all areas where sagebrush predominates. Shrubby species of similar character may also be present (two communities).
16 - Desert Shrub	This is a general type which includes areas where other desert shrubs aside from those separated into individual types constitute the predominant vegetation.
18 - Annuals	This type includes areas in which annual forbs constitute the dominant vegetation (two communities).

An example of a transect identification symbol is: $\frac{(1)\ \text{Hija}}{\text{B-5}}$

(1) = type of plant community

Hija = *Hilaria jamesii*--First two letters of the genus and the first two letters of the species.

B-5 = fifth transect established.

Aerial photographs for this project were taken during the latter part of 1966. They were used as an aid in establishing transect locations and in vegetative mapping. Individual species were mapped according to their composition within the stand. The composition ratings are based on the proportion of the total vegetation provided by each species. The species

maps were made to overlay on two base maps, one being a transect and road map and the other a plant community map. The use of overlays gives a better perspective as to location, abundance, and area covered by an individual species. The overlay maps show the abundance and distribution of the species listed in Table 1. (Persons interested in observing the maps should contact the authors.)

Table 1. Mapped Species List

Species	Common Name
1. *Artemisia arbuscula* subsp. *nova*	Black sagebrush
2. *Artemisia spinescens*	Bud sagebrush
3. *Artemisia tridentata*	Big sagebrush
4. *Atriplex canescens*	Four-winged saltbush
5. *Atriplex confertifolia*	Shadscale
6. *Bouteloua barbata*	Six-weeks grama grass
7. *Bromus rubens*	Red bromegrass
8. *Bromus tectorum*	Cheat grass
9. *Chrysothamnus nauseosus*	Big rabbitbrush
10. *Chrysothamnus viscidiflorus*	Little rabbitbrush
11. *Cowania mexicana* var. *stansburiana*	Cliff rose
12. *Dalea fremontii*	Fremont dalea
13. *Ephedra nevadensis*	Mormon tea
14. *Ephedra viridis*	Mountain joint-fir
15. *Eriogonum umbellatum*	Woody buckwheat
16. *Eurotia lanata*	Winter fat
17. *Grayia spinosa*	Spiny hop-sage
18. *Hilaria jamesii*	Galleta grass
19. *Hymenoclea salsola*	Cheese bush
20. *Lycium andersonii*	Anderson thornbush
21. *Orhyzopsis hymenoides*	Indian rice grass
22. *Salsola kali* var. *tenuifolia*	Russian thistle
23. *Sitanion hystrix*	Squirrel tail grass
24. *Stipa speciosa*	Desert needlegrass
25. *Tetradymia axillaris*	Horsebrush
26. *Tetradymia glabrata*	Little-leaf horsebrush
27. *Thamnosma montana*	Rue

RESULTS

Six plant communities were identified in the study area (See Appendix VII). These six communities were classified entirely by structural features, such as dominant species and life forms. Three of the communities, *Artemisia arbuscula* subsp. *nova*, *Artemisia tridentata*, and Desert Shrub, were considered to be in the final or mature stage, commonly identified as being in climax. The other three, Grass, *Salsola kali* var. *tenuifolia*, and *Eriogonum spp.*, are in a successional stage. There were 36 families and 85 species noted in the study area. (See Appendix III for family and species list.)

Artemisia arbuscula subsp. *nova* Community

The *A. arbuscula* subsp. *nova* community occupies 6,337 acres of the study area. It is best identified by its grayish-green coloration. This community is commonly found growing at higher elevations. Favorite habitats are hilltops, ridges, and steep slopes.

Soils generally are shallow and rocky. The total ground cover is 24.1%. The community is predominantly made up of shrubs. Shrub ground cover is 21.6%, grasses 2.1%, and forbs .4%.

The dominant shrub is *A. arbuscula* subsp. *nova*, black sagebrush. This species is a small bush 7 to 13 inches high. It makes up 57.2% of the composition and 13.4% of the total ground cover. Many other species occur, of course. Some of these include *Ephedra nevadensis*-Mormon tea, *Chrysothamnus viscidiflorus*-little rabbitbrush, *Grayia spinosa*-spiny hop-sage, *Atriplex canescens*-four-winged saltbush, and *Eurotia lanata*-winter fat. The more important grass and forb species include *Sitanion hystrix*-squirrel tail, *Stipa speciosa*-desert needlegrass, *Hilaria jamesii*-galleta grass, and *Sphaeralcea ambigua*-desert mallow. (For results of the *A. arbuscula* subsp. *nova* Community, see Appendix IV, Table IV-A.)

Artemisia tridentata Community

The *A. tridentata* plant community occupies 1,632 acres of the study area. Coloration is somewhat like that of the *A. arbuscula* community; however, it is generally lighter in color. This community is confined primarily to the bottom of the washes and out-wash areas. The soils tend to be quite deep and coarse. The total ground cover is 29.2%. The community is predominantly made up of shrubs. Shrub ground cover is 24.4%, grasses 3.0%, and forbs 1.8%.

The dominant species, *Artemisia tridentata* is a many-branched shrub standing from 1½ to 5 feet high, usually with a definite trunk and emitting an aromatic odor. It makes up 33.9% of the composition and 10.2% of the total ground cover.

Many other species occur in this community. The dominant shrubs in order of their importance include *Ephedra nevadensis, Atriplex canescens, Chrysothamnus viscidiflorus, Grayia spinosa,* and *Cowania mexicana* var. *stansburiana,* cliff rose. The important grass species are *Sitanion hystrix, Orhyzopsis hymenoides, Hilaria jamesii,* and *Stipa speciosa.* The dominant forbs are *Eriogonum spp.* (For results of the *A. tridentata* Community, see Appendix IV, Table IV-β.)

Desert Shrub Community

The desert shrub community occupies 3,521 acres. This community is normally found growing in the shallow valley basins and extending to some extent up the lower slopes of the foothills. The shrubs are usually spaced from 10 to 20 feet apart, a characteristic which sets off this community from the two sagebrush communities. During the spring months many low annuals occur between the shrubs. The soils are similar to those found in *Artemisia tridentata* community being relatively deep and sandy.

The desert shrub community consists of many species of different families. In respect to their systematic relationship, the desert shrubs are less homogeneous than either of the two sagebrush communities.

An aerial view of this community would reveal distinct color tones due to the foliage, stems, and branches of the plants. Mormon tea has a brownish hue. However, in many areas *Grayia spinosa* occurs in such abundance as to give a blue-gray aspect. During the spring months, this area would appear a vivid green due to the abundance of summer annuals.

The total ground cover is 26.8%. Like the two sagebrush communities, it is predominantly made up of shrubs. The total shrub ground cover is 20.2%, grasses 4.9%, and forbs 1.7%.

The most abundant species is *Ephedra nevadensis*. It makes up 18.7% of the composition and 4.9% of the ground cover. The other dominants in order of importance include *Grayia spinosa*, *Tetradymia glabrata*, and *Chrysothamnus viscidiflorus*. Important grasses are *Hilaria jamesii*, *Orhyzopsis hymenoides*, *Sitanion hystrix*, and *Stipa speciosa*. Important forbs are *Eriogonum spp.* and *Sphaeralcea ambigua*, globe mallow. (For results of the Desert Shrub Community, see Appendix IV, Table IV-C.)

Because the desert shrub community is made up of several dominant species, subtype designations were assigned. There are many different shrub species noted. However, only five were considered to be of major importance for subtype classification.

Subtype classifications:
Community - Desert Shrub
Subtype -

Ephedra nevadensis	Mormon tea
Grayia spinosa	Spiny hop-sage
Chrysothamnus	Rabbitbrush
Atriplex canescens	Four-winged saltbush
Tetradymia glabrata	Little-leaf horsebrush

(For results of the subtypes see Appendix V, Tables IV-A-E.)

Many of the vegetation species were not confined within specific community boundaries. Because of this, a composite of the three climax

communities was completed. The order of dominance for each individual species could then be correctly evaluated throughout the total climax. Data revealed that the total vegetation ground cover is 26.7%. The shrub ground cover being 21.4%, grass 4.4%, and forbs .9%. (For complete results refer to Appendix VI.)

The Grass Community

The grass community, which occupies 1,856 acres of the study area, is located in the burned areas. This community, which is almost exclusively grass and forbs, originated after a range fire in 1959. (See Appendix I.) The fire changed existing natural conditions. It destroyed the climax vegetation leaving the soil surface exposed to erosion. Following these changes, new species invaded the area. The first invaders into this area were mobile annuals. *Salsola kali* var. *tenuifolia* and species of Brome grasses were the primary invaders. Remnants of these pioneer species can still be observed throughout the burned area. However, with time perennial grasses have become established and are now dominant.

The grass community is made up of four dominant *Gramineae* genera, *Hilaria, Stipa, Orhyzopsis* and *Bromus*. Species distribution and composition vary throughout this community. The average total ground cover for the grass community is 29.7%. The grasses make up 20.1% of the ground cover, shrubs 2.4%, and forbs 7.2%.

The primary species is *Hilaria jamesii*, galleta grass. Galleta is a perennial growing from 12 to 20 inches tall. The leaves are mostly basal, fairly rigid, and bluish-green in color. The flower heads are purplish in color, fading to almost white at maturity. As a result of its woody rhizomes, it grows in large patches. This species makes up 25.4% of the composition and 7.8% of the total ground cover.

Many other species occur in this community. The dominant grasses in order of their importance include *Stipa speciosa, Bromus tectorum, B. rubens*, and *Orhyzopsis hymenoides*. The important shrubs include *Ephedra nevadensis* and *Grayia spinosa*. The dominant forb is the

pioneer invader *Salsola kali* var. *tenuifolia*. (For results of the Grass Community, see Appendix IV, Table IV-D.)

Salsola kali var. *tenuifolia* Community

The *Salsola kali* var. *tenuifolia*, Russian thistle, plant community occupies 267 acres of the study area. It is confined solely to areas of soil disturbance. This community is located in the immediate vicinity of the three mentioned nuclear testing sites and along the main gravel roads. It exists also as a remnant in many areas of the grass community. As succession progresses, it will in time be replaced by perennial grasses. The total ground cover is 26.6%. Forbs make up 26.3%, shrubs .3%; and there are only trace amounts of grasses.

Salsola kali var. *tenuifolia* is an intricately branched bushy annual growing from ½ to 2 feet tall. The stems are ridged and often reddish in color, especially at maturity. The leaves are ½ to 2 inches long, awl-shaped, and end in a spine. It makes up 95.3% of the composition and 25.3% of the ground cover. (For results of the *Salsola kali* var. *tenuifolia* Community, see Appendix IV, Table IV-E.)

Eriogonum Plant Community

The *Eriogonum* plant community is located primarily along the graveled roads. It consists of many species belonging to the genus *Eriogonum* commonly referred to as buckwheats. This community is similar to the Russian thistle community in that it grows normally on disturbed soil sites. Also, these species are invaders and exclusively annuals.

During the spring and summer months, this community is vivid green in color. However, during the early fall it turns dark brown.

The buckwheats are perhaps best identified by their umbrella shape. They grow from 2 inches to 1 foot in height. The leaves are mostly basal. The small flowers are usually white in color.

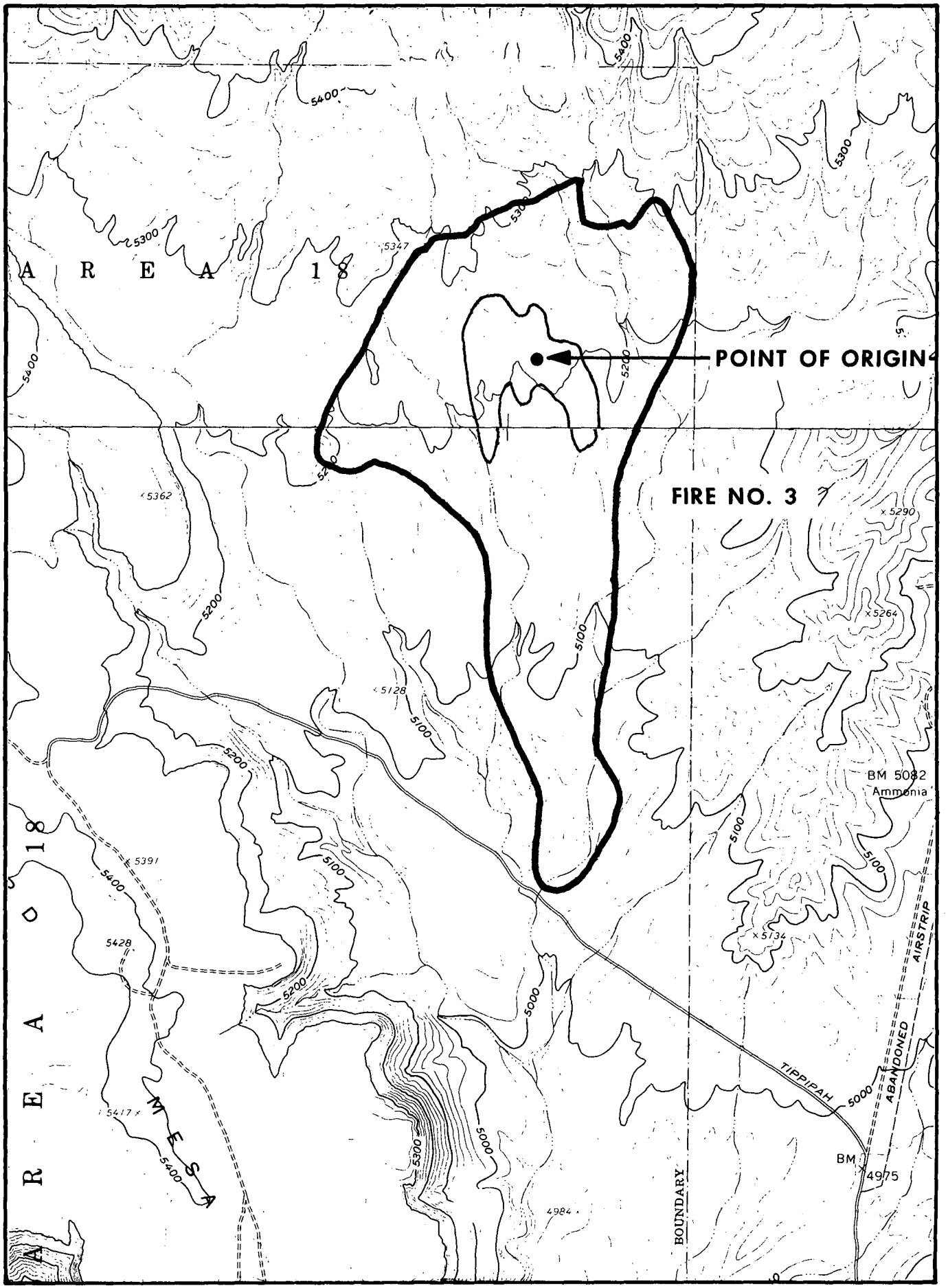
The area occupied by this community is very small compared to the other communities. Because of this, no transects were established.

SUMMARY

The ocular reconnaissance method of surveying vegetation was used to survey 13,630 acres in Area 18 Nevada Test Site. A total of 233 line transects were established to obtain species distribution, composition and ground cover.

There were six distinct plant communities identified: two sagebrush (*Artemisia arbuscula* subsp. *nova*, *A. tridentata*), two annual (*Salsola kali* var.*tenuifolia*, *Eriogonum*), one grass, and one Desert Shrub. These six communities contained a total of 36 families and 85 species. The *A. arbuscula* subsp. *nova* community occupied the largest area, 6,337 acres, and the *Eriogonum* community the smallest, 17 acres.

APPENDIX



Area 18 Range Fire 1959

PUBLIC HEALTH SERVICE

RANGE CONDITION WRITE-UP SHEET

Aerial Photo No. NTS 18-19 96 Location: T. _____ R. _____ Sec _____

Surveyor Kenneth W. Brown January 10, 1967

Plant Groups	Plant Names	% Ground Cover	% Composition	Remarks:
Grass or Grass-like Plants	*Sitanion hystrix*	1.1	4.1	T = trace (less than 0.1%)
	Orhyzopsis hymenoides	.2	.7	
	Bromus tectorum	T	T	
4.8%				
Forbs	*Sphaeralcea ambigua*	T	T	
	Opuntia spp.	T	T	
	Salsola kali var. *tenuifolia*	T	T	
				Check (in circle) if additional remarks are on reverse side. ◯
				CONDITION INDICATORS
				(Circle ones that apply)
				Range Condition (based on vegetation)
T %				EC GC FC PC
				Residues
Shrubs or Trees	*Artemisia arbuscula* subsp. *nova*	17.9	68.0	Adequate Inadequate
	Cowania mexicana var. *stansburiana*	3.6	13.6	Erosion
	Grayia spinosa	1.3	5.1	Non-active Slightly active
	Chrysothamnus viscidiflorus	1.3	4.7	Moderately active Severely active
	Ephedra viridis	1.0	3.8	Range Trend:
	Juniperus osteosperma	T	T	Improving Holding its own
	Ephedra nevadensis	T	T	Going down
95.2%	*Pinus monophylla*	T	T	FORAGE GROUND COVER _____
	Yucca Baccata	T	T	Stand for site
100%	Totals	26.4	100 %	Full 3/4 1/2 1/4 1/10

Use Adjustment:

Slope _____ %
Rocks _____ %
Brush _____ %
Unstable soils _____ %
Lack of water _____ %
Erosion _____ %
_____ %
TOTAL _____ %

Estimated Forage Yield:

Total Lbs/Ac _____
Usable Lbs/Ac _____
A/AUM _____
A/SM _____

B-91
Sheet Number

Range Site Name Area 18 _____

Land Capability Unit _____ Land Mapping Unit _____

Final Range Condition Rating _____

APPENDIX III

SPECIES LIST

GRASSES

GRAMINEAE Grass Family

1. *Aristida glauca*
2. *Bouteloua barbata*
3. *Bromus rubens*
4. *Bromus tectorum*
5. *Bromus spp.*
6. *Elymus cinereus*
7. *Hilaria jamesii*
8. *Muhlenbergia porteri*
9. *Orhyzopsis hymenoides*
10. *Poa spp.*
11. *Sitanion hystrix*
12. *Stipa speciosa*
13. *Tridens pulchellus*

APPENDIX III (Continued)

SPECIES LIST

SHRUBS AND TREES

CACTACEAE Cactus Family

1. *Opuntia basilaris*
2. *Opuntia spp.*

CHENOPODIACEAE Pigweed Family

1. *Atriplex canescens*
2. *Atriplex confertifolia*
3. *Atriplex spp.*
4. *Eurotia lanata*
5. *Grayia spinosa*

COMPOSITAE Sunflower Family

1. *Artemisia arbuscula* subsp. *nova*
2. *Artemisia spinescens*
3. *Artemisia tridentata*
4. *Chrysothamnus nauseosus*
5. *Chrysothamnus viscidiflorus*
6. *Gutierrezia sarothrae*
7. *Hymenoclea salsola*
8. *Tetradymia axillaris*
9. *Tetradymia glabrata*

CRUCIFERAE Mustard Family

1. *Lepidium fremontii*

CUPRESSACEAE Cypress Family

1. *Juniperus osteosperma*

FAGACEAE Beech Family

1. *Quercus gambelii*

GNETACEAE Joint Firs

1. *Ephedra nevadensis*
2. *Ephedra viridis*
3. *Ephedra funerea*

HYDROPHYLLACEAE Waterleaf Family

1. *Eriodictyon angustifolium*

LEGUMINOSAE Pea Family

1. *Dalea fremontii*

LILIACEAE Lily Family

1. *Yucca baccata*
2. *Yucca schidigera*

OLEACEAE Olive Family

1. *Menodora spinescens*

PINACEAE Pine Family

1. *Pinus monophylla*

POLEMONIACEAE Phlox Family

1. *Phlox stansburyi*

POLYGONACEAE Buckwheat Family

1. *Eriogonum fasciculatum*
2. *Eriogonum umbellatum*

ROSACEAE Rose Family

1. *Cowania mexicana* var. *stansburiana*
2. *Prunus fasciculata*
3. *Purshia glandulosa*

RUTACEAE Rue Family

1. *Thamnosma montana*

SAXIFRAGACEAE Saxifrage Family

1. *Philadelphus spp.*

SOLANACEAE Nightshade Family

1. *Lycium andersonii*

APPENDIX III (Continued)

SPECIES LIST

FORBS

BORAGINACEAE Borage Family

1. *Amsinckia tessellata*

CHENOPODIACEAE Pigweed Family

1. *Chenopodium fremontii*
2. *Chenopodium leptophyllum*
3. *Halogeton glomeratus*
4. *Salsola kali* var. *tenuifolia*

COMPOSITAE Sunflower Family

1. *Aster spp.*
2. *Baileya pleniradiata*
3. *Encelia spp.*
4. *Lygodesmia spinosa*
5. *Senecio spp.*

CRUCIFERAE Mustard Family

1. *Descurainia pinnata*
2. *Stanleya pinnata*

EUPHORBIACEAE Spurge Family

1. *Euphorbia spp.*

GERANIACEAE Geranium Family

1. *Erodium cicutarium*

HYDROPHYLLACEAE Waterleaf Family

1. *Phacelia spp.*

LEGUMINOSAE Pea Family

1. *Astragalus lentiginosus*
2. *Astragalus spp.*
3. *Dalea polyadenia*

LILIACEA Lily Family

1. *Allium spp.*
2. *Calochortus kennedyi*

LINACEAE Flax Family

1. *Linum lewisii*

MALVACEAE Mallow Family

1. *Sphaeralcea ambigua*

ONAGRACEAE Evening-Primrose Family

1. *Oenothera brevipes*
2. *Oenothera spp.*

POLEMONIACEAE Phlox Family

1. *Gilia eremica*
2. *Gilia scopulorum*
3. *Gilia spp.*
4. *Phlox spp.*

POLYGONACEAE Buckwheat Family

1. *Eriogonum nidularium*
2. *Eriogonum spp.*
3. *Oxytheca perfoliata*

SCROPHULARIACEAE Figwort Family

1. *Penstemon palmeri*
2. *Penstemon spp.*

SOLANACEAE Nightshade Family

1. *Nicotiana attenuata*

UMBELLIFERAE Carrot Family

1. *Lomatium nevadense*

APPENDIX IV

Table IV-A. *Artemisia arbuscula* subsp. *nova* Community Summary

	Percentage Ground Cover	Percentage Composition
Grasses		
Sitanion hystrix	.7	3.1
Hilaria jamesii	.5	1.9
Stipa speciosa	.4	1.7
Orhyzopsis hymenoides	.4	1.2
Bromus rubens	.1	.4
Bromus tectorum	T	T
Bouteloua barbata	T	T
Tridens pulchellus	T	T
Total	2.1	8.3
Shrubs and Trees		
Artemisia arbuscula subsp. *nova*	13.4	57.2
Ephedra nevadensis	2.1	9.3
Chrysothamnus viscidiflorus	2.2	9.1
Grayia spinosa	2.1	8.1
Atriplex canescens	.4	1.6
Cowania mexicana var. *stansburiana*	.2	1.1
Eurotia lanata	.3	1.0
Tetradymia glabrata	.2	.8
Lycium andersonii	.4	.7
Chrysothamnus nauseosus	.1	.3
Artemisia tridentata	.1	.3
Ephedra viridis	.1	.3
Tetradymia axillaris	T	.1
Juniperus osteosperma	T	.1
Yucca baccata	T	T
Eriogonum fasciculatum	T	T
Gutierrezia sarothrae	T	T
Prunus fasciculata	T	T
Atriplex confertifolia	T	T
Pinus monophylla	T	T
Artemisia spinescens	T	T
Total	21.6	90.0

T = trace (less than 0.1%)

APPENDIX IV

Table IV-A. *Artemisia arbuscula* subsp. *nova* Community Summary (Con.)

	Percentage Ground Cover	Percentage Composition
Forbs		
Sphaeralcea ambigua	.2	.8
Ann. spp.*	.1	.6
Eriogonum spp.	.1	.1
Opuntia spp.	T	.1
Euphorbia spp.	T	.1
Descurainia pinnata	T	T
Senecio spp.	T	T
Stanleya pinnata	T	T
Gilia scopulorum	T	T
Amsinckia spp.	T	T
Gilia eremica	T	T
Salsola kali var. *tenuifolia*	T	T
Phlox spp.	T	T
Calochortus kennedyi	T	T
Linum lewisii	T	T
Astragalus spp.	T	T
Eriogonum nidularium	T	T
Oxytheca perfoliata	T	T
Gilia spp.	T	T
Lomatium nevadensis	T	T
Menodora spinescens	T	T
Halogeton glomeratus	T	T
Total	.4	1.7

* Annual remnant (unidentified)
T = trace

APPENDIX IV

Table IV-B. *Artemisia tridentata* Community Summary

	Percentage Ground Cover	Percentage Composition
Grasses		
Sitanion hystrix	.9	2.9
Orhyzopsis hymenoides	.8	2.8
Hilaria jamesii	.5	1.6
Stipa speciosa	.4	1.3
Bromus tectorum	.2	.5
Bromus rubens	.1	.1
Bromus spp.	.1	.1
Tridens pulchellus	T	T
Elymus cinereus	T	T
Bouteloua barbata	T	T
Poa spp.	T	T
Total	3.0	9.1
Shrubs and Trees		
Artemisia tridentata	10.2	33.9
Ephedra nevadensis	3.6	13.2
Atriplex canescens	3.0	11.4
Chrysothamnus viscidiflorus	1.5	6.2
Cowania mexicana var. *stansburiana*	1.7	5.6
Grayia spinosa	1.5	5.4
Tetradymia glabrata	.6	2.4
Chrysothamnus nauseosus	.5	1.8
Ephedra viridis	.4	1.1
Eurotia lanata	.2	.9
Thamnosma montana	.2	.9
Artemisia arbuscula subsp. *nova*	.2	.7
Eriodictyon angustifolium	.1	.2
Lycium andersonii	.1	.1
Menodora spinescens	.1	.1
Atriplex spp.	.1	.1
Tetradymia axillaris	.1	.1
Gutierrezia sarothrae	.1	.1
Juniperus osteosperma	.1	.1
Eriogonum umbellatum	.1	.1
Hymenoclea salsola	T	T

T = trace

APPENDIX IV

Table IV-B. *Artemisia tridentata* Community Summary (Con.)

	Percentage Ground Cover	Percentage Composition
Shrubs and Trees		
Ephedra funerea	T	T
Pinus monophylla	T	T
Phlox stansburyi	T	T
Artemisia spinescens	T	T
Yucca baccata	T	T
Total	24.4	84.4
Forbs		
Eriogonum spp.	.8	3.0
Ann. spp.*	.3	1.4
Sphaeralcea ambigua	.2	.8
Descuraivia pinnata	.2	.8
Salsola kali var. *tenuifolia*	.1	.1
Aster spp.	.1	.1
Senecio spp.	.1	.1
Euphorbia spp.	.1	.1
Gilia eremica	.1	.1
Eriogonum nidularium	T	T
Amsinckia spp.	T	T
Oenothera spp.	T	T
Lomatium nevadensis	T	T
Astragalus lentiginosus	T	T
Phlox spp.	T	T
Penstemon spp.	T	T
Stanleya pinnata	T	T
Opuntia spp.	T	T
Lygodesmia spinosa	T	T
Total	1.8	6.5

T = trace
* = Annual remnant (unidentified)

APPENDIX IV

Table IV-C. Desert Shrub Community Summary

	Percentage Ground Cover	Percentage Composition
Grasses		
Hilaria jamesii	2.8	11.0
Orhyzopsis hymenoides	1.0	3.1
Sitanion hystrix	.6	2.4
Stipa speciosa	.4	1.3
Bouteloua barbata	.1	.5
Bromus rubens	T	.1
Bromus tectorum	T	.1
Muhlenbergia porteri	T	T
Total	4.9	18.5
Shrubs and Trees		
Ephedra nevadensis	4.9	18.7
Grayia spinosa	4.1	15.0
Tetradymia glabrata	3.3	12.0
Chrysothamnus viscidiflorus	2.7	11.0
Atriplex canescens	1.5	7.6
Artemisia tridentata	.7	3.0
Chrysothamnus nauseosus	.3	2.3
Lycium andersonii	.7	1.9
Eurotia lanata	.4	1.3
Atriplex confertifolia	.5	1.3
Artemisia arbuscula subsp. *nova*	.3	.9
Artemisia spinescens	.2	.9
Eriogonium umbellatum	.2	.7
Thamnosma montana	.1	.4
Eriodictyon angustifolium	.1	.2
Tetradymia axillaris	.1	.1
Hymenoclea salsola	.1	.1
Dalea fremontii	T	T
Cowania mexicana var. *stansburiana*	T	T
Menodora spinescens	T	T
Yucca baccata	T	T
Philadelphus spp.	T	T
Total	20.2	77.4

T = trace

Table IV-C. Desert Shrub Community Summary (Con.)

	Percentage Ground Cover	Percentage Composition
Forbs		
Eriogonum spp.	.5	1.4
Sphaeralcea ambigua	.4	1.3
Salsola kali var. *tenuifolia*	.1	.4
Ann. spp.*	.1	.4
Amsinckia spp.	.1	.2
Descurainia pinnata	.1	.1
Gilia spp.	.1	.1
Gilia eremica	.1	.1
Lepidium fremontii	.1	.1
Euphorbia spp.	T	T
Opuntia spp.	T	T
Senecio spp.	T	T
Oxytheca perfoliata	T	T
Stanleya pinnata	T	T
Astragalus spp.	T	T
Oenothera spp.	T	T
Calochortus kennedyi	T	T
Phlox spp.	T	T
Allium spp.	T	T
Chenopodium spp.	T	T
Eriogonum nidularium	T	T
Oenothera brevipes	T	T
Phacelia spp.	T	T
Lomation nevadensis	T	T
Lygodesmia spinosa	T	T
Total	1.7	4.1

* Annual remnant (unidentified)
T = trace

APPENDIX IV

Table IV-D. Grass Community Summary

	Percentage Ground Cover	Percentage Composition
Grasses		
Hilaria jamesii	7.8	25.4
Stipa speciosa	2.5	9.0
Bromus tectorum	2.7	8.5
Bromus rubens	1.9	6.2
Orhyzopsis hymenoides	1.8	5.9
Bouteloua barbata	1.5	4.3
Sitanion hystrix	.7	3.2
Tridens pulchellus	.5	1.6
Poa spp.	.4	1.3
Bromus spp.	.3	.7
Muhlenbergia porteri	T	.1
Aristida glauca	T	T
Total	20.1	66.2
Shrubs and Trees		
Ephedra nevadensis	.9	3.1
Grayia spinosa	.5	1.8
Atriplex canescens	.3	1.1
Artemisia spinescens	.2	.7
Chrysothamnus viscidiflorus	.1	.7
Lycium andersonii	.2	.6
Artemisia arbuscula subsp. *nova*	.1	.3
Eurotia lanata	.1	.2
Tetradymia glabrata	T	.1
Yucca baccata	T	.1
Artemisia tridentata	T	T
Hymenoclea salsola	T	T
Cowania mexicana var. *stansburiana*	T	T
Tetradymia axillaris	T	T
Juniperus osteosperma	T	T
Gutierrezia sarothrae	T	T
Ephedra viridis	T	T
Opuntia spp.	T	T
Total	2.4	8.7

T = trace

APPENDIX IV

Table IV-D. Grass Community Summary (Con.)

	Percentage Ground Cover	Percentage Composition
Forbs		
Salsola kali var. *tenuifolia*	3.8	13.3
Sphaeralcea ambigua	1.2	4.7
Eriogonum spp.	1.0	3.2
Lygodesmia spinosa	.4	1.3
Chenopodium fremontii	.3	.9
Euphorbia spp.	.2	.8
Eriogonum nidularium	.1	.3
Gilia spp.	.1	.3
Amsinckia tessellata	.1	.2
Erodium cicutarium	T	.1
Astragalus spp.	T	T
Senecio spp.	T	T
Chenopodium leptophyllum	T	T
Oxytheca perfoliata	T	T
Gilia eremica	T	T
Baileya pleniradiata	T	T
Encelia spp.	T	T
Stanleya pinnata	T	T
Lomatium nevadensis	T	T
Calochortus kennedyi	T	T
Total	7.2	25.1

T = trace

APPENDIX IV

Table IV-E. *Salsola kali* var. *tenuifolia* Community Summary

	Percentage Ground Cover	Percentage Composition
Grasses		
Hilaria jamesii	T	T
Orhyzopsis hymenoides	T	T
Total	T	T
Shrubs and Trees		
Chrysothamnus viscidiflorus	.3	.8
Atriplex canescens	T	T
Total	.3	.8
Forbs		
Salsola kali var. *tenuifolia*	25.3	95.3
Eriogonum spp.	.9	3.8
Gilia spp.	.1	.1
Oxytheca perfoliata	T	T
Astragalus spp.	T	T
Stanleya pinnata	T	T
Total	26.3	99.2

T = trace

APPENDIX V

Table V-A. Subtype - *Ephedra nevadensis*

	Percentage Ground Cover	Percentage Composition
Grasses		
Orhyzopsis hymenoides	3.6	10.6
Bouteloua barbata	.6	2.3
Sitanion hystrix	.4	1.5
Stipa speciosa	.3	1.2
Hilaria jamesii	.3	.9
Bromus tectorum	.2	.6
Bromus rubens	T	.1
Total	5.4	17.2
Shrubs and Trees		
Ephedra nevadensis	10.4	33.9
Tetradymia glabrata	1.8	8.9
Grayia spinosa	2.1	8.2
Chrysothamnus viscidiflorus	2.0	7.1
Atriplex canescens	1.5	4.9
Eriogonum umbellatum	1.4	4.2
Artemisia tridentata	1.0	3.9
Lycium andersonii	.5	2.6
Thamnosma montana	.8	2.2
Artemisia arbuscula subsp. *nova*	.3	.8
Artemisia spinescens	.2	.6
Eurotia lanata	T	T
Chrysothamnus nauseosus	T	T
Atriplex confertifolia	T	T
Total	22.0	77.3

T = trace

APPENDIX V

Table V-A. Subtype - *Ephedra nevadensis* (Con.)

	Percentage Ground Cover	Percentage Composition
Forbs		
Eriogonum spp.	1.3	3.7
Descurainia pinnata	.3	.8
Ann. spp.*	.2	.4
Oenothera spp.	.1	.2
Salsola kali var. *tenuifolia*	.1	.2
Gilia spp.	T	.1
Sphaeralcea ambigua	T	.1
Opuntia spp.	T	T
Stanleya pinnata	T	T
Lomation nevadensis	T	T
Astragalus lentiginosus	T	T
Total	2.0	5.5
TOTAL GROUND COVER	29.4	

* Annual remnant (unidentified)
T = trace

APPENDIX V

Table V-B. Subtype - *Grayia spinosa*

	Percentage Ground Cover	Percentage Composition
Grasses		
Hilaria jamesii	1.3	4.6
Stipa speciosa	.9	2.9
Sitanion hystrix	.5	2.1
Orhyzopsis hymenoides	.4	1.7
Bouteloua barbata	.2	.6
Bromus spp.	.1	.5
Bromus rubens	.1	.2
Bromus tectorum	T	T
Muhlenbergia porteri	T	T
Total	3.5	12.6
Shrubs and Trees		
Grayia spinosa	10.7	36.4
Ephedra nevadensis	3.5	13.8
Chrysothamnus viscidiflorus	3.2	12.8
Tetradymia glabrata	1.4	5.6
Eurotia lanata	1.3	4.6
Atriplex canescens	.8	3.1
Artemisia arbuscula subsp. *nova*	.5	1.5
Artemisia tridentata	.3	1.1
Lycium andersonii	.3	1.0
Artemisia spinescens	.2	1.0
Tetradymia axillaris	.1	.4
Thamnosma montana	T	.1
Hymenoclea salsola	T	.1
Dalea fremontii	T	.1
Eriodictyon angustifolium	T	.1
Eriogonum umbellatum	T	T
Cowania mexicana var. *stansburiana*	T	T
Chrysothamnus nauseosus	T	T
Total	22.3	81.7

T = trace

Table V-B. Subtype - *Grayia spinosa* (Con.)

	Percentage Ground Cover	Percentage Composition
Forbs		
Sphaeralcea ambigua	.7	2.5
Ann. spp.*	.4	1.4
Eriogonum spp.	.2	.8
Salsola kali var. *tenuifolia*	.1	.4
Euphorbia spp.	.1	.3
Opuntia spp.	T	.1
Senecio spp.	T	.1
Oxytheca perfoliata	T	.1
Yucca baccata	T	T
Amsinckia spp.	T	T
Stanleya pinnata	T	T
Astragalus spp.	T	T
Descurainia pinnata	T	T
Gilia spp.	T	T
Gilia eremica	T	T
Total	1.5	5.7
TOTAL GROUND COVER	27.3	

* Annual remnant (unidentified)

T = trace

APPENDIX V

Table V-C. Subtype - *Chrysothamnus*

	Percentage Ground Cover	Percentage Composition
Grasses		
Sitanion hystrix	1.2	5.6
Orhyzopsis hymenoides	.8	3.1
Hilaria jamesii	.7	2.7
Stipa speciosa	.1	.4
Bromus rubens	T	T
Total	2.8	11.8
Shrubs and Trees		
Chrysothamnus viscidiflorus	4.9	18.6
Ephedra nevadensis	3.4	17.2
Chrysothamnus nauseosus	1.6	12.3
Atriplex canescens	1.7	10.9
Grayia spinosa	2.3	9.3
Tetradymia glabrata	2.2	8.4
Eurotia lanata	.4	1.8
Lycium andersonii	.3	1.3
Artemisia spinescens	.3	1.2
Eriodictyon angustifolium	.1	.2
Artemisia arbuscula subsp. *nova*	.1	.1
Artemisia tridentata	T	T
Cowania mexicana var. *stansburiana*	T	T
Total	17.3	81.3
Sphaeralcea ambigua	.6	3.1
Amsinckia spp.	.2	1.3
Eriogonum spp.	.2	.6
Ann. spp.*	.1	.5
Gilia eremica	.1	.5
Gilia spp.	.1	.5

T = trace
* = Annual remnant (unidentified)

APPENDIX V

Table V-C. Subtype - *Chrysothamnus* (Con.)

	Percentage Ground Cover	Percentage Composition
Forbs		
Stanleya pinnata	.1	.3
Salsola kali var. *tenuifolia*	.1	.1
Oxytheca perfoliate	T	T
Phlox spp.	T	T
Allium spp.	T	T
Euphorbia spp.	T	T
Chenopodium spp.	T	T
Opuntia spp.	T	T
Eriogonum nidularium	T	T
Astragalus spp.	T	T
Oenothera brevipes	T	T
Phacelia spp.	T	T
Total	1.5	6.9
TOTAL GROUND COVER	21.6	

T = trace

APPENDIX V

Table V-D. Subtype - *Atriplex canescens*

	Percentage Ground Cover	Percentage Composition
Grasses		
Hilaria jamesii	3.5	9.2
Stipa speciosa	.5	1.6
Sitanion hystrix	.4	1.2
Orhyzopsis hymenoides	.5	1.1
Bromus rubens	T	.1
Total	4.9	13.2
Shrubs and Trees		
Atriplex canescens	4.8	24.1
Chrysothamnus viscidiflorus	2.4	13.7
Artemisia tridentata	2.8	9.1
Tetradymia glabrata	2.9	8.5
Grayia spinosa	2.5	8.1
Atriplex confertifolia	2.9	7.9
Ephedra nevadensis	1.7	4.7
Artemisia arbuscula subsp. *nova*	1.0	3.0
Hymenoclea salsola	.3	.2
Menodora spinescens	.1	.2
Total	21.4	79.5
Forbs		
Sphaeralcea ambigua	.8	3.1
Eriogonum spp.	.4	1.6
Salsola kali var. *tenuifolia*	.2	1.5
Ann. spp.*	T	.1

T = trace
* = Annual remnant (unidentified)

APPENDIX V

Table V-D. Subtype - *Atriplex canescens* (Con.)

	Percentage Ground Cover	Percentage Composition
Forbs		
Stanleya pinnata	T	T
Lygodesmia spinosa	T	T
Astragalus spp.	T	T
Descurainia pinnata	T	T
Oxytheca perfoliata	T	T
Opuntia spp.	T	T
Total	1.4	6.3
TOTAL GROUND COVER	27.7	

T = trace

APPENDIX V

Table V-E. Subtype - *Tetradymia glabrata*

	Percentage Ground Cover	Percentage Composition
Grasses		
Orhyzopsis hymenoides	.9	2.3
Stipa speciosa	.6	1.7
Sitanion hystrix	.6	1.7
Total	2.1	5.7
Shrubs and Trees		
Tetradymia glabrata	11.6	38.1
Ephedra nevadensis	7.3	23.6
Grayia spinosa	4.0	12.7
Chrysothamnus viscidiflorus	3.7	10.9
Eurotia lanata	.4	1.5
Artemisia tridentata	.4	1.3
Lycium andersonii	.4	1.1
Eriodictyon angustifolium	.4	.6
Lepidium fremontii	.1	.4
Thamnosma montana	.1	T
Chrysothamnus viscidiflorus	T	T
Atriplex canescens	T	
Total	28.3	91.5
Forbs		
Eriogonum spp.	.7	2.4
Sphaeralcea ambigua	.1	.3

T = trace

APPENDIX V

Table V-E. Subtype - *Tetradymia glabrata*

	Percentage Ground Cover	Percentage Composition
Forbs		
Astragalus spp.	.1	.1
Stanleya pinnata	T	T
Oxytheca perfoliata	T	T
Lomatium nevadensis	T	T
Total	.9	2.8
TOTAL GROUND COVER	31.3	

T = trace

APPENDIX VI

Table VI-A. Summary *Artemisia arbuscula* subsp. *nova*, *Artemisia tridentata*, and Desert Shrub Communities

	Percentage Ground Cover	Percentage Composition
Grasses		
Hilaria jamesii	2.2	8.3
Orhyzopsis hymenoides	.9	2.8
Sitanion hystrix	.7	2.8
Stipa speciosa	.4	1.4
Bouteloua barbata	.1	.4
Bromus tectorum	.1	.1
Bromus rubens	T	.1
Tridens pulchellus	T	T
Bromus spp.	T	T
Elymus cinereus	T	T
Poa spp.	T	T
Muhlenbergia porteri	T	T
Total	4.4	15.9
Shrubs and Trees		
Ephedra nevadensis	4.3	16.6
Grayia spinosa	3.4	13.0
Tetradymia glabrata	2.4	9.5
Chrysothamnus viscidiflorus	3.8	8.8
Artemisia arbuscula subsp. *nova*	1.8	7.8
Atriplex canescens	1.4	7.5
Artemisia tridentata	1.7	6.3
Lycium andersonii	.9	3.5
Chrysothamnus nauseosus	.3	1.8
Eurotia lanata	.3	1.2
Atriplex confertifolia	.3	.9

T = trace

APPENDIX VI

Table VI-A. Summary *Artemisia arbuscula* subsp. *nova*, *Artemisia tridentata* and Desert Shrub Communities (Con.)

	Percentage Ground Cover	Percentage Composition
Shrubs and Trees		
Cowania mexicana var. *stansburiana*	.2	.8
Artemisia spinescens	.2	.7
Eriogonum fasciculatum	.1	.5
Thamnosma montana	.1	.3
Ephedra viridis	.1	.2
Eriodictyon angustifolium	.1	.2
Tetradymia axillaris	T	.1
Juniperus osteosperma	T	T
Yucca baccata	T	T
Gutierrezia sarothrae	T	T
Prunus fasciculata	T	T
Pinus monophyllus	T	T
Menodora spinescens	T	T
Atriplex spp.	T	T
Gutierrezia sarothrae	T	T
Hymenoclea salsola	T	T
Ephedra funerea	T	T
Lygodesmia spinosa	T	T
Dalea fremontii	T	T
Philadelphus spp.	T	T
Total	21.4	79.7
Forbs		
Eriogonum spp.	.4	1.5
Sphaeralcea ambigua	.2	1.3
Ann. spp.*	.1	.5
Salsola kali var. *tenuifolia*	.1	.3
Descurainia pinnata	.1	.2
Amsinckia spp.	T	.2

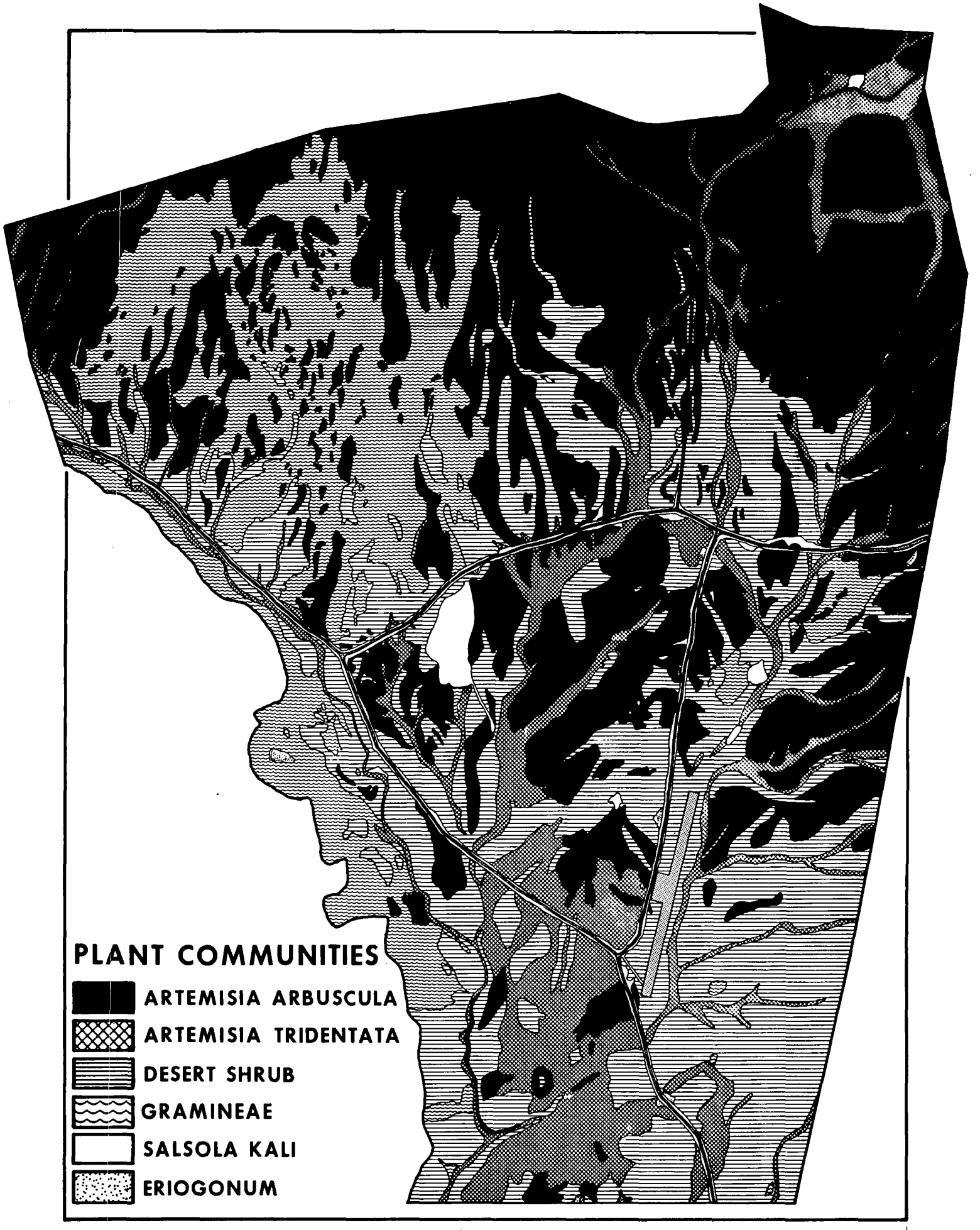
T = trace
* Annual Remnant (unidentified)

APPENDIX VI

Table VI-A. Summary *Artemisia arbuscula* subsp. *nova*, *Artemisia tridentata* and Desert Shrub Communities (Con.)

	Percentage Ground Cover	Percentage Composition
Forbs		
Euphorbia spp.	T	.1
Gilia spp.	T	.1
Gilia eremica	T	.1
Lepidium fremontii	T	.1
Opuntia spp.	T	T
Senecio spp.	T	T
Oxytheca perfoliata	T	T
Stanleya pinnata	T	T
Astragalus spp.	T	T
Oenothera spp.	T	T
Lomation nevadensis	T	T
Calochortus kennedyi	T	T
Phlox spp.	T	T
Allium spp.	T	T
Chenopodium fremontii	T	T
Eriogonum nidularium	T	T
Oenothera brevipes	T	T
Phacelia spp.	T	T
Lygodesmia spinosa	T	T
Aster spp.	T	T
Penstemon spp.	T	T
Gilia scopulorum	T	T
Linum lewisii	T	T
Total	.9	4.4
TOTAL GROUND COVER	26.7	

T = trace


PLANT COMMUNITIES
ARTEMISIA ARBUSCULA
ARTEMISIA TRIDENTATA
DESERT SHRUB
GRAMINEAE
SALSOLA KALI
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