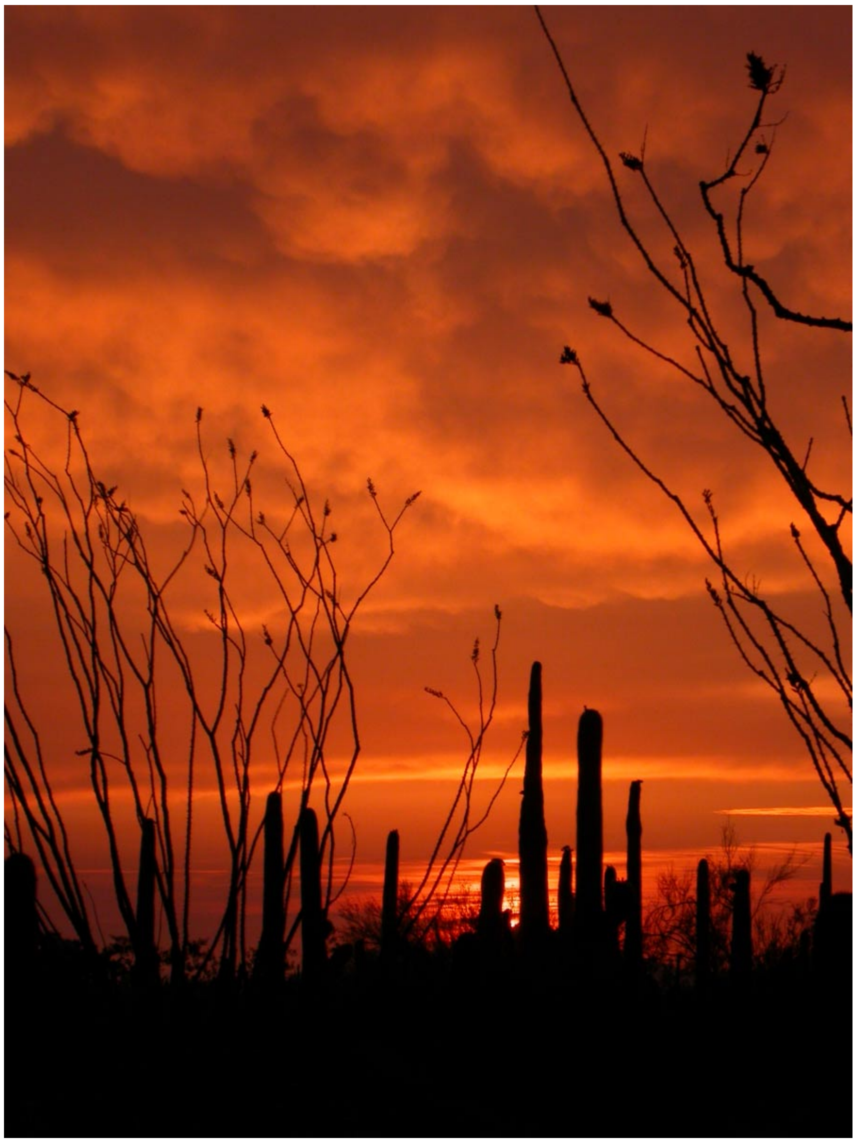
The Natural Communities and Ecological Condition of the Sonoran Desert National Monument and Adjacent Areas



Pacific Biodiversity Institute

The Natural Communities and Ecological Condition of the Sonoran Desert National Monument and Adjacent Areas

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October 2003

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Preferred Citation:
Morrison, P.H., H.M. Smith IV, S.D. Snetsinger. 2003. *The Natural Communities and Ecological Condition of the Sonoran Desert National Monument and Adjacent Areas.* Pacific Biodiversity Institute, Winthrop, Washington. 113 + xvi p. + Vol. 2 (appendices) 395 p.

EXECUTIVE SUMMARY

The purpose of this project was to describe, map and assess the ecological condition of the natural communities and the extent of exotic plant invasion in the Sonoran Desert National Monument (SDNM) and adjacent areas. The study area consisted of the SDNM, a ¼ mile buffer around the SDNM and adjacent portions of the US Air Force Barry M. Goldwater Range (BMGR) and Tohono O'odham Nation (TON).

In Phase 1, the natural communities of the SDNM and adjacent areas were mapped and described. Limited reconnaissance fieldwork was conducted for use in the initial descriptions. We integrated multiple sources of data in mapping the natural communities including field data, satellite imagery, topography, soil maps, and prior vegetation maps, but relied most heavily on interpretation of digital color infrared orthophotos. We developed two GIS models using topographic information to aid in separating the *Creosotebush–Bursage Desert Scrub* community from the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community and to predict the distribution of the *Mountain Upland* community.

In Phase 2, we incorporated both coarse scale and fine scale approaches to condition assessment. In the coarse scale approach we used a chronosequence of aerial photography and multiple GIS layers to conduct a landscape-level assessment of disturbance features over the entire study area. The fine-scale approach involved a field-based assessment in which we collected detailed natural community data (320 plots) and more abbreviated exotic plant data (836 plots) at selected, representative sites. We conducted multiple analyses on these data (using hierarchical cluster analysis, detrended correspondence analysis (DECORANA), analysis of variance (ANOVA), and linear regression) to assess the natural variation and influence of stressors on natural community composition and distribution of exotic plants. The relative influence of stressors varied by community type. The factors that we determined to be most influential for each major community are summarized in Table A. There were insufficient examples occurring in the study area and/or plot sample sizes to evaluate the variation in composition and factors that might influence condition within four minor natural communities: rock outcrops, desert grasslands, desert springs and tinajas. These four communities are not included in Table A.

Table A. Primary factors influencing variation in species composition for each major natural community in the study area.

Primary Factors Influencing Variation in Composition within Each Natural Community	Creosotebush-Bursage Desert Scrub (87 plots)	Paloverde – Mixed Cacti - Mixed Scrub on Bajadas (34 plots)	Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes (64 plots)	Mesquite Woodland (13 plots)	Mountain Upland (36 plots)	Braided Channel Floodplain (21 plots)	Mountain Xeroriparian Scrub (16 plots)	Valley Xeroriparian Scrub (25 plots)
Elevation	X				X	X	X	X
Slope Steepness			X		X			
Aspect			X		X		X	
Soil Texture		X						
Geology			X				X	
Distance from Potential Livestock Congregation Area	X	X		X				
Distance from Roads				X				
Livestock Impact Index	X					X		

Our analysis of exotic plant distributions revealed significant differences in exotic plant cover by community type. Of the matrix communities, *Creosotebush–Bursage Desert Scrub* had the highest exotic plant cover, followed by *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* and *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes.*

We looked at the relationship of percent cover of exotic species to multiple environmental and human-related disturbance factors, and found significant correlations with elevation, slope, aspect, and proximity to livestock congregation areas. Analysis of the five most common exotic species (*Schismus arabicus*, *Bromus rubens*, *Brassica tournefortii, Sisymbrium irio,* and *Erodium cicutarium*) showed differing strengths of relationships with the factors. We found that none of the species' distributions were significantly related to distance from roads. This finding reflected our field experience, where exotic plant cover was not predictably higher along unimproved roads, although it was quite high along the few major paved road corridors crossing the study area. We also created maps showing relative percent cover of 15 of the more common exotic species at all of our field plot locations.

In order to assess ecological condition, we first identified a number of field-based measurements that strongly influence condition and/or quantify levels of disturbance (species richness in native vs. exotic plants, ground cover of native vs. exotics plants, amount of bare ground, and diversity and abundance of native grass species). We used these to define and describe three levels of ecological condition, ranging from highly impaired areas (Condition Class 1) to relatively intact areas (Condition Class 3).

We developed condition models for each community based on results of our analysis of primary stressors for that community (see Table A), results of DECORANA and clustering analyses, and review of field data. For communities whose composition significantly varied according to degree of livestock impact, we based our models and maps on a distance from potential livestock congregation area GIS layer, applying varying thresholds of distance for the three condition classes, by community type. For communities with little variation in condition (as evidenced by analysis of plot data and based on field experience), a single condition class was applied to the entire natural community (e.g. *Rock Outcrops* are in good condition and were assigned Condition Class 3 and *Desert Springs*, which are in poor condition, were assigned to Condition Class 1). The *Desert Grasslands* community was a unique case. On SDNM lands this community is in poor shape and was assigned Condition Class 1, but adjacent grasslands on TON lands are in substantially better condition and were assigned Condition Class 2.

The maps of ecological condition for the individual communities were merged to create a single map. This map was then overlaid by disturbance data, created from the landscape-level disturbance assessment. Features in the disturbed layers were assigned appropriate levels of condition and were integrated with the community ecological condition map, such that sites assigned to lower condition classes (i.e. more impaired) in the disturbed layers overrode higher condition classes in the community map. Inputs to the community condition models and final map are shown in Table B.

Table B. Inputs to the community condition models and final condition map.

Factors Used in Modeling and Mapping Ecological Condition Class	Creosotebush-Bursage Desert Scrub	Paloverde - Mixed Cacti - Mixed Scrub on Bajada	Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slope	Mountain Upland	Mesquite Woodland	Braided Channel Floodplain	Valley Xeroriparian Scrub	Mountain Xeroriparian Scrub	Desert Grassland	Rock Outcrop	Desert Springs
Distance from potential livestock congregation area	X	X			X	X	X				
Natural community boundary (i.e. community was assigned to a single condition class)			X	X				X		X	X
Natural community boundary divided between SDNM and TON lands									X		
Roads	X	X	X	X	X	X	X	X	X	X	X
Linear disturbances	X	X	X	X	X	X	X	X	X	X	X
Developed/disturbed sites	X	X	X	X	X	X	X	X	X	X	X
Frequency of expended ordinance sweep operations (relevant only to communities occurring on the BMGR)	X	X	X				X	X		X	

Overall the ecological condition of the study area is moderately good. But the ecological condition of natural communities varies considerably from one location to another. Some communities appear to be experiencing high levels of human-related stress while other communities experience little stress. Of the three matrix communities that make up 97.5% of the study area, *Paloverde – Mixed Scrub – Mixed Cacti on Rocky Slopes* is in the best overall condition, followed by *Paloverde – Mixed Scrub – Mixed Cacti on Bajadas*, and finally *Creosotebush – Bursage Desert Scrub*, which contains a fair amount of highly disturbed areas. Figure A shows the proportion of each community that is in Condition Classes 1 through 3 (i.e. ranging from most impaired to most intact).

Based on our Phase 2 field data and analyses, we refined the natural community descriptions and map from Phase 1. We also extended the natural community map to include a one-quarter mile buffer outside the SDNM and significant parts of the BMGR and TON. We visually assessed the extended map to look for discontinuities of natural communities along the monument border and found that most communities continue their natural distribution patterns without artificial interruptions.

The refined natural community map is one of many data layers generated and/or improved during this study that may aid the BLM in resource management objective setting and decision-making. Tables C and D list new data created by Pacific Biodiversity Institute as part of this project that have been delivered to the BLM and TNC.

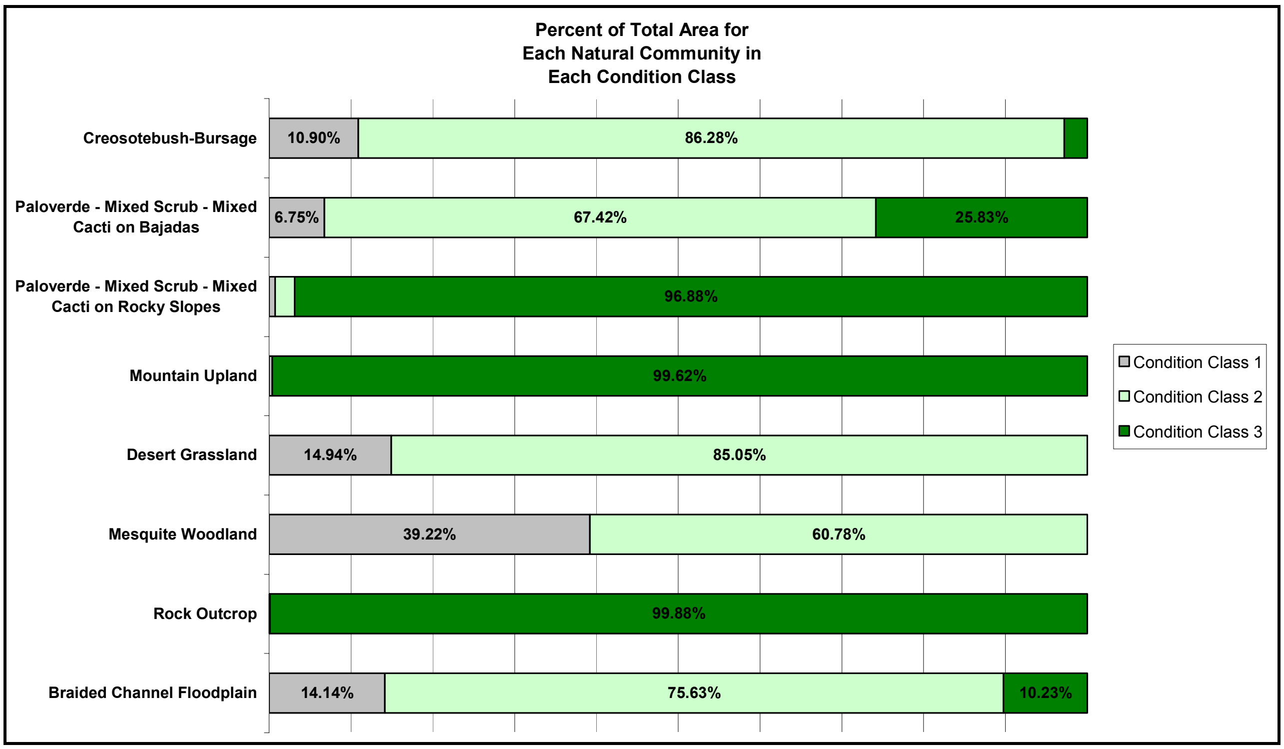

Figure A. Proportion of natural communities assigned to condition classes 1 through 3 (class 1 is most impaired, class 3 is most intact, and class 2 is intermediate).

Table C. GIS layers created by PBI for this project.

Data layer name	Description
SDNM_Natural_Communities	Polygon layer depicting the spatial distribution of the natural communities (excluding the valley and mountain xeroriparian scrub communities)
Ecological_Conditions	Polygon layer illustrating the geospatial layout of the three community condition classes
Xeroriparian_Scrub_Communities	Linear layer depicting the spatial distribution of the valley and mountain xeroriparian communities
Study_Area_Boundaries	Polygon layer illustrating the extent of the study area and the coarse scale ownership boundaries within the study area
Phase2_GPS_Waypoints	Point layer representing all the GPS waypoints taken during Phase 2 (includes all plots and miscellaneous observation points)
Developed-Disturbed_Sites	Polygon layer depicting small areas of land that have been substantially altered by human activity (including spreader dikes).
High_Density_Cow_Trail_Area	Polygon layer depicting areas of high cattle trail density
LinearDisturbances	Linear layer representing roads, trails, cattle trails, and other linear disturbance features that are visible in aerial imagery.

Table D. GIS layers improved by PBI for this project

GIS Layers Improved	Description of Improvement(s)
BLM Roads data	Our Linear Disturbance layer contains roads that are not on any of the existing road layers (but not all linear disturbances are roads). Our recommendation is that a reevaluation of the current road layer would result in a more complete inventory of roads in the study area.
Range Improvements Points	Our livestock congregation areas layer, which contains additional range improvement locations, represents an improvement to this layer.
Tinajas and Springs	We added a tinaja to a copy of this layer.
Initial natural community map of SDNM extrapolated from the BMGR (Hall et al 2001)	Our natural community map represents an improvement to this layer.

The information collected in this study and the analysis presented in the report will be useful in establishing a baseline of information on the condition of natural communities in the study area during the 2003 growing-season. The methods used in this study can be employed at a later date to collect similar data and then compare and contrast with data collected in this study. This will enable an assessment of changes and trends in the condition of the natural communities in this area.

We make several recommendations for further analysis and/or improvement of data. The ecological condition models and map could likely be substantially improved with more complete, accurate, and well-attributed roads and range improvement data. Formal accuracy assessments of the natural community and ecological condition maps could be useful in helping to guide applications of these data, and inform strategies for improving the data. Analysis of satellite imagery on an annual basis could be one cost-effective strategy for assessing landscape level changes in ecological condition over time. Finally, substantial field data were collected during this project that, if further analyzed, could provide additional insight into ecological condition of the natural communities.

Project Sponsorship

This report was prepared under CONTRACT AZFO-020821 (Natural Community Mapping, Characterization, and Condition Assessment for the Bureau of Land Management's Sonoran Desert National Monument) with The Nature Conservancy of Arizona. The goal of this report is to aid a partnership between the Conservancy, the Bureau of Land Management, the Department of Defense, and the Sonoran Institute, which is developing a biodiversity management framework for the Sonoran Desert National Monument.

Acknowledgements

During Phase 1 of the project, Aileen Jeffries assisted with fieldwork and logistical support, database design, data entry and analysis. George Wooten and Kim Romain assisted with mapping of the natural communities through photo-interpretation of color infrared digital orthophotos. Stephanie Weinstein and Barry Spicer assisted with fieldwork and provided valuable advice.

During Phase 2, Dr. Don Johnson assisted with fieldwork and checked the entire natural community database for data integrity. Lisa Hahn, Joyce Francis, Kathy Darrow, Greta Anderson and Elizabeth Makings all worked on the project as field botanists. Elizabeth Makings also verified plant specimens at the Arizona State University herbarium. Dr. Richard Felger spent many hours advising us and examining nearly all the plant specimens and verified identification of these specimens at the University of Arizona herbarium.

Throughout both phases of the project Dr. John Hall (TNC Arizona) provided considerable advice and assistance. John managed the project for TNC. John carefully reviewed the draft reports and provided extremely useful comments, which contributed to a greatly improved final document.

Mona Johnston and Heather Evans (interns at Pacific Biodiversity Institute) scanned and georeferenced historical aerial photographs. Heather Evans provided assistance with the revision and extension of natural community mapping. Juliet Rhodes, Carollee Spaulding, and Sarah Schrock conducted phase 2 data entry. Mona Johnston provided a graphic illustration of the braided channel floodplain community. Dr. Don Johnson, Mona Johnston and Aileen Jeffries assisted with editing of the final report. Paul Brown worked hard to keep our computer system healthy during the project and helped us deal with many technical challenges. Tracy Heffelfinger capably and efficiently handled the accounting on this project.

Jim Malusa and Dr. Roger Morrison consulted with us during the project and provided important advice that aided our mapping of some of the natural communities. Dr. Roger Morrison graciously provided us with his archive of 1968 and 1969 color infrared high altitude aerial images for use in the historical chronosequence. Anne Gondor (TNC Arizona), Stephanie Weinstein (TNC Arizona), and Karen Kelleher (BLM) all helped with providing us with geospatial data, references and assistance. The Luke Air Force Range (via Betsy Wirt) provided us crucial access to the East Tactical Area, Area A and other areas on the BMGR. The US Air Force also graciously provided us with temporary housing and office space at the Gila Bend Air Auxiliary Airfield. The project could not have been accomplished without the considerable software donations and support from Environmental Systems Research Institute and ERDAS. Some of the computer hardware used in the project was a generous donation by the Hewlett Packard Corporation and the Conservation Technology Support Program.

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Introduction

The purpose of this project is to describe, map and assess the ecological condition of the natural communities and the extent of exotic plant invasion in the Sonoran Desert National Monument (SDNM) and adjacent areas. The study area consisted of the SDNM, a ¼ mile buffer around the SDNM and adjacent portions of the US Air Force Barry M. Goldwater Range (BMGR) and Tohono O'odham Nation (TON) (Figure 1).

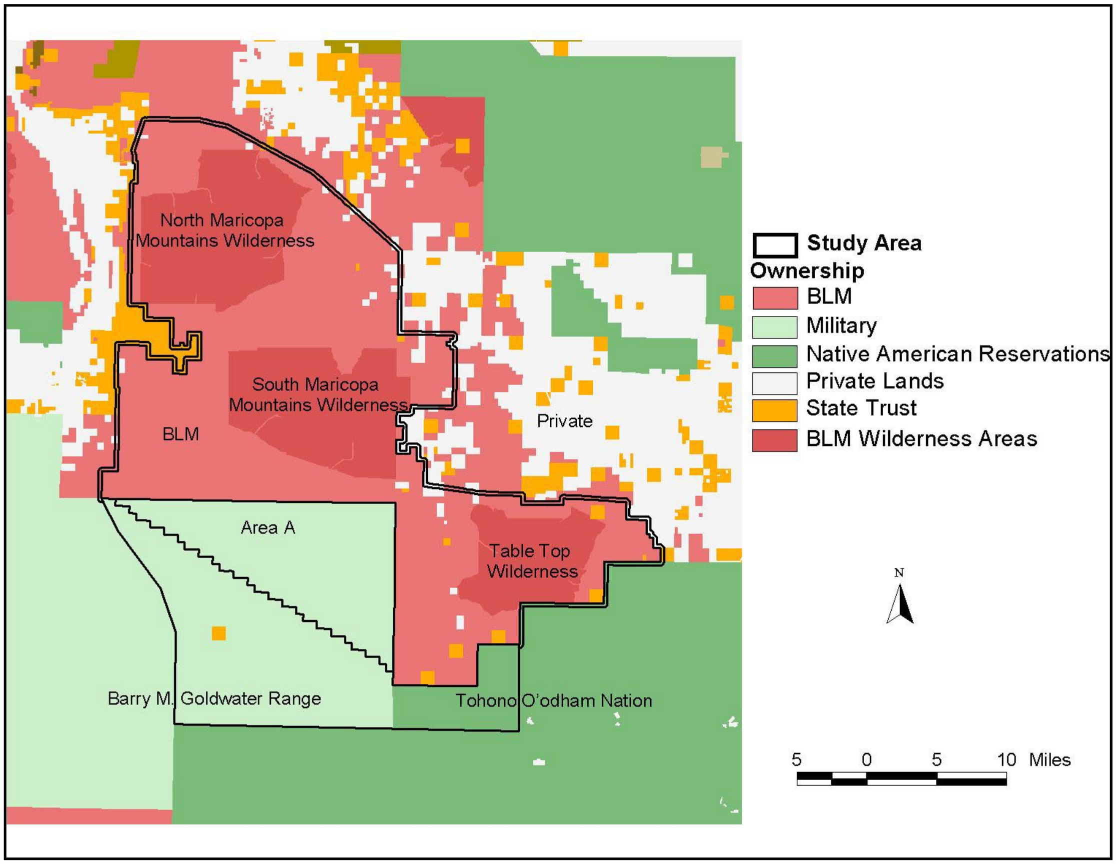


Figure 1. Ownership and management of the study area

This project was conducted in two phases. In Phase 1, the natural communities of the SDNM and adjacent areas were mapped and described. Limited reconnaissance fieldwork was conducted for use in the initial descriptions. The natural communities were mapped based on analysis of field data, satellite imagery, digital color infrared orthophotos and GIS modeling using topographic information.

In Phase 2, we incorporated both coarse scale and fine scale approaches to condition assessment. The coarse scale approach involved a landscape-level assessment and covered the entire study area. It was based on analysis of a chronosequence of aerial photography and GIS analysis of multiple data layers. The fine-scale approach involved a field-based assessment and was limited to representative sites selected throughout the study area. Natural community plot data and exotic plant plot data were analyzed to assess the natural variation and the influence of stressors on natural community composition as well as distribution of exotic plants. The outcome of combining and linking both approaches in one project yielded a more thorough and cost effective assessment of the ecological condition of the study area than would have been possible with either approach alone.

The information collected in this study and the analysis presented in this report will be useful in establishing a baseline of information on the condition of natural communities during the 2003 growing-season. The methods used in this study can be employed at a later date to collect similar data and then compare and contrast with data collected in this study. This will enable an assessment of changes and trends in the condition of the natural communities in this area.

Methods

Overall GIS Data and Aerial Imagery Methods

For use in both phases of the project, we acquired, processed, and reviewed existing imagery, including Landsat satellite data and digital orthophotos (Table 1). We acquired color infrared digital orthophoto quarter quads (CIR DOQQs) for almost the entire study area from the Arizona Regional Image Archive (ARIA). In addition, we examined panchromatic digital orthophotography provided by the BLM for the entire study area. This imagery had been merged at a 15-minute quad scale and was highly compressed with the ENVI compression algorithm. The image quality of the panchromatic orthophotography was not as good as the CIR DOQQs, so we used the CIR DOQQs in all areas of the study area except for a few areas where we could not obtain CIR DOQQ coverage.

Table 1. Imagery used in study.

Image Type	Image layer	Source	Date	Resolution
Digital Orthophotography	Color Infrared Digital Orthophoto Quarter Quads	ARIA	1996	1 meter
	Panchromatic Digital Orthophoto merged 15 minute quads (ENVI compressed format)	BLM	1996	1 meter
Landsat Satellite Imagery	TM7 image for path37 row37	ARIA	May 11, 2002	15 and 30 meter
	TM7 image for path37 row37	ARIA	March 17, 2002	15 and 30 meter
	TM7 image for path37 row37	ARIA	May 20, 2000	15 and 30 meter
	TM7 image for path37 row37	ARIA	Oct. 10, 1999	15 and 30 meter
	TM image for path37 row37	ARIA	July 22, 1985	30 meter

We acquired, processed and reviewed existing GIS data on vegetation, soils, geology, elevation, hydrography, disturbance and development, land ownership, and roads (Table 2). We used the elevation data (30-meter digital elevation model) to derive additional topographic layers (slope, aspect, shaded relief and 5-meter contours). The best available spatially explicit precipitation data (PRISM data) was also obtained and assessed, but its accuracy in the study area was questionable and it was not used. The PRISM data model is a statistical-topographic model for mapping climatological precipitation over mountainous terrain (Daly et al 1994) and is often the best precipitation data to use in a study of this nature. Our examination of the data for the study area revealed that PRISM significantly under-predicted precipitation in the Sand Tank Mountains. Some of the GIS layers are illustrated in Figure 2. All data were projected into a common map projection of UTM Zone 12, North American datum 1983, GRS1980 spheroid. It is one of the most robust map projections in use today.

Table 2. GIS Layers Used in Study.

Data Theme	Geospatial data layer description	Source	Date	Map Scale
Vegetation	Initial natural community map of SDNM extrapolated from the BMGR (Hall et al 2001)	TNC	2002	1:100,000 to 1:250,000
	Arizona GAP vegetation map	(AZ Land Information System (ALRIS)	1998	1:24,000
	Xeroriparian areas (same as streams)	TNC/BLM	2001	1:100,000
	Biotic Communities (Brown & Lowe (1980))	ALRIS	1993	1:100,000
Soils	NRCS soil layers	NRCS website	2002	1:24,000
	Arizona Soils	ALRIS	Digitized off map dated 1975	1:1,000,000
Geology	Geologic map of Arizona	ALRIS	1992	1:1,000,000
Topography	Digital elevation model data (DEM)	USGS/ARIA		30-meter
	Digital raster graphics (topographic maps)	USGS/ARIA		1:24,000
	Slope (derived from DEM)	PBI		30-meter
	Aspect (derived from DEM)	PBI		30-meter
	Shaded relief image (from DEM)	PBI		30-meter
	5-meter contours (from DEM)	PBI		1:24,000
Hydrography	Streams	USGS		1:100,000
	Tinajas and Springs	TNC	1997	1:24,000
Water developments	Wells and water development activities (ACTVREV, ACTVNON)	Arizona Dept. of Water Resources		
	Spreader Dikes	BLM		
Range Improvements	Range Improvements Points	BLM	1999	1:24,000
	Range Improvements Lines	BLM	2001	1:24,000
Land Ownership	Arizona GAP Ownership	Arizona GAP		
	AZLAND	ALRIS	1998	1:100,000
	SDNM Boundary	TNC/BLM	2002	
Transportation	BLM road layer	BLM	2000	1:100,000
	New draft BLM road layer	BLM	2003	1:24,000
	Roads for the BMGR	BMGR through TNC		
	TIGER road layer	US Census Dept.	2000	1:100,000
	Major Roads	ALRIS	1992	1:100,000

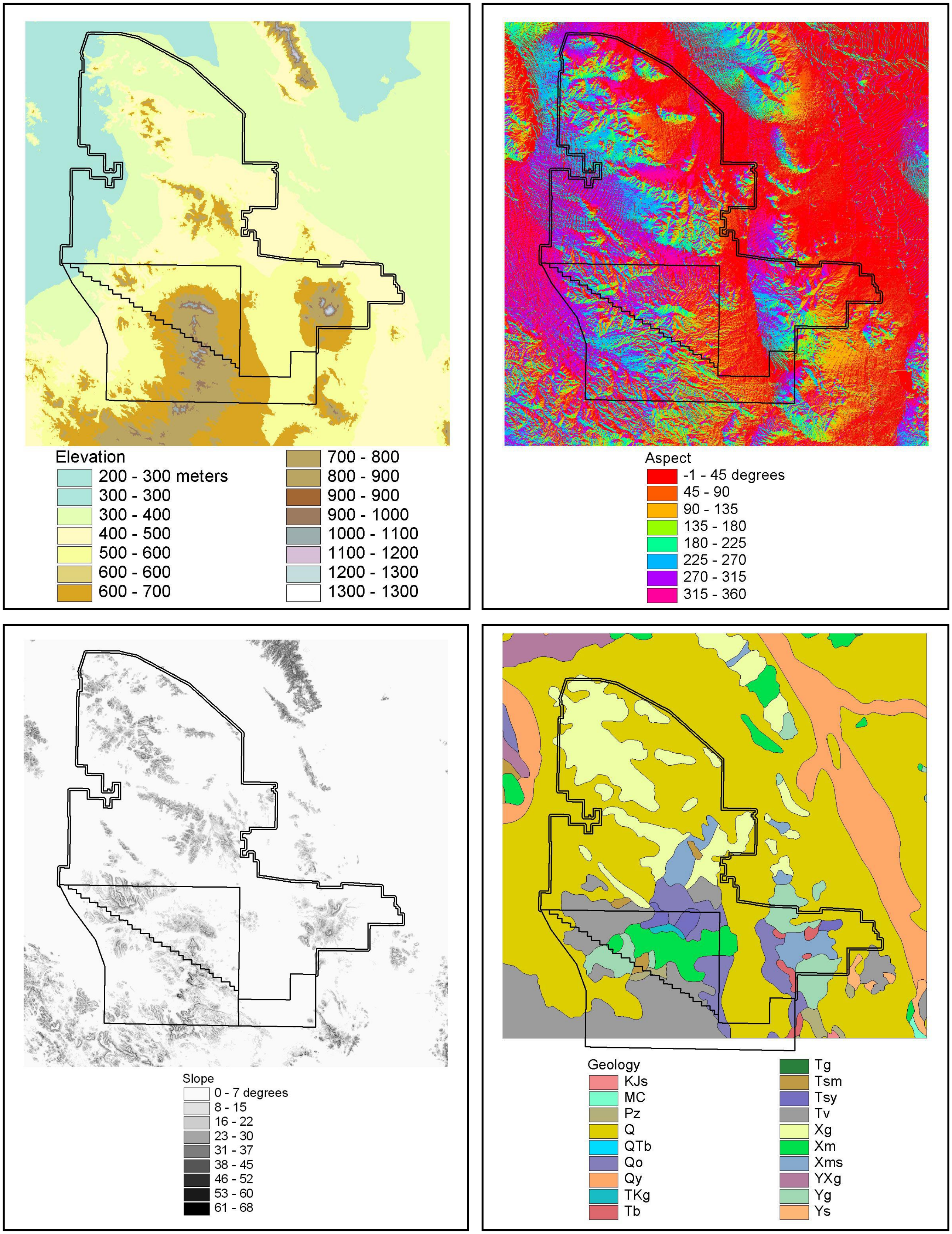


Figure 2. GIS layers of some of the abiotic factors examined in the study (refer to Table 2 for source information).

GIS layers were also created by the Pacific Biodiversity Institute and improved upon during this project, both to fulfill contractual obligations and to aid in the analyses of the study area. Tables 3 and 4 list and briefly describe the assortment of GIS layers that were created or improved upon.

Table 3. GIS layers created by PBI for this project.

Data layer name	Description
SDNM_Natural_Communities	Polygon Layer depicting the spatial distribution of the natural communities (excluding the valley and mountain xeroriparian scrub communities)
Ecological_Conditions	Polygon Layer illustrating the geospatial layout of the three community condition classes
Xeroriparian_Scrub_Communities	Linear Layer depicting the spatial distribution of the valley and mountain xeroriparian communities
Study_Area_Boundaries	Polygon Layer illustrating the extent of the study area and the coarse scale ownership boundaries within the study area
Phase2_GPS_Waypoints	Point Layer representing all the GPS waypoints taken during Phase 2 (includes all plots and miscellaneous observation points)
Developed-Disturbed_Sites	Polygon Layer depicting small areas of land that have been substantially altered by human activity (including spreader dikes).
High_Density_Cow_Trail_Area	Polygon Layer depicting areas of high cattle trail density
LinearDisturbances	Linear Layer representing roads, trails, cattle trails, and other linear disturbance features that are visible in aerial imagery.

Table 4. GIS layers improved by PBI for this project

GIS Layers Improved	Description of Improvement(s)
BLM Roads data	Our Linear Disturbance layer contains roads that are not on any of the existing road layers (but not all linear disturbances are roads). Our recommendation is that a reevaluation of the current road layer would result in a more complete inventory of roads in the study area.
Range Improvements Points	Our livestock congregation areas layer, which contains additional range improvement locations, represents an improvement to this layer.
Tinajas and Springs	We added a tinaja to a copy of this layer.
Initial natural community map of SDNM extrapolated from the BMGR (Hall et al 2001)	Our natural community map represents an improvement to this layer.

Phase One Methods

We developed an integrated approach to the preliminary mapping and description of natural communities. We used vegetation maps, a wide variety of GIS data, Landsat TM7 satellite imagery, digital orthophotography, review of literature on natural communities and reconnaissance-level fieldwork that focused on collection of ecological data on composition, structure and function of the natural communities.

Additional information on the methodology for mapping and describing individual communities is included in the natural community descriptions (Appendix A).

Preliminary Assessment of Available Data and Draft Natural Community Map

First, we reviewed the draft natural community map and GIS model developed by TNC for the BMGR and extrapolated to the SDNM. We used Landsat Enhanced Thematic Mapper 7 (TM7) satellite imagery from several dates (Table 1) to aid in this review. We performed an unsupervised spectral classification of the March 2002 image and examined normalized difference vegetation indices (NDVI) for several image dates. We examined the differences between the NDVI images to determine if vegetation changes were apparent that could aid in mapping the natural communities. The analysis of satellite imagery proved to be useful in determining some differences in vegetative composition between natural communities and ecological condition within communities. But we also found that significant variation in spectral response recorded in the satellite imagery was related to variation in soil and geology. Further use of satellite imagery for assessing ecological condition of communities on an annual basis is discussed in the recommendations section.

During our initial review and evaluation of the draft community map we examined other GIS data on vegetation, geology, soils, topography, hydrography, water developments, roads, and land ownership (Table 2). We assembled, read and reviewed pertinent literature on Sonoran Desert vegetation mapping and classification, and made contact with several relevant sources and experts. We briefly reviewed BLM's aerial photo-based vegetation/ecological-site mapping, their Ecological Site Inventory data, the Natural Resource Conservation Service (NRCS) Ecological Site Descriptions (ESDs) and associated soil maps and GIS data to determine how it might be of use in mapping the natural communities.

Based on our initial evaluation of all the above GIS data and imagery it became apparent that significant improvements in TNC's draft natural community map and GIS model for the SDNM were necessary to accurately depict the natural communities. We discussed our initial proposed modifications with TNC for this and subsequent tasks. At this stage, we determined that some of the NRCS soil mapping could be used in improving the natural community map.

We produced a series of maps to guide our fieldwork. The first map was of the entire study area and had a 1:85,000-scale Landsat TM7 satellite image background with the initial TNC natural community polygon boundaries, hydrography, and roads as overlays. The second set of maps was produced at a 1:12,830-scale with the CIR DOQQs as the background and hydrography, roads, and the NRCS soils layer as overlays.

Phase 1 Fieldwork

Our fieldwork was conducted from November 27 to December 23, 2002. The focus of this work was to closely examine the natural community boundaries depicted in the initial map provided by TNC, to examine the NRCS soil mapping, and to gather field ecology data and photographs that could be used to describe and depict the natural communities. We also recorded many field notes and map notations about the location of natural community boundaries and locations.

We collected information on the vegetation composition and structure in a representative sample of the natural communities as part of this reconnaissance fieldwork. The percent cover of all plant species within a 30-meter radius sample plot was recorded along with information on ground cover of bedrock, rock, gravel, sand and soil. Information on elevation, aspect, and slope was collected as well as pertinent information on landform, geology, and soil conditions. The location and description of each plot was recorded, including a GPS waypoint number. Each field plot was located to an accuracy of 5 to 8 meters using a Garmin eTrex GPS receiver. We also recorded GPS tracks to review the area examined during each day's fieldwork.

In addition to the field plots, many other observations of natural community locations and boundaries were noted in field notes and field maps. Often binoculars were used to examine areas that were not readily accessible by foot and notes about the vegetation composition and structure were recorded. Digital photographs were taken at each field plot (usually four photos per plot) and numerous additional photographs were taken of plant species, natural communities, and landscape perspectives on the natural communities.

During our fieldwork we used numerous botanical references to aid in the identification and verification of plant species encountered in natural community plots. These references include Baldwin et al (2002), Benson and Darrow (1981), Benson (1969), Felger (2000), Kearney and Peebles (1960), Turner et al (1995), Turner et al (2000), Hickman (1993), Epple and Epple (1995), Earle (1980), Jaeger (1941), and Arizona Rare Plant Committee (no date). Appendix B contains a list of the plants found during both phases of this study.

We attempted to sample the significant ecological gradients within each community type, but were limited due to time and budget constraints. During the month of fieldwork, we collected plot data at 123 sites. We recorded natural community presence or boundaries at over 200 additional sites. Over 1000 photographs were taken, recording the composition, structure, and condition of the natural communities on the SDNM and adjacent lands.

Our fieldwork was conducted during the time of maximum plant dormancy. Most herbaceous plants and grasses were in senescence and annual plants were essentially non-existent. Grazing by livestock had reduced many grass species to short stubble, making identification nearly impossible. Because of these factors, many plants were difficult to identify. Some plant species were recorded as "unknown shrub" or only identified to the genus level. The extended drought experienced by this region accentuated the dormancy of many plants and often made it difficult to find remnants of leaves or seeds. Because of these factors the natural community composition and structure recorded in the reconnaissance field data should be considered as an initial and incomplete description of these natural communities.

During our Phase 1 fieldwork, we visited the only "tinajas" that are mapped on the SDNM. The two "tinajas" are mislabeled or misclassified on the existing maps and GIS data layers. They are "tanks" – or human constructed water developments. We mapped these as developed areas. There are no natural springs known to exist on the SDNM. Because of these factors, we did not include the *Desert Springs* or *Tinajas* natural communities in our initial Phase 1 map. However, our Phase 2 mapping included areas in the BMGR that contained *Desert Springs* and natural *Tinajas.* Therefore, we included *Desert Springs* and *Tinajas* in our Phase 2 maps.

Field Mapping

Some delineation of natural community boundaries was conducted during the 2002 fieldwork. This included field mapping of some of the *Mountain Upland* community boundaries and some of the boundaries between the *Creosotebush–Bursage Desert Scrub* and the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* communities.

Analysis of Field Data

All natural community plot data were entered into a Microsoft Access database. Reports on each natural community were generated summarizing the average cover for each plant species and the percent of the plots in each community that each plant species occurred in (constancy). This enabled an evaluation of which species were most frequently encountered in each community and which species were dominant in each natural community.

The plot data were examined to determine which species were limited to specific communities and are likely to be indicator plants for those communities. Variations in tree cover and total vegetative cover were examined. Evidence of natural variation within natural communities was also examined. This analysis of plot data was used to help classify each plot into a single natural community type. In cases where plots were transitional between natural communities a secondary community type was also assigned to the plot.

The plot data and other observational data were then used as a guide for natural community mapping.

Interpretation of Digital Orthophotography

The CIR DOQQs proved to be extremely useful in the delineation of natural communities. Three people worked for nearly one month interpreting this imagery and on-screen digitizing or editing natural community boundaries. This work was checked for accuracy by the authors of this study. In addition to the DOQQs, the photo-interpreters used the plot data, other observation data, digital topographic data (elevation, aspect, slope, and contour lines), Landsat TM7 satellite imagery, NRCS soil data, hydrographic data, and geologic maps to aid in the interpretation of natural community boundaries.

Modeling of Natural Communities

Two GIS based models were developed for the project. The first model was developed to help separate the *Creosotebush–Bursage Desert Scrub* community from the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community. This distinction was perhaps the most difficult task encountered during the project, since the communities grade into each other. The model that was developed is described in the *Creosotebush–Bursage Desert Scrub* community description (Appendix A).

The second model was developed to predict the distribution of the *Mountain Upland* community. This model was based on analysis of the field plot data, other field observations, and limited field mapping. This model is described in detail in the *Mountain Upland* community description (Appendix A).

Integration

All the above data were integrated to compile the final map of natural communities. We first combined the three matrix communities (*Creosotebush–Bursage Desert Scrub*, *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas,* and *Paloverde - Mixed Cacti - Mixed Scrub on Rocky*

Slopes) into a base map. Then the small patch communities (*Mountain Uplands, Desert Grasslands, Mesquite Woodlands,* and *Rock Outcrops)* were superimposed. In Phase 1, The riparian communities (*Braided Channel Floodplain*, *Valley Xeroriparian Scrub,* and *Mountain Xeroriparian Scrub)* were not superimposed, but are considered overlays to the matrix and small patch communities (but the *Braided Channel Floodplain* was imbedded in the natural community layer in Phase 2). Lastly, a *Developed/Disturbed Area* GIS layer was developed. This layer depicts small patches of land that have been substantially altered by human activity. Many of these areas retain some of the components of the original natural community present before development. Therefore these communities should be considered an additional overlay to the matrix, small patch and riparian communities.

Initial Community Descriptions

Initial community descriptions were developed based on literature review, field observations, and careful analysis of natural community plot data. These descriptions were revised during Phase 2 of this project (Appendix A).

Phase Two Methods

During Phase 2 we conducted a landscape-level assessment using digital imagery to look at areas of major disturbance and cover change. We collected extensive field data on community composition and structure, disturbance elements, and other environmental factors. These data were used to update the natural community descriptions and map from Phase 1. Information on exotic species distribution and abundance was also collected. We used these data to map and analyze distributions of exotic species. We conducted a variety of analyses to look at the relative influence of natural and human-related factors on the range of variation in community composition. Finally, we used the field data in combination with GIS layers to model and map relative ecological condition of the natural communities.

Review of Literature

All readily available information about historic and current condition of natural communities, rangeland conditions, and other environmental conditions from the BLM and US Air Force was obtained for this project. Literature searches and review of all readily available documents and photographs that are relevant to an assessment of the historical and current condition of natural communities in the SDNM were conducted. Review of prior information is helpful in evaluating how current conditions may have changed from past conditions and if current trends will result in desired future conditions on the SDNM.

Landscape-level Assessment

The landscape-level assessment incorporated current and historic aerial photography, satellite imagery, and map-based information to create a map with which to visually analyze the spatial relationships of disturbance features and the natural communities.

We used current and historical aerial photo chronosequencing to help us focus on areas within each natural community where native vegetation, soils, landforms or hydrology had been observably altered by human activities. Chronosequencing also helped us to decipher features visible in the current aerial imagery that were hard to interpret due to fuzziness, strange textures, or unique patterning.   In this process we used a historical sequence of aerial photography from 1958 to 1996 (Table 5).

Table 5. Types of aerial photography used in landscape assessment.

Photo date	Source	Photo type	Scale
1958	BLM	Scanned panchromatic paper print	
1968	Roger Morrison, USGS/NASA	Scanned CIR color transparency	
1969	Roger Morrison, USGS/NASA	Scanned CIR color transparency	
1996	ARIA	CIR DOQQ	1 meter

Through interpretation of the aerial imagery and utilization of existing GIS data, we assembled many additional GIS layers for use in Phase 2. These are described in the section below.

Development of Disturbance GIS Layers

We developed five GIS layers representing various types and levels of disturbance. These layers are potential livestock congregation areas, roads, disturbed areas (polygon features, with disturbance type unspecified), linear disturbances, areas heavily disturbed from livestock, and areas of visibly lower vegetative cover than adjacent areas (associated with fence line boundaries). From the potential livestock congregation areas and roads data we created two additional gradient layers for use in the condition modeling and mapping. These are distance from potential livestock congregation areas and distance from roads (measured in meters) (Table 6 and Figure 3).

The potential livestock congregation area map was developed from the BLM's range improvement point GIS layer and represents sites potentially heavily used by, or attractive to livestock. Included are corrals and all water developments (tanks, wells, etc.) except wildlife catchments. In addition we included livestock water developments that we identified during fieldwork or from examination of digital orthophoto quads. The potential livestock congregation areas are a point coverage representing the center of the area of congregation. This point layer was used to develop the distance from livestock congregation grid, which was used in ecological condition modeling (Figure 3). Not all potential livestock congregation points have active livestock activity at any given time. As mentioned above, we derived this layer in large part from the BLM's range improvement point GIS layer. The BLM's range improvement layer does not contain information about past, present or potential future use. The level of use is not known for these points. We do know from our field examinations that the use level varies considerably from point to point and that some BLM range improvements may not have had much use for several years.

We created a road map by combining data from three GIS road layers. These layers were a BLM road layer acquired in April 2001, a draft BLM road layer from March 2003, and a road layer for the BMGR provided to us by TNC in March 2003.

"Developed/Disturbed Areas" are nonlinear disturbance features that are visible in the most recent aerial imagery we used during our analysis (CIR DOQQs from 1996) or in more recent Landsat TM7 satellite imagery. These areas can be anything from a parking area or gravel quarry to an industrial site. The SDNM's various berms and spreader dikes are included in this layer. From a spatial perspective, polygons rather than lines best represent the "Developed/Disturbed Areas". During development of this layer we examined the entire study area for signs of visible ground disturbance. We also examined existing GIS layers (like BLM range improvements, spreader dikes, etc.) to see how much disturbance existed at those sites.

"Linear Disturbances" are disturbance features like roads, dozer paths and scrapes, cattle trails, off-road vehicle paths, and hiking trails that are visible in the aerial imagery (not including roads already mapped in GIS data layers provided to us by the BLM, TNC, or BMGR). These features' spatial forms are best represented by lines rather than polygons because they have very narrow widths.

"High-Density Cow Trail Areas" or "Cow Circles" are roughly circular areas around a water source in which cattle trail density is high, resulting in a unique fan like pattern of cattle trails radiating out from the water source. We mapped areas within the outer edges of this fan like pattern of linear disturbances as a "High-Density Cow Trail Area". The amount of disturbed area is higher near the center of the cow "circle" than at the exterior since the distance between cow trails is greater in the outer part of the "circle".

Table 6. GIS data on disturbances developed during Phase 2.

GIS theme	Description
Potential Livestock Congregation Areas	Based largely on BLM's range improvement layer (livestock water sources, corrals) and additional livestock water sources identified by PBI
Roads	Road locations compiled from 2 BLM road layers, and a BMGR road layer
Developed/Disturbed Areas	Areas with development or fairly significant human disturbance visible on CIR DOQQs
Linear disturbances	Linear features with development or fairly significant human or cattle disturbance visible on CIR DOQQs
High-Density Cow Trail Areas	Areas around potential livestock congregation areas with visible disturbance (lack of vegetation, erosion) and a high density of cow trails that are observable in the field and/or on CIR DOQQs.
Areas of visibly lower vegetative cover than adjacent areas – associated with fence line boundary	Areas with lower vegetative cover than surrounding comparable areas separated only by fence lines. These areas are visible in both DOQQs and Landsat satellite imagery.
Distance from Potential Livestock Congregation Areas	Distance from potential livestock congregation areas, measured in meters.
Distance from Roads	Distance from roads, measured in meters.

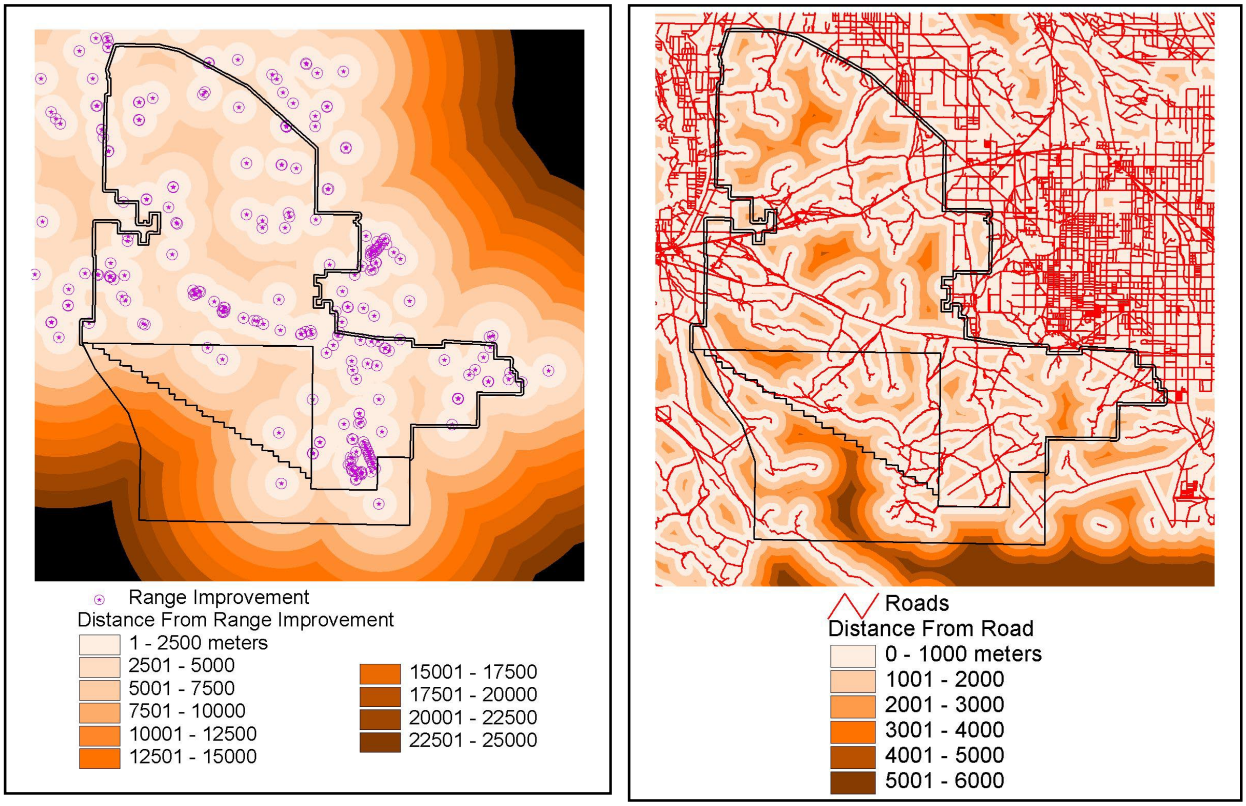


Figure 3. GIS layers showing disturbance gradients for distance from potential livestock congregation areas and distance from roads. (Refer to Table 2 for source information)

Phase 2 Field Data Collection

From March 27th, 2003 to May 21st, 2003, we conducted field sampling and other field-based studies to determine the presence of invasive exotic plants and the conditions of the natural communities. The fieldwork was designed to cover the natural diversity of the study area. More samples were placed in natural communities predicted to have higher levels of stress from human activities or where natural variation in community composition and structure were high.

A field crew composed of botanists and ecologists familiar with Sonoran Desert vegetation was responsible for data collection. A senior staff member was present throughout the fieldwork process, though the composition of the field crew varied depending on individual availability. The field crew was trained on site.

Plant Identification and Specimen Collection Methods

A significant amount of Phase 2 fieldwork consisted of collecting and identifying plants. In order to positively confirm the identification of species recorded in our plots and other areas of interest, field specimens were intensely scrutinized. In many cases voucher and unknown specimens were collected to be further analyzed at base camp where there was a dissecting microscope and reference library (Figure 4). All the collected specimens were further examined by either professional botanist Richard Felger at the University of Arizona, or Elizabeth Makings at Arizona State University. Once positive identifications were made, the field data forms were updated accordingly. The plant specimens are temporarily located at the PBI office, but we intend to pursue additional funding to order and label the specimens so that they may be deposited in the Arizona State University herbarium.

Figure 4. Elizabeth Makings uses a dissecting microscope at base-camp to identify a plant specimen.

Exotic Species Plots

The exotic species field-sampling method consisted of estimating percent cover of exotic species within 3-m radius plots on both sides of roads and travel corridors at half-mile intervals. In a selected sample of plots we also recorded the frequency of each exotic species (number of individuals). The plot centers were located at 3 and 10-meter distances from the road edge on each side of a road at the half-mile interval (unless one side was inaccessible due to ownership constraints or safety issues) (Figures 5 and 6). Information on road classification was recorded for each plot that occurred along a road. In addition to this sampling method, the presence and abundance of exotic plants were recorded in our natural community ecology plots. We also recorded information at other locations where exotics were abundant. The field data collection form that was used for exotic species sampling is included as Appendix Q**.** We sampled 836 exotic species plots throughout the study area. The data collected on exotic plants contains the information necessary for submittal to the Southwest Exotics Mapping Program (SWEMP).

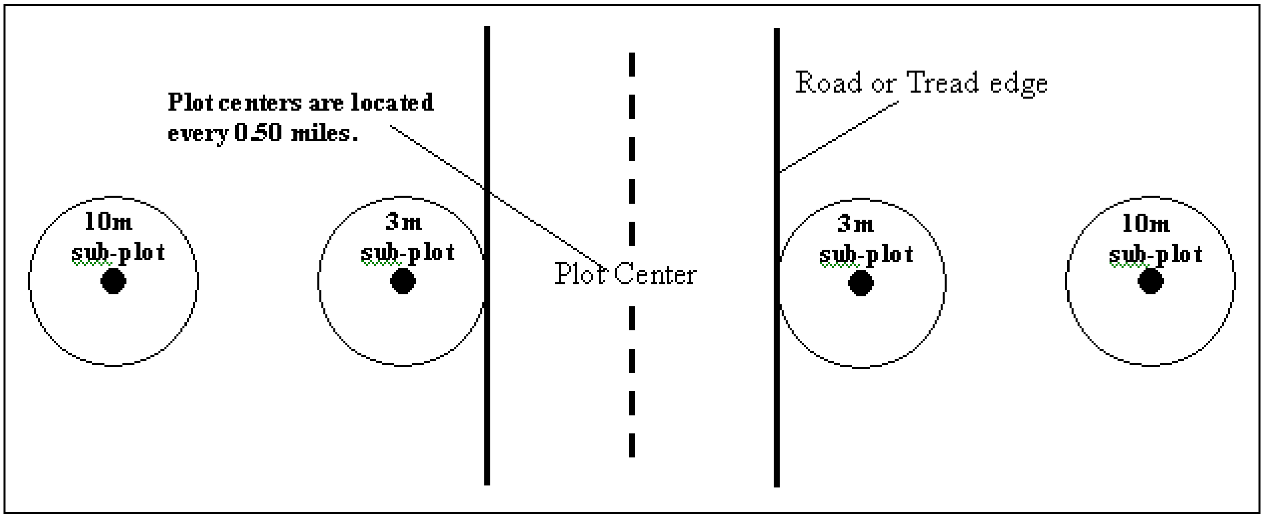


Figure 5. Illustration of the exotic species plot layout.


Figure 6. Locating exotic species plots at 3-m and 10-m from a road's edge was done using a painted nylon cord with an anchoring stake at one end.

Natural Community Condition Assessment Plots

Circular plots were used to collect data on the ecological condition of natural communities. Within a 12.5-meter radius plot, we made ocular estimates of the total percent canopy covers of all species. At each plot center coordinates were taken with a GPS, and the elevation, slope, and aspect of the plot were found using an altimeter, clinometer, and compass. The percent cover of bedrock, rock, gravel, sand, and soil were individually recorded as cover estimates (not a cover class). Geologic substrate was also described (if it was readily discernable), along with landform and the micro-topography of the site. In addition to these data, any evidence of stressors or disturbance agents that occurred on the plot or in the vicinity of the plot were recorded. Information on soil surface condition, presence of biotic crusts, desert pavement, erosion, and plant pedestaling were also documented. The field data collection form for natural community sampling is included as Appendix P. Plant composition information was recorded in nine life form/structure categories: trees, cacti, shrubs, vines, grasses, ferns and club mosses, herbs, moss, and biotic crust. The number of individual saguaros occurring in a plot was also recorded. Each saguaro was listed as being in one of three size classes: below 1 meter in height, between 1 and 5 meters in height, or above 5 meters in height. We sampled 320 natural community condition plots within the study area.

Location of Plots

The exotic species plots and natural community plots were distributed so that all natural communities were sampled according to their extent and degree of natural variability (Figures 7 and 8). Additional sampling was done in areas where human stress factors may have influenced exotic species distributions and natural community composition and structure.

Natural community condition assessment field plots were specifically located by two methods. First, they were designated along disturbance-gradient transects that extended out from selected disturbed areas. The first plot was usually located in the heart of the disturbed area. The next plot's center was located along the previously determined disturbance-gradient transect line, 50-m from the first plot's center, or 50-m from the disturbed area's observed boundary (when the latter extended beyond 50-m from the center of the disturbance). The third plot's center was 100-m from the disturbed area. The 4^{th} through 13^{th} plots' centers were located at 500-m meter increments from the disturbed area, with the last plot's center located 5 km from the disturbed area (Figure 9). For many of the disturbance-gradient transects the final plots were not reached due to constraints imposed by landscape features or other disturbances. The orientation of the disturbance-gradient transect was determined by selection of a random azimuth (selected from a random number table) but the degree of randomness was constrained so that the transect lay largely within a similar environment along its extent, and so that it was not unduly influenced by other disturbance sources.

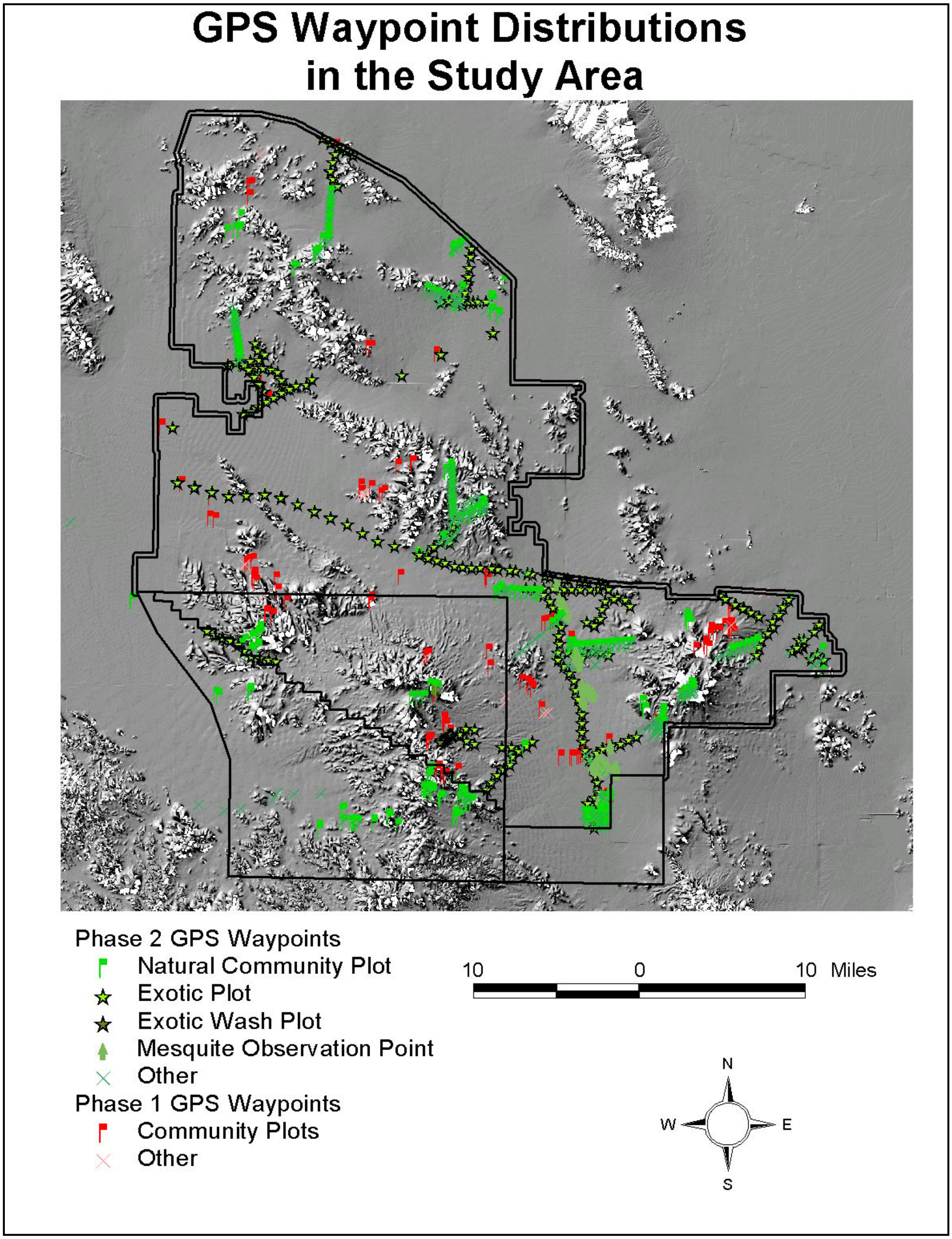


Figure 7. Distribution of all data collection locations.

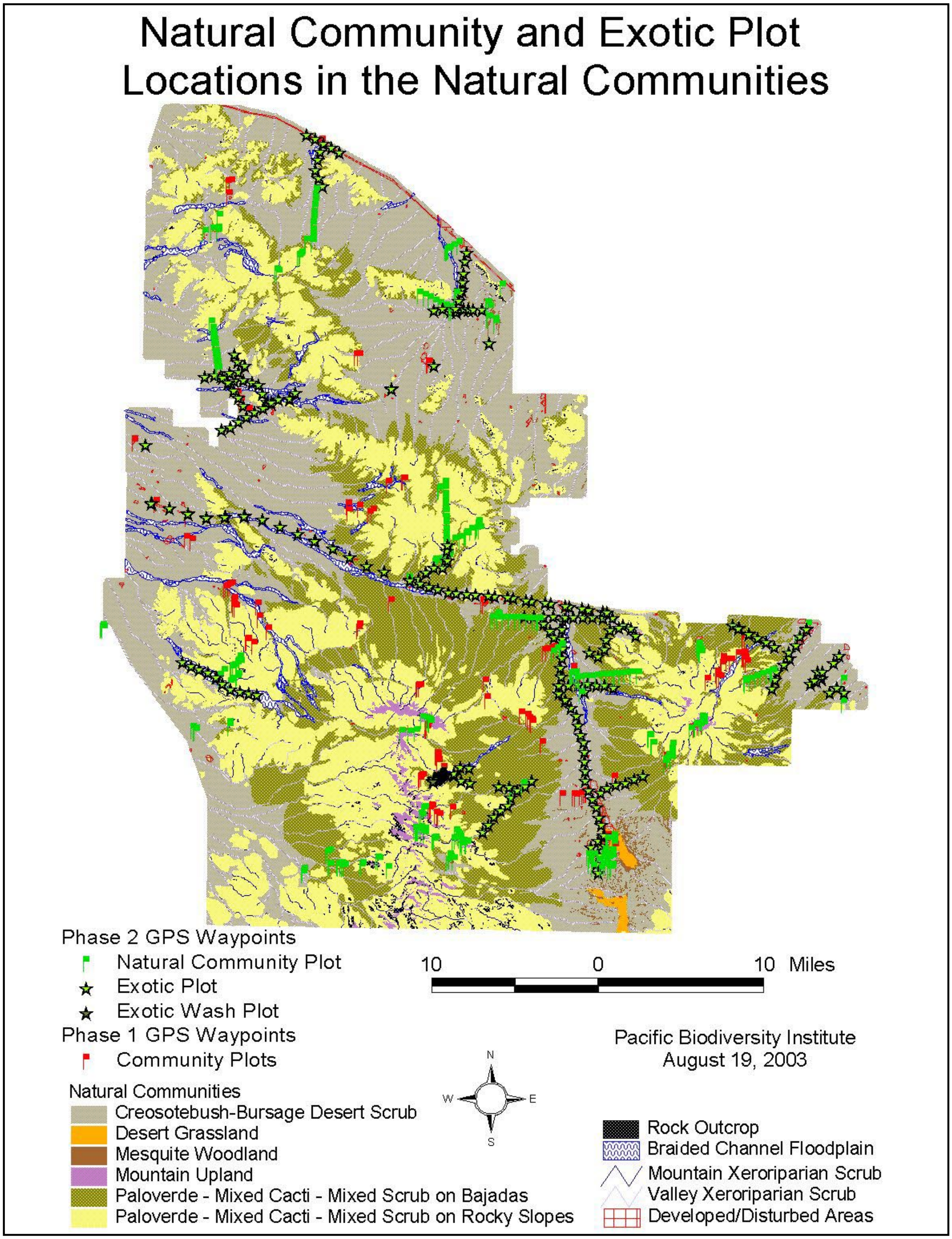


Figure 8. Distribution of natural community and exotic plots.

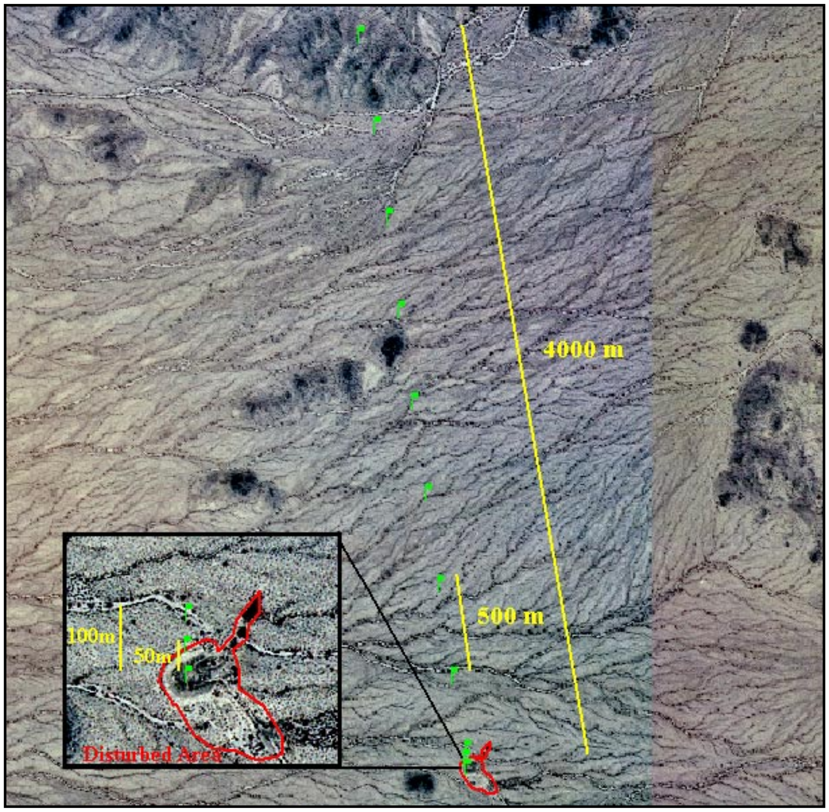


Figure 9. Example of a disturbance gradient transect (originating from Gap Tank).

Second-, some plots were strategically located to pick up the natural variation that occurs within natural communities. An effort was also made to locate plots in areas that may represent “baseline conditions”, where little or no human-induced alteration appears to have occurred. The locations of these plots were selected using GIS analysis and image interpretation techniques prior to field sampling.

To assist in future natural communities monitoring, permanent plot markers (1.5 foot long, 3/8” diameter rebar stakes painted red) were placed at the natural community condition assessment sample sites (Figure 10). Some of these stakes were pounded so that their ends were flush or slightly below the ground surface. Precise relocation of these plots may require the use of metal detectors. The metal stakes in addition to GPS waypoints allow for precise relocation of all the natural community assessment plots. Exotic species plots were only marked by GPS waypoints.

Locating and recording the center of a natural community condition assessment plot using a Garmin eTrex GPS receiver.

Pounding in a rebar permanent plot marker to mark the center of a natural community assessment plot.

Laying out the point intercept transect cable.

Half meter points along the point intercept transect cable were marked with duct tape so as to be easily seen.

Figure 10. Examples of how the natural community condition assessment plots were established.

Point Intercept Transects

Point-intercept transects were used in selected natural community condition assessment plots to provide objective estimates of plant species cover. These transects were used repeatedly throughout the project to help calibrate field crew ocular cover estimates. Intercept information was taken at half meter intervals along four separate 12.5-meter transects, each starting from the center of the plot, forming a cross (Figure 11). The transects were laid out along the four cardinal directions, and plant species intercepting the transect at a half meter point (see Figure 10) were recorded. It was possible to have multiple species recorded at any given half meter point. This information was then used to calculate percent cover of each species in a given plot. At each intercept point, the presence of litter, soil, sand, gravel, rock, biotic crust or moss was also recorded, if one of these was present without vascular plant cover. The field data collection form used for point intercept sampling is included as Appendix R.

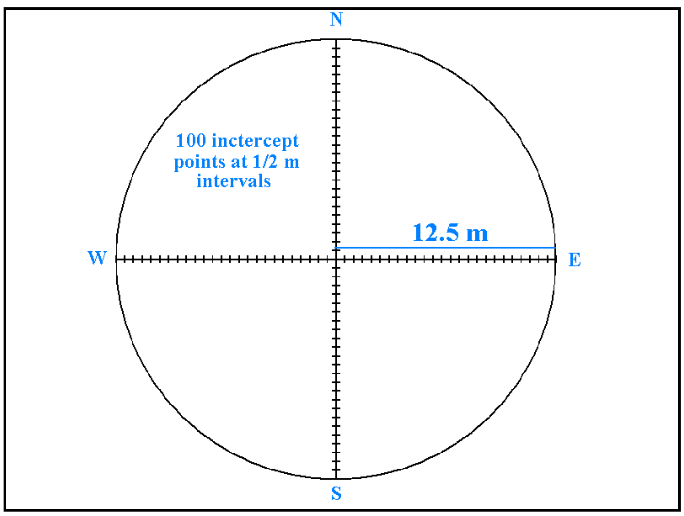


Figure 11. Illustration of the point intercept sampling layout.

While the point-intercept transects provided more objective data than ocular cover estimates, we found that they were inadequate in describing species diversity, since less abundant species were often not recorded by the point intercept method. We also found that they were inadequate in describing the relative cover of plants in communities where plants were often highly clumped (riparian areas, rocky slopes, mountain uplands). Because of these findings, the standard natural community assessment data methods (described above) were also used at the point intercept transect locations. Our final species composition and cover estimates recorded for these locations represented our synthesis of the two data collection methods.

Miscellaneous Field Observations

The fourth method of field data collection was the collection of field observations and notes taken while traversing natural communities between sampling locations and more intensive field study sites. Included in these observations were the presence of rare plants, exotic plants and unusual plant communities (Figure 12). The field data collection form used for collecting information between plots is included as Appendix T.

Figure 12. *Castela emoryi* in the Creosotebush-Bursage community in the Vekol Valley. This large specimen's location was recorded in our miscellaneous field observations data.

Field Collection of Disturbance Data

During field sampling, data on a variety of disturbance elements and stressors were collected. These data were useful in establishing an overall concept of baseline conditions. Only fine scale disturbances that had typically affected a natural community within the last 5 years were discernable. The development of disturbance data layers on a landscape level was previously described in the Phase 2 methods.

Each site was evaluated for the following disturbance elements and stressors.

a) Invasion of exotic species
b) Level of grazing pressure
c) Effects of vehicles on highways and roads
d) Off-road vehicle use
e) Recreational use
f) Hydrologic alteration
g) Mining

Grazing pressure and off-road vehicle use were quantified in a number of ways. Cow prints, cow dung, cow trails, horse prints, and horse dung were each individually tallied and recorded for each plot in which they occurred. Vehicle use was quantified by recording the number of individual vehicle tracks that occurred in each plot, and totals were sorted by the type of vehicle that made each track (car, motorcycle, ATV, etc.).

Quality Assurance

Quality assurance of field data was accomplished through a variety of means. These included:

- Inspection of plot data sheets by senior staff
- Independent sampling of selected plots by senior staff and comparison to data recorded by the field team.
- Duplicate (sometime triplicate) estimation of species occurrence and cover within many of the plots by multiple, independent observers. Once each observer had independently recorded species occurrence and estimated cover, then the results were compared and discussed, and a final estimate was entered for each species.
- Point-intercept transects in selected plots were used to calibrate observer cover estimates.

The above methods have proven to provide consistent and repeatable species cover estimates between trained observers.

Assessment of Unique Communities

Desert Grasslands

We conducted field surveys and natural community plots on the BLM side of the SDNM/TON boundary. An interesting trend we looked at for the *Desert Grasslands* community is the continuing mesquite invasion of the *Desert Grasslands.* We examined a series of historic aerial photos (chronosequencing) to help us understand the spatial dynamics of this trend in the past forty years.

Braided Channel Floodplain

The *Braided Channel Floodplain* community is a complex of various habitat types that occur on surfaces created and maintained by disturbances of varying magnitude and frequency. This community has some of the highest biodiversity in the study area due to the complex interspersion of habitat types**.** Sampling of the floodplain community was done by conducting transects across various floodplains, measuring the dimensions of the variety of surfaces encountered and conducting 12.5-m radius natural community plots on these surfaces. The result was detailed characterizations of the floodplain community at each transect location. Multiple transects across the study area provided a good assessment of the variation of condition and natural variability within this community.

Mesquite Woodlands

Data collection

The spatial distribution and ecological characteristics of *Mesquite Woodlands* were assessed using a combination of three different methods: analysis of aerial imagery, community ecology assessments, and **Mesquite Condition and Extent Plots**. Each method had its own strengths and weaknesses in accurately assessing mesquite community components, and combining the three methods provided the best overall understanding of mesquite communities.

The first method focused solely on mesquite patch distributions on a broad landscape level. We used Landsat TM7 satellite images, digital infrared orthophotos, and a reconnaissance field survey to digitize locations of suspected mesquite community patches and to gain a preliminary perspective about the range of variation of mesquite communities. The initial mapping was done as part of Phase 1 of this project. Further refinement of this landscape-level mapping was done during the initial stages of Phase 2, using GIS software and aerial photography from different time periods to distinguish probable mesquite community patches by their distinctive spectral qualities, texture, landscape location, and patch shapes. We mapped any changes of suspected mesquite communities through on-screen digitizing. This provided the Phase 2 field crew with geographically explicit areas of interest on which to focus the other two assessment methods. We updated the map as needed, based on the Phase 2 fieldwork.

The second method employed was the community ecology assessment, which was identical to the vegetation sampling done in the other natural communities, with the addition of tree height and diameter data. This method provided the most in depth data on differences in plant species diversity and composition between different mesquite patches. However, as this method was limited to an observational range of 12.5 m per plot, we found that an alternative sampling method would be necessary to adequately ground truth the extent of probable mesquite patches delineated by the aerial imagery mapping.

The third assessment method was designed during Phase 2 fieldwork to better provide mesquite community distributional data and some ecological data over many of the areas mapped during the aerial imagery work. This method consisted of traversing an area of interest and taking GPS waypoints along the way. At each waypoint an observer recorded spatial, structural, and compositional data, and also a subjective observational radius to which these components applied (Figure 13). Other important ecological dynamics, such as evidence of disturbance, were also recorded at each waypoint. The flexibility of the observational radius in this third method, as opposed to the vegetation sampling method, allowed for much more of the area of interest to be sampled while still providing important ecological data. The plot form used for this method is in Appendix S.

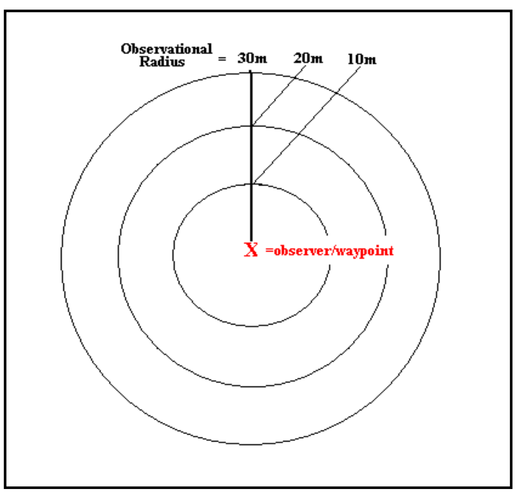


Figure 13. Illustration of the observation radius concept. The observational radius (OR) represents the amount of area an observer could see and to which the observations applied.

Data analysis

Mesquite community conditions were assessed using the data collected during Phase 2 fieldwork. Because of the substantial variation within the mesquite community, we divided the

Mesquite Woodlands into three sub-community types prior to analysis. These sub-community types are as follows:

1) Mesquite dominated woodlands established before the late 1960s
2) Mesquite stands found on or near spreader dikes or water tanks
3) Pure mesquite stands invading other natural communities after 1968

We describe the sub-communities by percent cover of growth form, and various condition factors such as average distance from water improvements and percent cover of exotic species. Table 7 shows the number of plots or spatial observation points taken within each sub-community type.

Table 7. Distribution of plots in various mesquite stand types.

Mesquite Stand Types	Number of Natural Community Plots	Number of Mesquite Condition and Extent Plots
Naturally Occurring/Persistent Stand	10	39
Stand in Tank/Disturbed Area	2	17
Young Stand in Area Previously Not Dominated by Mesquite (Invading Mesquite)	1	13
Total	13	69

Refinement and Extension of the Natural Community Map

While undertaking the fieldwork described above, substantially more was learned about the spatial distributions and characteristics of the natural communities. We used this information to modify the Phase 1 natural community map and community descriptions.

In order to detect whether any major cover type discontinuities occur along the monument boundary, we extended the natural community map to include a one-quarter mile buffer outside the SDNM and significant parts of the BMGR and TON. We mapped the additional area through on-screen digitizing, using a combination of digital aerial imagery cross-referenced with the Phase 2 field data, much in the same way the original natural communities map was produced in Phase 1.

We used the extended data to visually assess the degree and primary types of discontinuities in cover that occur along the monument boundary. We provide a qualitative description of these findings in the results.

Analysis of Exotic Plant Distributions

We examined the 5 most common exotic species on the monument (in terms of percent cover) in relation to human-based disturbance and environmental factors that might influence their distribution. We used linear regression to look at the distribution of *Brassica tournefortii*, *Bromus rubens*, *Erodium cicutarium*, *Schismus arabicus*, *Sisymbrium irio*, and the total number of exotic species in relation to elevation, slope, aspect, distance from potential livestock congregation areas, and distance from roads. We examined the relationships of these factors to exotic species distributions across and within community types. These analyses were based on a combined data set of the exotic plots and natural community plots. The exotic plot data, which were gathered using a quick, and less in-depth approach than the natural community data, did not include information on soil texture, geology, and vehicle and livestock impact indices and so these factors were not included in the analysis.

In order to use aspect in linear regressions, we converted this to two separate continuous variables as follows (Zar 1999):

Eastness = sin ((aspect in degrees * PI)/180)
Northness = cos ((aspect in degrees * PI)/180)

Northness quantifies the degree to which an aspect is north, and eastness, the degree to which it is east. For example, northness for an angle of 360 degrees is 1, for 90 degrees is 0, and 180 degrees is –1.

Lastly, we used ANOVA to check for differences in percent cover of exotic species by community type. We limited this analysis to the natural community data, since the distribution of the exotic plots was heavily skewed to communities with higher exotic cover, and this would strongly influence the average cover of exotics calculated for each community. The regressions and ANOVA were run using SPSS 8.0 for Windows software.

Analysis of Variation within Natural Communities

We used two community analysis techniques to examine the variability of species composition within the natural communities. These were Detrended Correspondence Analysis (DECORANA or DCA) (Hill and Gauch 1980), an ordination technique, and hierarchical cluster analysis. Of the wide variety of ordination techniques available, we chose to use DECORANA for several reasons. First, we wanted to use an indirect gradient analysis approach, which, as opposed to direct gradient analysis, is most useful in representing the actual underlying gradients in community data, whether or not those gradients relate to secondary variables measured in the study (e.g. elevation, slope, etc.). The two most popular indirect gradient analysis programs are DECORANA and NMDS. Each have their own strengths and weaknesses and perform more or less satisfactorily depending on the type of data and applications. DECORANA is more commonly used in community ecology and is based on an underlying unimodal model of species distributions. NMDS is better suited to data that are non-normal or discontinuous (if species composition is determined less by a gradient than by other factors) (McCune and Mefford 1999; Palmer 2003). In addition, some of instability problems that were noted with previous versions of DECORANA had been addressed in the PC-ORD 4.1 software (McCune and Mefford 1999), which we used for conducting all of our analyses.

In order to get the most meaningful results, we eliminated extremely rare species from the analysis data sets (Gauch 1989). “Rare” species were those that occurred in less than 5 of the 320 natural community plots. We graphed and examined the ordination results, then looked at correlations of various environmental factors and human-related disturbance factors to that variation. Environmental factors were elevation, slope, aspect, soil, and geology. Human-related disturbance factors were distance from potential livestock congregation areas, distance from road, a livestock impact index, and a vehicle impact index (the two indices were previously described). To simplify and clarify analysis results for each community, we included only those factors that appeared influential in affecting variation for that community based on our field experience. Table 8 lists the primary factors influencing variation in species composition for each natural community.

Table 8. Primary factors influencing variation in species composition for each natural community

Primary Factors Influencing Variation in Composition within Each Natural Community	Creosotebush-Bursage Desert Scrub (87 plots)	Paloverde - Mixed Cacti - Mixed Scrub on Bajadas (34 plots)	Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes (64 plots)	Mesquite Woodland (13 plots)	Mountain Upland (36 plots)	Braided Channel Floodplain (21 plots)	Mountain Xeroriparian Scrub (16 plots)	Valley Xeroriparian Scrub (25 plots)
Elevation	X				X	X	X	X
Slope Steepness			X		X			
Aspect			X		X		X	
Soil Texture		X						
Geology			X				X	
Distance from Potential Livestock Congregation Area	X	X		X				
Distance from Roads				X				
Livestock Impact Index	X					X		

Ecological Condition of Natural Communities

In order to look at ecological condition we first identified a number of field-based measurements that strongly influence condition and/or quantify levels of disturbance. These were number and percent cover of native species, number and percent cover of exotic species, number and percent cover of native grasses, percent cover of sand and soil, a livestock index, and a vehicle use index. Based on these factors we defined and described three levels of ecological condition. Next, to test whether our GIS data could be used to model and map condition, we analyzed relationships of the plot-based measures of condition and disturbance to GIS-derived layers of distance from potential livestock congregation areas and distance from roads.

We used multiple sources of information (DECORANA graphs, cluster analysis results, and review of field data) to assign each natural community plot to one of the three condition classes. We used ANOVA to test how well the condition classes (as assigned to the field plots) were differentiated from each other in terms of the field-based measurements of condition and disturbance. The ANOVA was conducted only for the *Creosotebush – Bursage Desert Scrub* community, as an example.

Next we developed models for the 3 condition classes on a community-by-community basis. These models were developed based on examination of the previously assigned condition classes of the plots, distance from potential livestock congregation areas and distance from roads for those plots, the DECORANA results, cluster analysis results, and other field data. Finally we created a map portraying the modeled condition classes for all communities.

Relationship of Field-Based Condition and Disturbance Measures to GIS Layers of Disturbance

We used linear regression to look at relationships of field-based measurements of condition and disturbance to GIS-generated data layers that might contribute to a condition model. Specifically, we looked at field observations of number and percent cover of native species, number and percent cover of exotic species, number and percent cover of native grasses, percent cover of sand and soil, livestock impact, and vehicle impact in relation to distance from roads and distance from potential livestock congregation areas.

We ran regressions of each of the field-based variables against the GIS-derived distance from potential livestock congregation areas and distance from road variables for all natural community plot locations (n=320) using SPSS 8.0 software.

In order to quantify livestock impact, we incorporated 4 field-based measurements of livestock impact into a single livestock index. This index was calculated for each plot as:

Livestock Index = Number of cowprints + Number of horseprints + Number of cowtrails + Number of cow/horse dung piles

Similarly, we incorporated 3 field measurements of vehicle-related disturbance into a vehicle index for each plot. We gave heaviest weighting to the "number of roadways" measurement since the impact of this variable is proportionately greater and longer lasting than that of the other 2 variables. The vehicle index was calculated as:

*Vehicle Index = (100*Number of roadways) + Number of car tracks + Number of motorcycle/ATV tracks*

Segregation of Natural Community Plots into Condition Classes

We segregated the natural community plots into three condition classes. The three classes range from highly disturbed and altered sites (Condition Class 1) to relatively undisturbed sites (Condition Class 3), and are described in detail in the results. The condition class assignments were made primarily on the basis of professional judgment, and were informed by the integration of the DECORANA (ordination) results, cluster analysis results, our field data, field notes, and plot photographs.

As a starting point for working with each community's plot data, we looked at the ordination graphs and cluster analysis results for natural groupings of plots that we knew, based on our field experience, were of a similar condition level. In some cases the plots in our analyses divided nicely along these lines (e.g. *Creosotebush – Bursage Desert Scrub*). In other communities where there were less dramatic differences in ecological condition (e.g. *Rocky Outcrops*), the ordination and cluster analyses results were less useful in delineating groups of plots with similar condition. In these cases, we had to rely more heavily on review and interpretation of our field data to make decisions on condition class.

To test the integrity of the assigned condition classes, we used multivariate ANOVA to check for differences in field-based measures of condition and disturbance for plots assigned to the three condition classes. The field-based measures were number and percent cover of native species, number and percent cover of exotic species, number and percent cover of native grasses, percent cover of sand and soil, livestock impact index, and vehicle impact index. This analysis was done for the *Creosotebush-Bursage Desert Scrub* community only, as an example.

Modeling and Mapping of Ecological Condition

Once the natural community plots were assigned to a condition class, we examined the summary statistics for the plots of each community's condition classes and used these, in combination with professional judgment based on our field experience, to develop criteria for modeling condition for a given community. These criteria were then objectively applied to the entire community to create a map of condition class. Our models varied by community and were typically based on varying thresholds applied to the distance from roads and distance from potential livestock congregation areas GIS layers. We integrated the condition class maps for all communities in order to create the map of condition classes for the entire study area.

Next, we overlaid our roads layers, the developed/disturbed sites layer, and the linear disturbances layer and added these layers into our condition map as representing Condition Class 1 areas.

Lastly, we overlaid GIS data concerning the BMGR's East Tactical Area expended ordinance sweep program. This data layer depicts the extent and frequency of expended ordinance sweep activity and development in that region. We evaluated this layer with respect to the potential ecological impacts inherent with the different activity types. This layer was also evaluated in concert with our own field observations, resulting in a geo-spatially stratified condition class layer for the BMGR's East Tactical Area. This last layer was then added to the main condition map to produce the final ecological condition map.

The factors used in modeling and mapping the ecological condition classes in the study area are shown in Table 9.

Table 9. Inputs to the community condition models and final condition map.

Factors Used in Modeling and Mapping Ecological Condition Class	Creosotebush-Bursage Desert Scrub	Paloverde - Mixed Cacti - Mixed Scrub on Bajada	Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slope	Mountain Upland	Mesquite Woodland	Braided Channel Floodplain	Valley Xeroriparian Scrub	Mountain Xeroriparian Scrub	Desert Grassland	Rock Outcrop	Desert Springs
Distance from potential livestock congregation area	X	X			X	X	X				
Natural community boundary (i.e. community was assigned to a single condition class)			X	X				X		X	X
Natural community boundary divided along SDNM and TON lands									X		
Roads	X	X	X	X	X	X	X	X	X	X	X
Linear disturbances	X	X	X	X	X	X	X	X	X	X	X
Developed/disturbed sites	X	X	X	X	X	X	X	X	X	X	X
Munitions disturbance sites (relevant only to communities occurring on the BMGR)	X	X	X				X	X		X	

Results

Natural Communities of the Study Area

We mapped and described 12 natural communities in the study area (Table 10, Figure 14). These natural communities range from primary matrix communities to small patch communities. The communities are described in much more detail in Appendix A. This description includes information on composition, structure, function, disturbance processes, landscape context, examples of baseline conditions, mapping methods, biophysical modeling parameters, discussion of previous mapping efforts, and relationship to existing plant community classification systems.

Further natural community data is also presented in Appendices C and D. Appendices C and D contain in depth information on each community's composition and structure based upon our field data. All the plant species encountered in our Natural Community Condition Assessment Plots are expressed in these appendices, organized by the community in which they were found, and their growth form categories. The difference between Appendices C and D is that the species in Appendix C are sorted in an ascending order according to average percent cover, whereas the species in Appendix D are sorted in ascending order according to percent constancy.

Table 10. Upland Natural Community Descriptions.

Natural Community	Description
Creosotebush-Bursage Desert Scrub	Primary matrix community occupies the lowest elevations on the SDNM covering desert flats, valley bottoms and lower portions of bajadas. Community is dominated by *Larrea divaricata tridentata* and has a relatively low leguminous tree component compared to the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* and *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* communities.
Paloverde - Mixed Cacti - Mixed Scrub on Bajadas	Secondary matrix community with greater leguminous tree and cacti cover than the *Creosotebush-Bursage Desert Scrub* community. This community is typically spatially "sandwiched" in between the *Creosotebush-Bursage Desert Scrub* and the *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* communities. This community occurs on the gentle slopes of desert bajadas. This is the community in which saguaro forests are found.
Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes	Tertiary matrix community occupying the mountainous slopes in the study area. A higher leguminous tree component, as well as a more frequent occurrence of *Encelia farinosa farinosa*, and *Lycium* species, distinguish this community from the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community.
Mountain Uplands	Patch community limited to the highest elevations (and mostly northern aspects) occurring in the study area. This botanically diverse community is primarily distinguished by the occurrence of *Canotia holacantha*, *Agave deserti simplex*, *Yucca baccata,* and other high elevation shrubs and trees.
Desert Grasslands	Patch community, limited to the upper Vekol Valley flats. This community is identifiable by its dominant bunch grass (*Pleuraphis mutica*) component and single canopy layer structure.
Mesquite Woodlands	Small patch community occurring in lowland flats, usually near a riparian or xeroriparian area. This community is characterized by its woodland structure and the dominance of *Prosopis velutina.*
Rock Outcrops	Small patch community typically occurring within a matrix of the *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* or *Mountain Upland* communities. This community has very low vegetative cover compared to the surrounding matrix communities, and the substrate is bedrock without soil accumulation.

Table 11. Riparian Natural Community Descriptions.

Natural Community	Description
Valley Xeroriparian Scrub	Linear patch community occurring around and encompassing the seasonal wash beds on the bajadas and lowland flats in the study area. This community has a high leguminous tree component, abundant vines, and a multi-layered canopy structure. It is distinguished from the *Mountain Xeroriparian Scrub* community by having a wash channel that is not confined to a bedrock substrate. This community's spatial occurrence is sensitive to peak flow events.
Mountain Xeroriparian Scrub	Linear patch community occurring around and encompassing the seasonal wash beds on the steeper mountain slopes of the study area. This community has a high leguminous tree component, and a multi-layered canopy structure. It is distinguished from the *Valley Xeroriparian Scrub* community by having a wash channel that is confined to a bedrock substrate. This community's spatial occurrence is not sensitive to peak flow events.
Braided Channel Floodplains	Patch community that has many similarities to the V*alley Xeroriparian Scrub* community but differs in regard to width, dominant geomorphic/hydrologic processes and vegetation composition. This community occupies relatively broad floodplain areas within the mountain valleys and along major washes on the bajadas. Multiple, cross-braiding channels characterize this community. Significant island areas and adjacent floodplain zones often exist that are inundated by floodwaters during high flow events. These areas are much wider than the typical xeroriparian communities and often bear some resemblance to river floodplains along major perennial rivers throughout the world.
Desert Springs	Small patch community that surrounds and encompasses a naturally occurring spring. This community is distinguished by having a unique plant species composition compared to the surrounding matrix community in which it occurs. The presence of plants typically sensitive to dry soil conditions are a good indicator of this community.
Tinajas	Small patch community that encompasses a naturally occurring tinaja. This community does not usually contain much terrestrial vegetation. It is found in a bedrock dominated substrate.

Refinement and Extension of the Natural Community Map

The natural community map, which was refined based on Phase 2 fieldwork, is shown in Figure 14. This map also includes natural community boundaries within a quarter mile buffer around the monument, and extensions into the BMGR and TON lands. Total areas covered by each natural community on the SDNM and extended areas are provided in Table 12. We did not subtract the area occupied by the riparian communities from the non-riparian communities in which they occur (*Braided Channel Floodplain* areas were subtracted). Xeroriparian communities are mapped with a 10-meter buffer on either side of the 1:100,000 GIS hydrography data upon which they are based.

Table 12. Area covered by major natural communities

	Natural Community	SDNM (hectares)	SDNM Buffer (hectares)	BMGR and TON Extension (hectares)	Total Study Area (hectares)
Non-Riparian Communities	*Creosotebush-Bursage Desert Scrub*	82,909	6,566	15,436	104,911
	Paloverde - Mixed Cacti – Mixed Scrub on Bajadas	50,895	1,215	7,787	59,897
	Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes	59,190	660	21,749	81,599
	Mountain Upland	1,283	0	1,019	2,302
	Desert Grassland	102	0	679	781
	Mesquite Woodlands	676	49	957	1,681
	Rock Outcrop	627	2	998	1,627
	Total Area of Non-Riparian Communities	**195,683**	**8,491**	**48,625**	**252,799**
Riparian Communities					
	Braided Channel Floodplain	5,186	157	176	5,519
	Valley Xeroriparian Scrub	2,790	158	544	3,492
	Mountain Xeroriparian Scrub	348	1	177	526
	Total Area of Riparian Communities				**9,537**

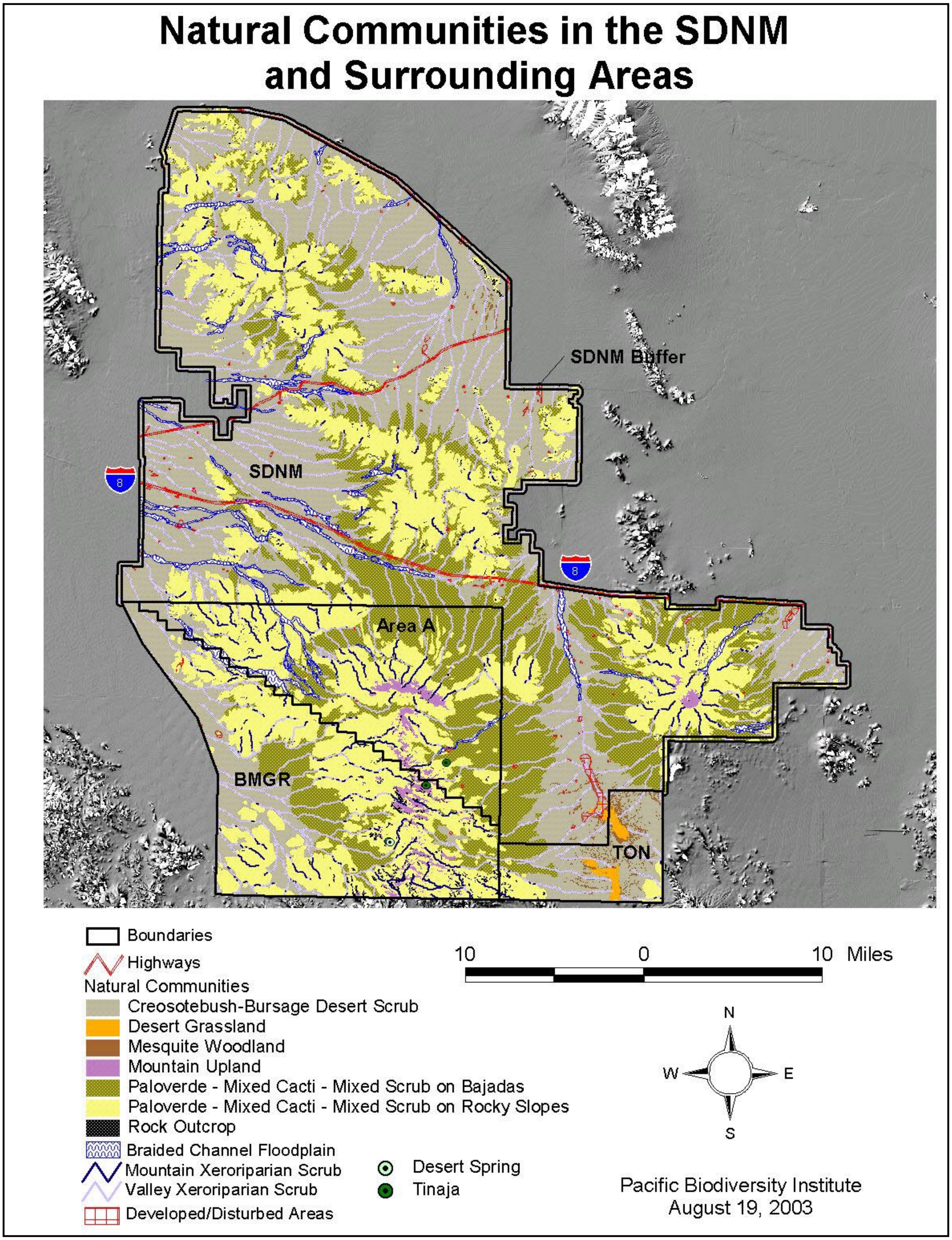


Figure 14. Natural communities in the SDNM and surrounding areas.

A visual inspection focusing on the continuity of the SDNM's major community types within the quarter mile SDNM buffer area showed that most communities continue their natural distribution patterns without artificial interruptions. However, on the northern boundary of the SDNM, along the El Paso Pipeline Road where it intersects with Prong Wash, the *Creosotebush-Bursage Desert Scrub* community is slightly interrupted within the SDNM buffer by agricultural fields.

Botanical Inventory of the SDNM and Adjacent Areas

During the Phase 1 and 2 fieldwork sessions, we identified 325 native plant species and 21 exotic plant species within the study area. A list of all the species encountered is presented in Appendix B.

Because the Phase 2 field season was delayed due to circumstances outside our control, our ability to positively identify every species we encountered was diminished. In many cases, phenology was not ideal for species identification due to the combination of several years of regional drought and the late timing of our spring fieldwork. At the time of our surveys, many plants had gone to seed and their leaves had already withered.

Specifically, certain species, such as *Caulanthus lasiophyllus and Sisymbrium irio,* became increasingly difficult to tell apart as field specimens dried up in late spring. Some cacti were difficult to accurately identify. Species from the genus *Opuntia* were too difficult for us to collect for expert assistance and sometimes proved to be beyond our realm of expertise to identify on site. We did not attempt to distinguish *Schismus arabicus* and *Schismus barbatus* (very similar exotic grasses). All specimens of the genus *Schismus* were recorded in our data as *Schismus arabicus*. All specimens that were examined by Dr. Richard Felger or Elizabeth Makings were *arabicus.* Other scientist working in this area have often just recorded this species at a genus level.

Analysis of Exotic Plant Distributions

Twenty-one species of exotic plants were found in the study area (Table 13). Many of these plants were found in only a few localities. The extreme drought conditions probably limited the visible occurrence of some species that are present in the study area. Surveys during wetter periods will likely reveal additional species.

Table 13. Exotic species found in the study area.

Scientific Name	Family	Growth Form	Common Name	Abbreviation
Avena fatua	Poaceae	grass	wild oat	AVEFAT
Brassica tournefortii	Brassicaceae	herb	Sahara mustard	BRATOU
Bromus carinatus	Poaceae	grass	California brome	BROCAR
Bromus rubens	Poaceae	grass	red brome	BRORUB
Chenopodium murale	Cheonopodiaceae	herb	nettleleaf goosefoot	CHEMUR
Conyza canadensis	Asteraceae	herb	Canadian horseweed	CONCAN
Cynodon dactylon	Poaceae	grass	Bermuda grass	CYNDAC
Eragrostis lehmanniana	Poaceae	grass	Lehmann lovegrass	ERALEH
Erodium cicutarium	Geraniaceae	herb	filaree	EROCIC
Hordeum murinum	Poaceae	grass	mouse barley	HORMUR
Hordeum pusillum	Poaceae	grass	little barley	HORPUS
Malva parviflora	Malvaceae	herb	cheeseweed	MALPAR
Pennisetum ciliare	Poaceae	grass	buffelgrass	PENCIL
Phalaris minor	Poaceae	grass	canary grass	PHAMIN
Salsola tragus	Chenopodiaceae	herb	russian thistle	SALTRA
Schismus arabicus	Poaceae	grass	mediterranean grass	SCHARA
Schismus barbatus	Poaceae	grass	mediterranean grass	SCHBAR
Sisymbrium irio	Brassicaceae	herb	London rocket	SISIRI
Sonchus oleraceus	Asteraceae	herb	cow thistle	SONOLE
Tamarix ramosissima	Tamaricaceae	shrub	salt cedar, tamarisk	TAMRAM
Triticum aestivum	Poaceae	grass	common wheat	TRIAES

Variation in Cover of Exotic Species Between Natural Communities

We examined the distribution of exotic species by community type (Figure 15). The highest average percent cover of exotics was found in *Mesquite Woodlands*, followed by *Braided Channel Floodplains,* and *Creosotebush - Bursage Desert Scrub*. The community with the lowest average percent cover of exotics was *Rock Outcrops*, followed by *Mountain Uplands*.

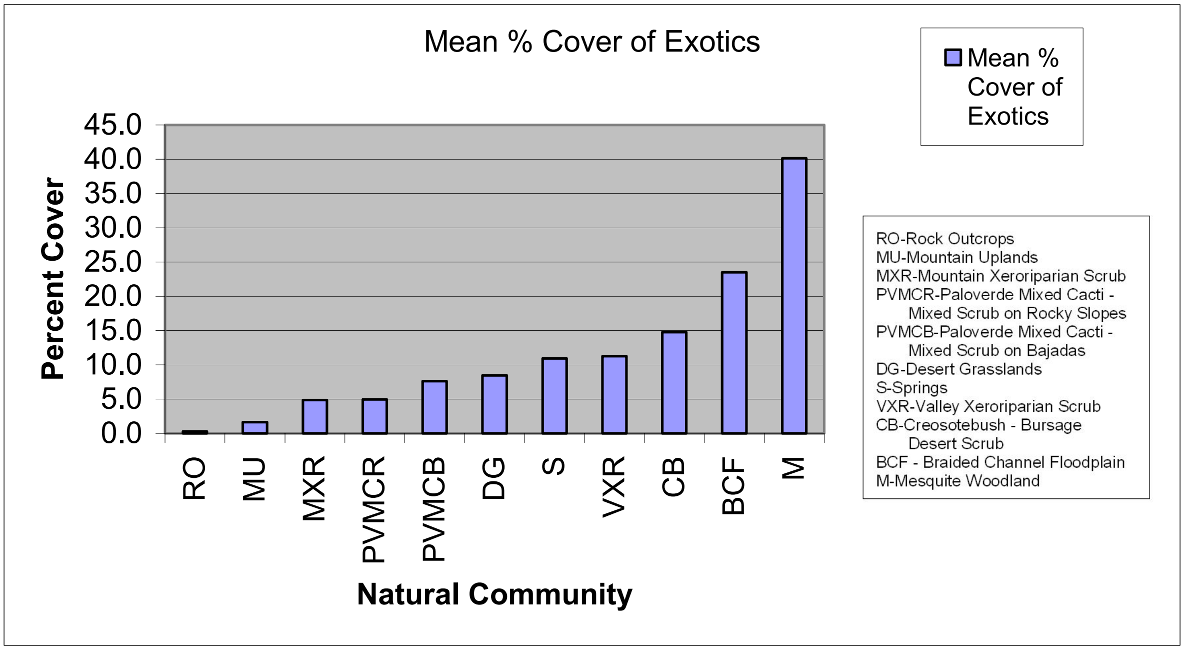


Figure 15. Mean cover of exotic species by community type.

We used ANOVA to check for statistically significant differences in percent cover of exotic species by community type and found significant differences among the communities (F 13.884, p-value <.001). To further clarify differences we used Tukey's HSD for multiple comparisons. Table 14 shows subsets of the natural communities based on significant differences from the multiple comparisons. The *Rock Outcrops*, *Mountain Upland*, *Mountain Xeroriparian Scrub*, and *Paloverde - Mixed Cacti-Mixed Scrub on Rocky Slopes* communities had the lowest percent cover of exotics (subset 1). The second subset with higher percent cover of exotics was composed of the *Paloverde - Mixed Cacti-Mixed Scrub on Bajadas, Desert Grasslands, Desert Springs, Valley Xeroriparian Scrub, Creosotebush-Bursage Desert Scrub,* and *Braided Channel Floodplains* communities. Some of these communities could not be significantly differentiated from other communities in subset 1, and these overlap communities are shown in both groups. The break between subgroup 1 and 2 is based on the significantly higher cover of exotics in *Paloverde - Mixed Cacti-Mixed Scrub on Bajadas* as compared to *Paloverde - Mixed Cacti-Mixed Scrub on Rocky Slopes*. Subgroup 3 consists solely of *Mesquite Woodlands*, which had by far the highest percent cover of exotics of all community types.

Table 14. Sample sizes and subsets (1-3) of natural communities based on differences (p < .05) in percent cover of exotic species.

Natural Community	Number of plots	1	2	3
Rock Outcrops	7	0.3		
Mountain Uplands	36	1.6		
Mountain Xeroriparian Scrub	16	4.8		
Paloverde-Mixed Cacti-Mixed-Scrub on Rocky Slopes	64	4.9		
Paloverde-Mixed Cacti-Mixed-Scrub on Bajadas	35	7.6	7.6	
Desert Grasslands	13	8.4	8.4	
Springs	3	10.9	10.9	
Valley Xeroriparian Scrub	25	11.3	11.3	
Creosote-Bursage Desert Scrub	87	14.8	14.8	
Braided Channel Floodplain	21		23.5	
Mesquite Woodlands	13			40.2

Analysis of Exotic Species Cover in Relation to Disturbance and Environmental Factors

Using linear regression to examine relationships of the 5 most common (i.e. highest percent cover) exotic species to human-related disturbance and environmental factors (elevation, slope, aspect, distance from potential livestock congregation areas, and distance from road), we found statistically significant relationships with 4 species - *Schismus arabicus*, *Bromus rubens*, *Brassica tournefortii,* and *Sisymbrium irio* (Table 15). *Erodium cicutarium* could not be significantly related to any of the factors. With the exception of *Schismus arabicus* in relation to elevation, however, all of the r-squared values (which represent the amount of variation in percent cover explained by the factor) were low. Distance from road did not significantly explain any of the variation in any of the species, and distance from potential livestock congregation areas was only weakly related to percent cover of *Schismus arabicus* and *Bromus rubens.* Elevation, with the highest r-squared values, explains 18.6% of the variation in percent cover of *Schismus arabicus* and 4.6% for *Bromus rubens.* Slope explains 4.5% of the variation in percent cover of *Schismus arabicus.*

When we ran regressions for each species-factor combination by community type, overall results were generally similar to those for all communities put together – statistically significant but rather weak relationships of a few exotic species with elevation, slope, aspect, and distance from potential livestock congregation areas. As with the overall analysis, when broken down by community type, *Schismus arabicus* and *Bromus rubens* generally showed the strongest relationships to any of the factors among the five exotic species. A notable exception was for the *Mesquite Woodlands* community, which had strong positive relationships of *Erodium cicutarium* with distance from potential livestock congregation areas and distance from road. *Mesquite Woodlands* did not show significant relationships with *Schismus arabicus, and Bromus rubens* was not present in our *Mesquite Woodlands* plots.

The regression results support observations in the field, that distribution of exotic species was not highly predictable except that some natural communities have higher concentrations than other communities and heavily disturbed areas have the highest concentrations of exotics. The relatively weak relationship of the exotic species with the GIS-derived human disturbance and environmental factors did not provide support for using these layers to model percent cover of exotic species as an additional input into our final condition model.

Table 15. Linear regression results showing relationship of human-related disturbance and environmental factors to percent cover of 5 exotic species.

All Communities (based on 752 plots, including Natural Community & Exotic plots) Cell values show (sign of regression slope), r-squared, (p-value). "-" represents non-significant findings, with p-value > .05						
	Brassica tournefortii	***Bromus rubens***	***Erodium cicutarium***	***Schismus arabicus***	***Sisymbrium irio***	**TOTAL EXOTICS**
# of plots with species present	46	39	225	695	108	
ELEVATION	(-) .011 (.004)	(+) .046 (.000)	-	(-) .186 (.000)	-	(-) .133 (.000)
SLOPE	-	(+) .026 (.000)	-	(-) .045 (.000)	-	(-) .046 (.000)
NORTHNESS	-	-	-	-	-	-
EASTNESS	-	(+) .009 (.021)	-	(-) .035 (.000)	-	(-) .020 (.000)
DISTANCE FROM LIVESTOCK CONGREGATION AREAS	-	(+) .005 (.050)	-	-	(-) .007 (.025)	(-) .007 (.018)
DISTANCE FROM ROADS	-	-	-	-	-	-

Exotic Species Distribution by Plot

We mapped the distribution of all exotic species based on their occurrence in natural community and exotic plots using a graduated symbol to illustrate the approximate amount of exotic plant cover at each location (Figure 16). We also created separate distribution maps for each of 15 exotic species based on their occurrence in natural community and exotic plots (Appendix E). Finally, we mapped the location and average percent cover of all exotic species in relationship to the natural communities (Figure 17). This was done by attributing the information presented in Table 14 to each natural community polygon. Also, the Developed/Disturbed Areas polygons were added to this map in the 25-50% exotic species cover category. The graduated symbol illustration in Figure 16 was also overlaid onto this map

These maps illustrate that most of the exotics were found within the *Creosotebush – Bursage Desert Scrub* matrix community or the small patch or riparian communities occurring with this matrix community. They also illustrate a high concentration of exotics along the I-8 road corridor, which runs east-west through the center of the monument. This is in contrast to many of the smaller roads and unpaved road corridors where we did not find noticeably higher concentrations of exotic species.

In the exotic species distribution maps, we also illustrated all the locations where exotic species were not present. We believe that this information on the absence of exotics will prove to be just as useful as the information on their presence. Areas without exotics may well represent refugia of native plants within a sea of exotic species and have considerable ecological significance. Many other locations only have common and widely dispersed exotics like *Schismus arabicus* and *Erodium cicutarium.* Monitoring the spread of exotics into un-infested areas, and studies on the population dynamics of exotic species are only possible with this kind of baseline information.

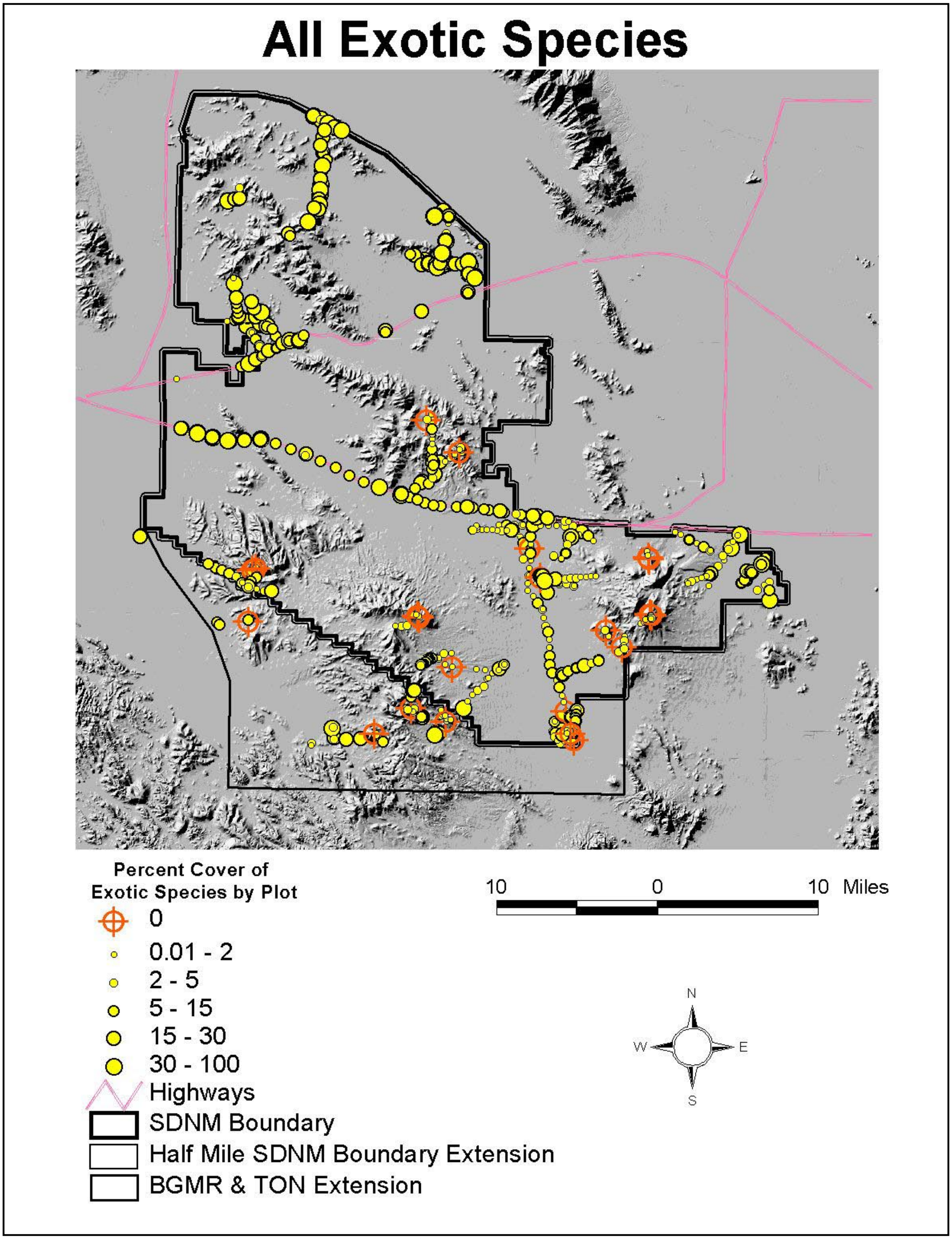


Figure 16. Total exotic species percent cover by plot

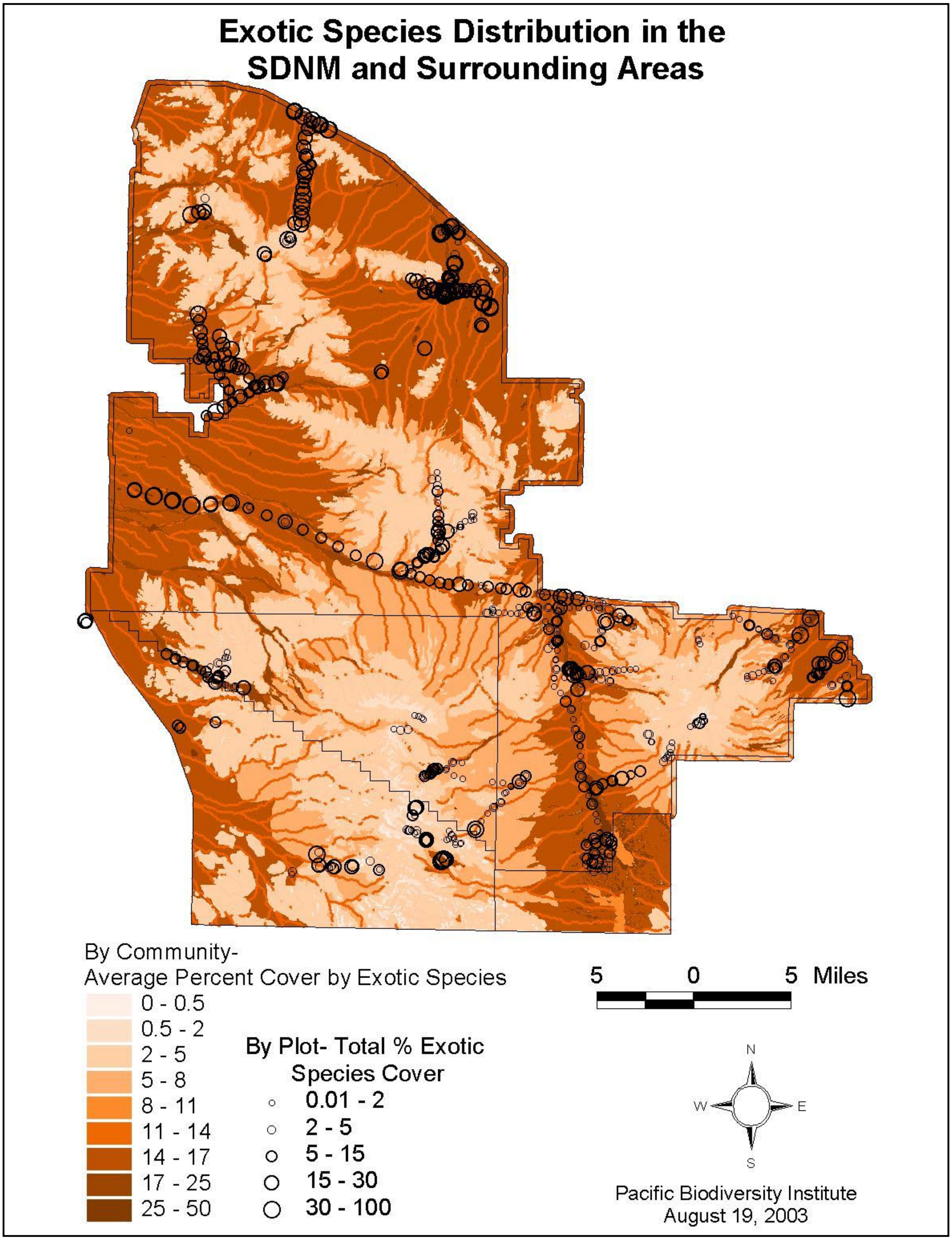


Figure 17. Average cover of exotic species by natural community.

Landscape-Level Assessment of Ecological Condition

The landscape condition was assessed using GIS data and aerial imagery. Figure 18 illustrates the distribution of the different types of visible disturbances that we mapped. Refer to the methods section for details about the creation and representation of the layers.

The total amount of "Developed/Disturbed Areas" according to our landscape assessment is 1,386 ha. The extent of impact on a given community's ecological condition from these disturbed sites is not necessarily contained completely within the mapped areas. Many of these developed areas function as exotic species distribution centers, allowing exotic species to become established and spread out in otherwise remote areas.

As with the "Developed/Disturbed Areas", the extent of impacts by the "Linear Disturbance" and "Roads" layers are not necessarily defined by the lines shown on the map. Because many of these lines represent established transportation routes, they often provide increased access to humans into areas that would otherwise be relatively inaccessible. Certain stress elements may be associated with this increased access. Taken together, the "Roads" and "Linear Disturbances" amount to over 250 kilometers of linear disturbance features.

There are over 1,900 hectares classified as "High-Density Cow Trail Areas". These types of areas proved to be highly disturbed sites (meriting Condition Class 1 or 2 status) according to our field survey results. The High-Density Cow Trail Areas are areas where there are radiating lines visible on aerial photography (cow trails) emanating out from a central area. As the distance from the central area increases, the degree of impact decreases. From examination of the field data it was apparent that the outer part of the "cow trail circles" would fit under Condition Class 2 and only the inner part within Condition Class 1. The difference between the inner and outer part of the High-Density Cow Trail Areas are adequately modeled in our livestock aggregation area distance modeling, where all areas within 500-m of a livestock aggregation area are mapped as Condition Class 1.

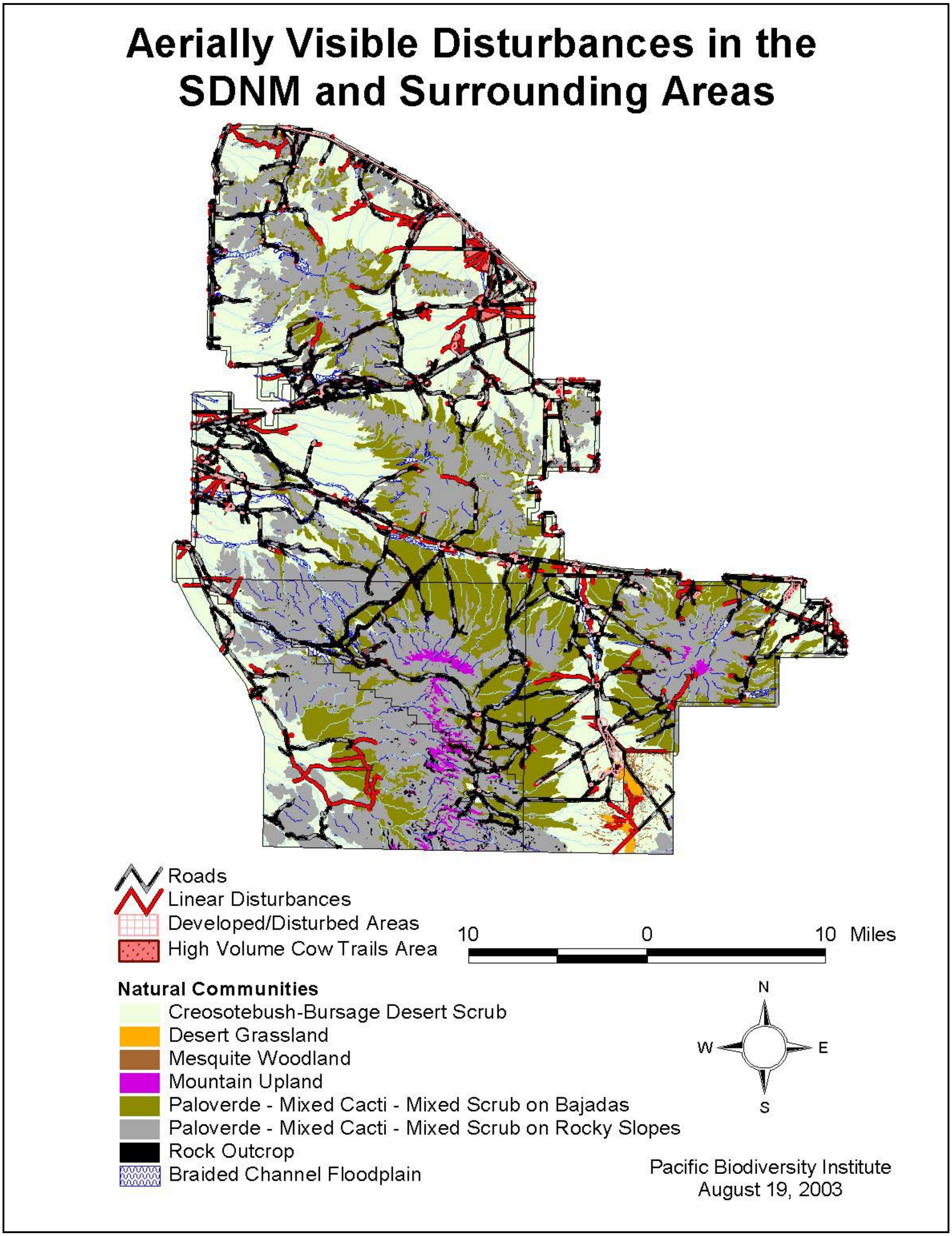


Figure 18. Coarse-scale disturbance map.

Taken together, it is apparent that the distribution and frequency of these disturbances are more typically located within certain natural community types, which in turn are correlated with certain large-scale topographic features. Low elevation areas with gentle slope (*Creosotebush-Bursage Desert Scrub, Paloverde - Mixed Cacti – Mixed Scrub on Bajadas, Braided Channel Floodplain, Valley Xeroriparian Scrub, Desert Grassland,* or *Mesquite Woodland* communities) contain the bulk of these coarse scale disturbances, probably because these types of areas are easier to develop and are the easiest to access. The natural communities in which these disturbance features were found have the highest mean cover of exotics, as was discussed previously.

Based on this information, the landscape-level ecological condition of the study area can be broken down into condition classes based upon the density of coarse scale disturbance features in a given area, or the distance of a given site from a coarse scale disturbance feature. In our final ecological condition map, we have classified all areas that are mapped as "developed/disturbed areas" and all areas within a 10-meter buffer of a linear disturbance or road in Condition Class 1. High-density cow trail areas were not included as an input layer in the final ecological condition map, because the level of impact and resulting ecological condition is better defined by our livestock aggregation area distance modeling.

Analysis of Variation within Natural Communities

We used ordination (DECORANA) and hierarchical cluster analysis to assess the variation in composition within natural communities and then examined the influence of a variety of environmental and human disturbance-related factors on that variation. For each community we provide graphs illustrating the clustering and ordination of the natural community assessment plots based on similarities in species composition. Similarity of species composition incorporates two measures: 1) how many of the same species occur in the plots and 2) similarity in percent cover of those species. Details on PC-ORD's clustering and DECORANA algorithms are described by Hill (1979) and McCune and Mefford (1999).

Cluster analysis and DECORANA are related tools in that both aid in visualizing the similarity of plots, however, we used them in slightly different ways. We used results of the cluster analysis and summary statistics created on the clusters to quantify and describe the variation within a community in terms of condition and disturbance-related variables (e.g. percent cover and number of native species, percent cover and number of exotics, etc.) (see Appendix F). Results of DECORANA were used primarily for evaluating the relationship of natural and human-related disturbance factors (e.g. elevation, slope, distance from road, etc.) on general patterns of compositional variation within a community. The two techniques are complementary, and integration of the results of these analyses helped reinforce the validity of our assessment of the variation within communities and the interpretation of that variation. The two analysis techniques and their corresponding graphs and figures are further described below.

Cluster analysis is a classification technique. It divides or classifies the data into as many groups as the data analyst specifies. We used our familiarity with the amount of variation present in the natural communities (from our fieldwork) and consideration of the number of plots in each community to determine the number of groups or clusters into which the data should be divided.

Once the data are grouped, it is up to the analyst to interpret the clusters and explain which factors (e.g. slope, distance from road, etc.) appear to be influencing division of the data. At any given level of clustering (e.g. five clusters vs. ten clusters), some clusters will be much more interpretable than others. We focus our discussion of the cluster analysis results on those groupings that are most interpretable.

An example of the hierarchical clustering results is Figure 19. The cluster analysis figures show the plot numbers on the left, color-coded by group number (the actual group numbers are meaningless except to identify separate clusters). By tracing back from the clusters on the dendrogram it is possible to see their relative distinctiveness. For example, clusters that separated from each other near the top of the hierarchical graph are more different from each other than those that are split closer to the bottom.

We also used DECORANA to examine variation in vegetative composition of plots. Rather than classifying the data into discrete groups, as in cluster analysis, DECORANA creates a continuous ordering of the plots based on their similarity. It reduces the dimensionality of the original data and creates 3 axes that relate to the strongest compositional patterns in the data. Typically the first 2 axes explain the bulk of the variation. The data can then be plotted on a 2-dimensional graph of the DECORANA axes, where plots that are located closer together are more similar in composition than those that are farther apart. DECORANA also orders species according to similarity in how they are distributed among the plots. Species, in addition to or instead of plots, can also be graphed against the DECORANA axes. As with the cluster analysis, it is then up to the analyst to look for meaningful explanations for patterns in these graphs.

An example of a DECORANA graph is Figure 20. The graph shows the locations of plots, identified by plot number (e.g. N23), in relation to the two primary DECORANA axes (i.e. the two axes which have the highest r-squared values and therefore explain the greatest amount of variation in species composition of the plots). The r-squared values for the individual axes and all axes combined (i.e. "cumulative r-squared") are reported at the top of a table provided for each community (e.g. Table 16). The DECORANA graphs also incorporate results of the cluster analysis. Rather than showing each plot with the same symbol, we symbolized the plots according to the cluster analysis group number. (The actual group numbers for the clusters are meaningless – they just provide a way of referring to discrete clusters of plots). Plots that are grouped in the cluster analysis that are also in close proximity to each other on the DECORANA graphs likely represent some of the most distinct variation components within a given community.

An example of a DECORANA graph showing compositional similarity of plots for a particular species is Figure 26(a) (*Lesquerella gordonii* in plots of the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community). In these graphs, the size of the marker represents the relative percent cover of the species in a plot – the larger the marker the higher percent cover. We incorporated the results of the cluster analysis in these graphs as well, by choosing different symbols (color and shape) to mark different clusters. By integrating these results on a single graph it is possible to see the extent to which the clusters are correlated with certain species and how well both the DECORANA and cluster analysis capture that pattern. For example, in Figure 26(a), the DECORANA groups together plots with high percent covers of *Lesquerella gordonii*, as seen by the large symbols in close proximity to each other on the right side of the graph. The cluster analysis did the same, as seen by the fact that almost all the plots with large symbols are in a single group

(group 36). This suggests that the distribution of *Lesquerella gordonii* is quite an important component in describing the variation for the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community.

To aid in the interpretation of the DECORANA graphs, we looked at the relationship of environmental and human-related disturbance factors that we felt might, based on our field experience, be influential in affecting variation of vegetative composition in a given community. Continuous factors analyzed and their abbreviations (if applicable) in associated figures and tables are elevation (Elev), northness (Northnes), eastness (Eastnes), soil texture (Soiltext), distance from potential livestock congregation areas (Imprvdist), distance from road (Roaddist), a field-based livestock activity index (LI) and a field-based vehicle activity index (VI). Geology was also analyzed, but as discrete classes - granite, metamorphic (Metamrph), alluvium (Alluv) and volcanic.

We report the r-squared values for relationships of these factors with the 3 DECORANA axes in a table for each community (e.g. Table 16). We also illustrate these results by creating a vector overlay of the factors with the highest r-squared values on the DECORANA graphs (example in Figure 20). These types of combined graphs are often called "joint plots". In a joint plot, the lines (vectors) relating to the factors radiate from the centroid of the ordination scores. The angle of the line tells the direction of the relationship and the length of the line represents the relative strength of the relationship. For example, in Figure 20, elevation has the longest line and therefore has the strongest relationship of the factors with either of the axes (this can also be seen by looking at the r-squared values in Table 16). Since the elevation vector is angled to the right, plots on the left side of the graph will generally be lower in elevation. As you move right, at the angle of the vector, elevation of plots increases. Since the livestock index vector (LI) and potential livestock concentration vectors (Imprvdist) are at nearly opposite angles, this implies opposite gradients – as one value is increasing in the given direction, the other is decreasing. For some communities, we included additional DECORANA graphs that symbolize the plots according to their relative values for a particular factor. These plots can be interpreted in the same way as those that symbolize plots by relative percent cover for a given species (described above). For example, in Figure 27, markers with larger sizes symbolize plots with larger values for northness.

We did not test for statistical significance of the factor-Decorana axis correlations. Rather, we used the r-squared values in combination with r-squared values of the DECORANA axes (which quantify the amount of variation in the plots explained by each axis), as aids in interpreting the patterns of variation visible in the DECORANA graphs. We applied a general rule of thumb (the PC-ORD default) of including factors with r-squared values of 0.2 or higher on the joint plot (and highlighting these in the tables). However, this varied slightly by community. In some cases, we made adjustments to the 0.2 threshold to highlight those factors that, based on our field experience and analysis interpretations, seemed to best explain the variation. As the actual r-squared values are available in a table for each community, the reader can always refer back to those if he or she wishes to explore the influence of factors using different thresholds.

Variation within the *Creosotebush - Bursage Desert Scrub* Community

Eighty-seven natural community assessment plots were established in the study area, representing a range of environmental conditions within this community. The plots can be grouped by hierarchical cluster analysis into ten major groups. Detailed information on the composition of all the cluster groups is presented in Appendix G.

The primary group of plots (group 1, Figures 19 and 20) represents plots with low vegetative cover and low species diversity (Appendix G). *Larrea divaricata tridentata* is the dominant shrub (7.1% cover) and *Lesquerella gordonii* (1.85%) and *Lepidium lasiocarpum* (1.09%) are dominant herbs. As one progresses down the cluster diagram, the next group encountered is cluster group 24. Cluster group 24 has a little less *Larrea divaricata tridentata* (5.5% cover) and more *Ambrosia deltoidea* (2.14% cover) in the shrub strata. It has considerably more herbaceous and grass cover than group 1. *Schismus arabicus* is the dominant plant in this group (12.56%). *Pectocarya* spp. are the most abundant herbs (5.54% cover). *Plantago ovata* (3.58%) and *Lepidium lasiocarpum* (3.22%) are relatively abundant.

The next group encountered as one proceeds down the cluster diagram (cluster group 3) is characterized by very high abundance of *Larrea divaricata tridentata* (25.5% cover) and significant amounts of *Prosopis velutina* (7% cover). The exotic species, *Erodium cicutarium* (5.21% cover) and *Schismus arabicus* (5.5% cover) are the dominant herb and grass species in this group. This group is transitional to the *Mesquite Woodland* natural community.

Cluster group 2 is the next major group encountered in the cluster diagram. It has nearly as much *Larrea divaricata tridentata* (6.79% cover) as group 1, but it has 7 times more herbaceous and grass cover. *Schismus arabicus* is the dominant plant in this group (25.64%) but *Plantago ovata* (18.29%) and *Lepidium lasiocarpum* (12.36%) are also very abundant.

Cluster group 32 is the major group at the bottom of the cluster diagram. This group is similar to Cluster group 2 with nearly identical amounts of *Larrea divaricata tridentata* cover. It is characterized by very high abundance of *Lepidium lasiocarpum* (21.45%).

The minor groups (23, 37, 40, 54 and 56) are described in Appendix G.

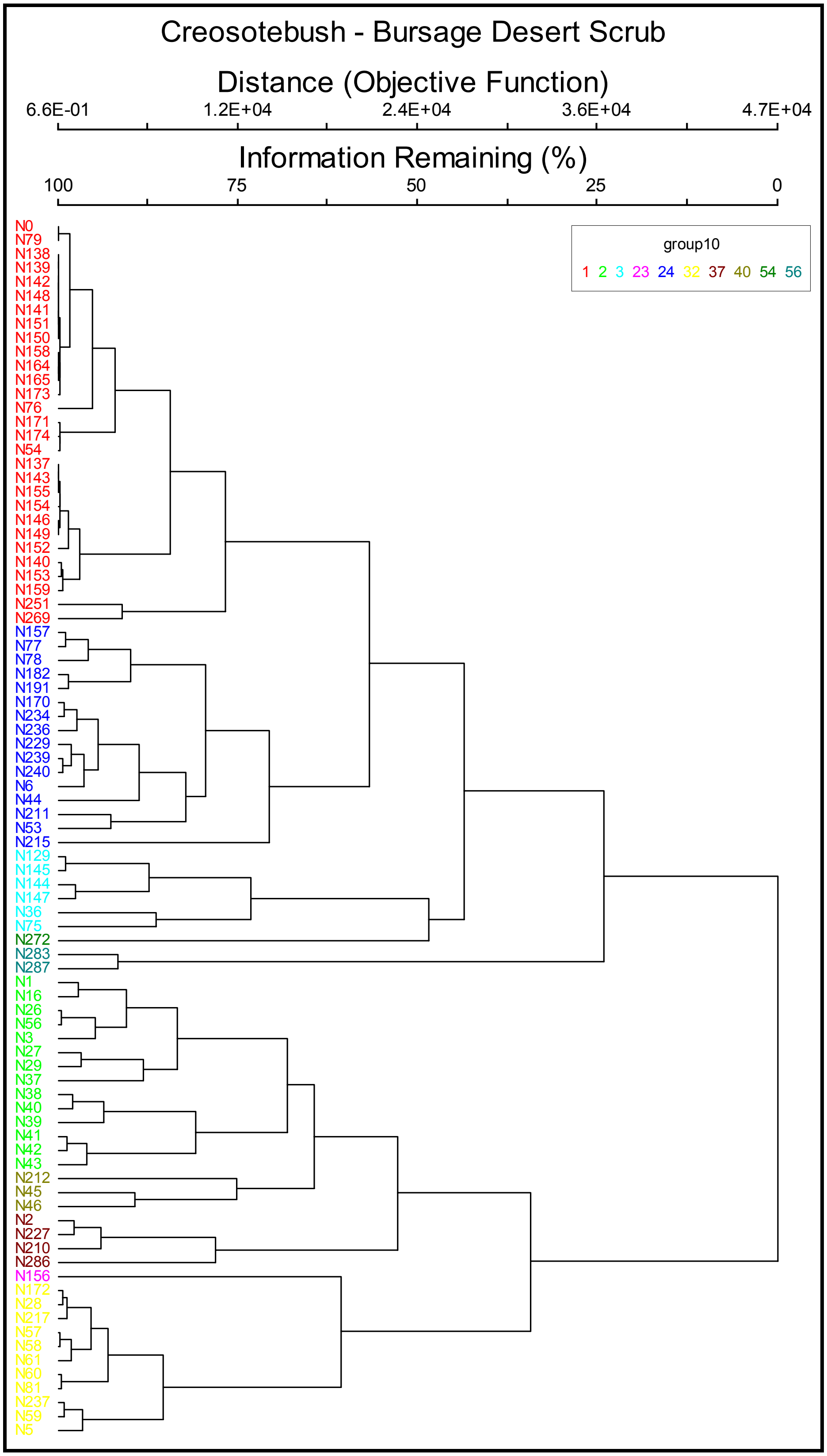


Figure 19. Hierarchical cluster analysis of *Creosotebush-Bursage Desert Scrub* natural community plots divided into ten major groups based on similarity of species composition.

Creosotebush - Bursage Desert Scrub occupies the greatest area of any of the natural communities and therefore has the potential for considerable natural variation in composition and structure. The relative uniformity of landform characteristics, however, limit this potential natural variation. This community only occurs in a narrow elevation range (most of the area is between 300 and 500 meters) on gentle slopes (0 to 2 degrees). Because of this, we did not consider aspect to be a significant factor in determining natural community composition and it was not included in the analysis.

Analysis of environmental factors in relation to DECORANA axes shows that elevation appears to be the primary factor driving natural variation (Table 16 and Figure 20). Although the elevation range of the community is rather small (about 250 to 685 meters), the upper elevations of this community and the lower elevations of the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* form an ecotone, meaning there is a gradual change in species composition as one community transitions into the other. In the higher elevations of the *Creosotebush - Bursage Desert Scrub* community, triangle-leaf bursage and tree covers increase. The relative cover of creosotebush decreases and total species diversity increases (as compared to the lower elevations).

Of the human-related disturbance factors examined, livestock use appears to be the greatest influence on community composition. DECORANA axis 2, which explains 15.6% of the variation in community composition, is most strongly related to the livestock index and distance from potential livestock congregation area factors (Table 16 and Figure 20).

Table 16. Coefficients of determination for DECORANA axes for plots within the *Creosotebush-Bursage Desert Scrub* community and correlation to environmental and disturbance gradients.

Creosotebush-Bursage Desert Scrub			
Cumulative r-squared for all 3 DCA axes = .399 (based on 87 plots)			
DECORANA Axis:	**1**	**2**	**3**
Axis r-squared	.176	.156	.067
	r-sq	**r-sq**	**r-sq**
Elevation	.516	.113	.177
Soil texture	*(Inadequate variation in the factor to calculate r-squared)*		
Livestock Index	.006	.258	.031
Vehicle Index	*(Inadequate variation in the factor to calculate r-squared)*		
Road distance	.062	.082	.024
Livestock congr. dist. (Imprvdist)	.000	.298	.004

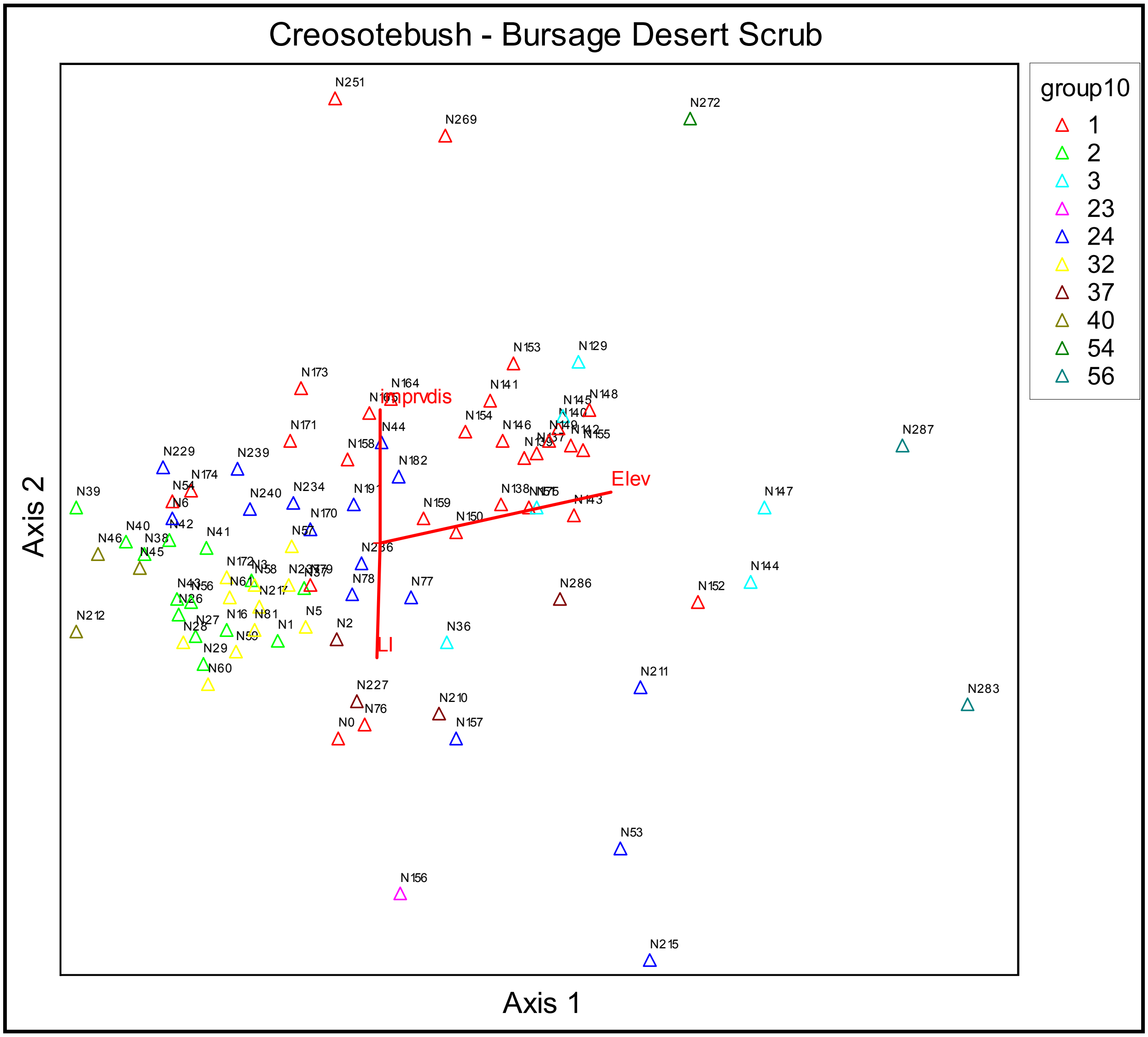


Figure 20. DECORANA graph of distribution of plots in Creosotebush-Bursage Desert Scrub in relationship to Axis 1 and 2 with plot clusters color-coded and relationship to significant secondary gradients illustrated by red line vectors.

Variation within the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* Community

Thirty-five field ecology plots were placed over a wide range of environmental conditions within this community. One outlier plot was removed from the dataset before conducting the DECORANA analysis because it was in a heavily disturbed area at the transition zone between the *Paloverde - Mixed Cacti-Mixed Scrub on Bajadas* community and the *Creosotebush-Bursage Desert Scrub* community. Although this plot was located in an area mapped as *Paloverde - Mixed Cacti-Mixed Scrub on Bajadas*, the location was so highly altered that it better represented highly disturbed *Creosotebush-Bursage Desert Scrub*. This plot was assigned to cluster group zero.

The remaining plots can be grouped by hierarchical cluster analysis into ten major groups (Figure 21). The first group of plots encountered in the cluster diagram (cluster group 1) contain *Parkinsonia microphylla* as the only tree species. There is also a moderate diversity of cacti, shrubs, herbs and grasses (Figures 21 and 22, Appendix H). This group has an overall low vegetative cover. The next group (cluster group 2) of plots represent areas without any tree or cacti cover, though they have a moderate cover of shrubs, herbs and exotic grasses. This group of plots' species composition matches better with the *Creosotebush-Bursage Desert Scrub* community, but because they occur as small inclusions within the *Paloverde - Mixed Cacti-Mixed Scrub on Bajadas* community, they should be included as a variation of this community.

Cluster group 3 has a more diverse tree canopy with *Olneya tesota* as the dominant tree species (2.57% cover). It has moderate shrub and herb cover with little grass or cacti. The next cluster group (group 14) is characterized by a low tree cover (1.5%) and a relatively high cover of cacti species (4.3%) – predominantly *Cylindropuntia acanthocarpa*. It has high herbaceous cover, with *Lepidium lasiocarpum* being the dominant plant in the community (13% cover).

The next major cluster group (group 8) in the cluster diagram is characterized by fairly low tree cover (2.5%), relatively high saguaro (*Carnegiea gigantea*) cover (0.88%), high shrub cover 18.38% and a high cover of herbs and grasses (27.69%). *Cryptantha maritima* (7.25% cover) is the dominant herb and *Schismus arabicus* is a common grass (10% cover).

The last major cluster group in the cluster diagram (group 12) is characterized by a much higher cover of *Parkinsonia microphylla* (10.74%) and a high cover of *Ambrosia deltoidea* (10.14%). It has a high herbaceous cover (19.86%), low grass cover (2.14%) and moderate cacti cover (2.04%). The native species diversity of this cluster group is exceptionally high and there is only one exotic plant species *Schismus arabicus* (1.89% cover) in this group of plots. This cluster group best represents typical baseline conditions for the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* community.

More information about the composition of the major and minor cluster groups is available in (Appendix H). The *Paloverde - Mixed Cacti – Mixed Scrub on Bajada* community is one of the most diverse natural community types with considerable variation in composition.

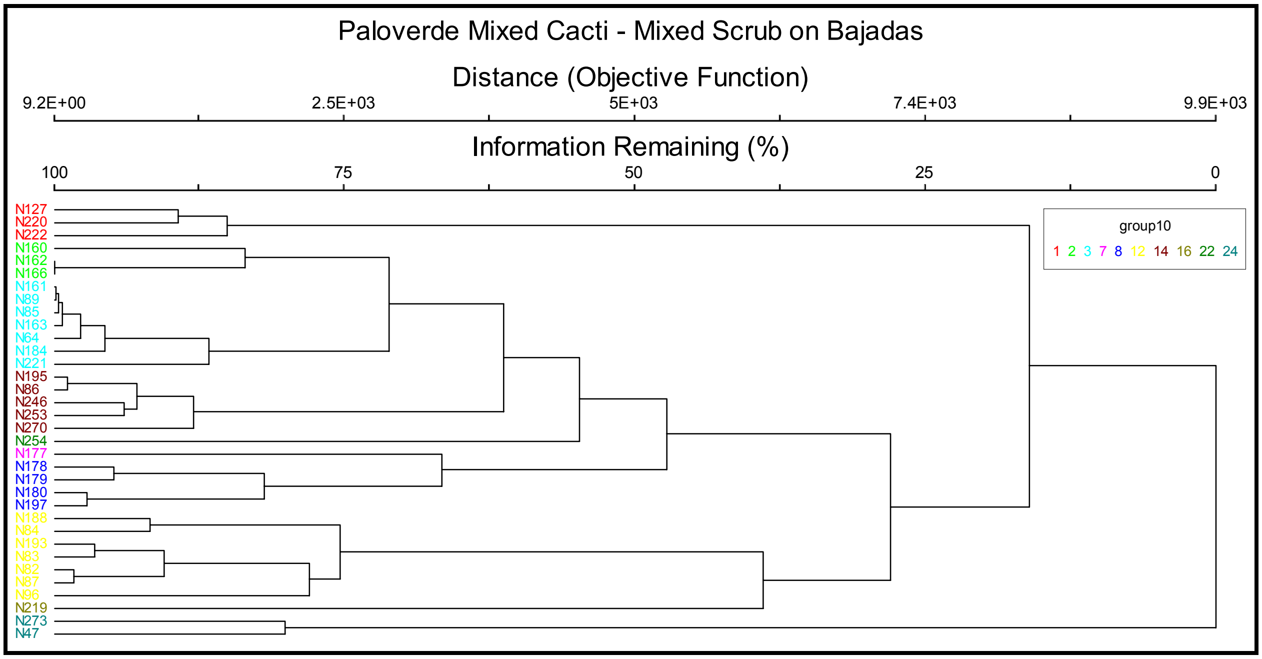


Figure 21. Hierarchical cluster analysis of the *Paloverde - Mixed Cacti-Mixed Scrub on Bajadas* natural community plots divided into ten major groups based on similarity of species composition.

The primary factors influencing the variation in composition within the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* community appear to be distance from potential livestock congregation areas (correlated with DECORANA Axis 1) and soil texture (correlated with DECORANA Axis 2) (Table 17, Figures 22 and 23). Although DECORANA axis 3 explains a higher percent of the variation than the other two axes (26.3% as compared to 18.4% and 11.6% for axes 1 and 2, respectively) it is not strongly correlated with any of our measured factors and therefore is not particularly interpretable. However, since it is significant in the overall ordination (i.e. in quantifying how similar plots are in terms of composition) we show the plots graphed against it and against axis 1, which has the second highest r-squared value (Figure 23).

Table 17. Coefficients of determination for DECORANA axes for plots within the *Paloverde - Mixed Cacti-Mixed Scrub on Bajadas* community and correlation to environmental and disturbance gradients.

Paloverde - Mixed Cacti-Mixed Scrub on Bajadas			
Cumulative r-squared for all 3 DCA axes = .563 (based on 34 plots) (one outlier removed)			
DECORANA Axis:	**1**	**2**	**3**
Axis r-squared	.184	.116	.263
	r-sq	**r-sq**	**r-sq**
Elevation	.169	.058	.006
Soil texture	.009	.201	.019
Livestock Index	.020	.079	.003
Vehicle Index	.031	.012	.017
Road distance	.032	.011	.069
Livestock congr. dist. (Imprvdist)	.353	.002	.055

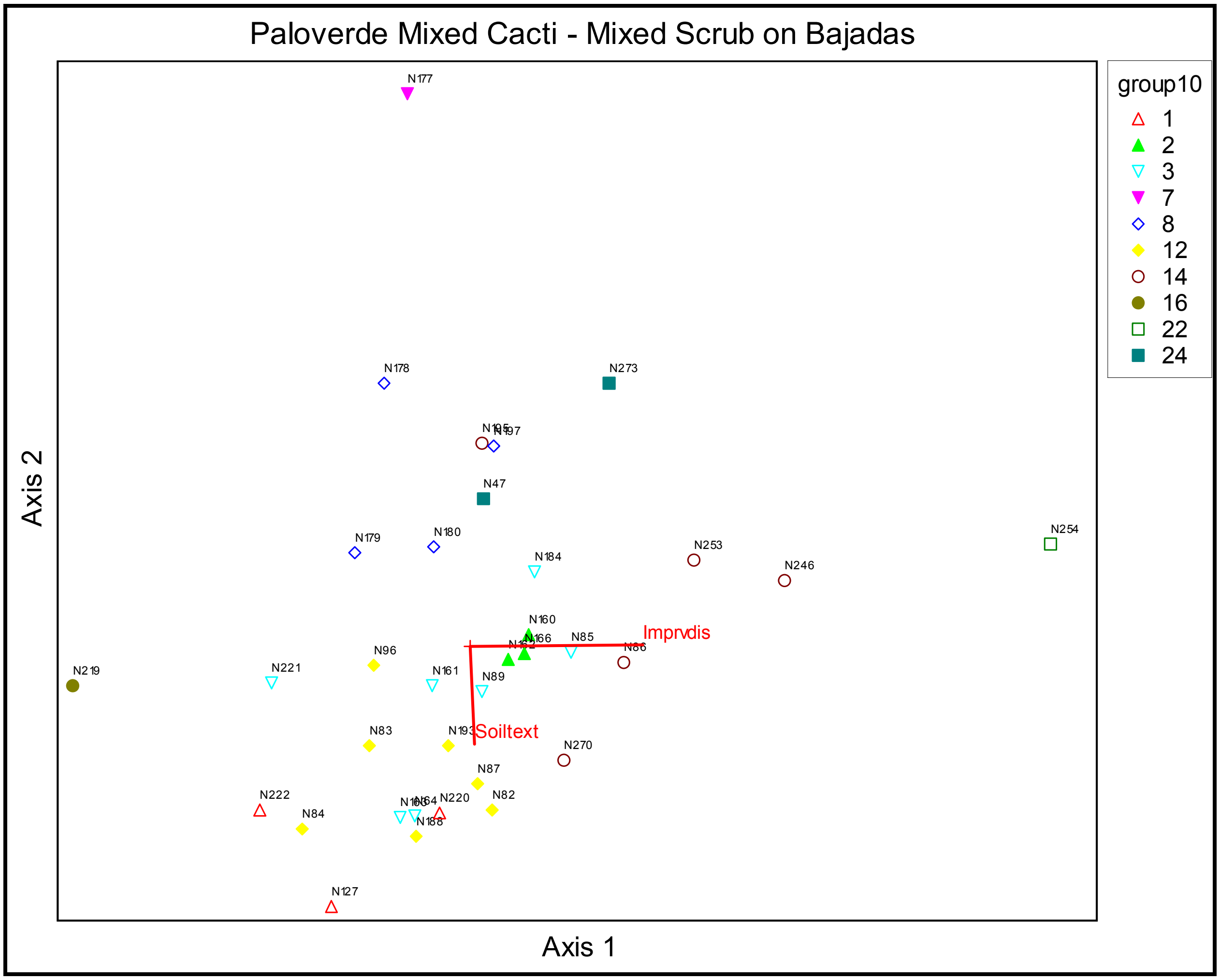


Figure 22. DECORANA graph of distribution of plots in the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* community in relationship to Axis 1 and 2 with plot clusters color-coded and relationship to significant secondary gradients illustrated by red line vectors.

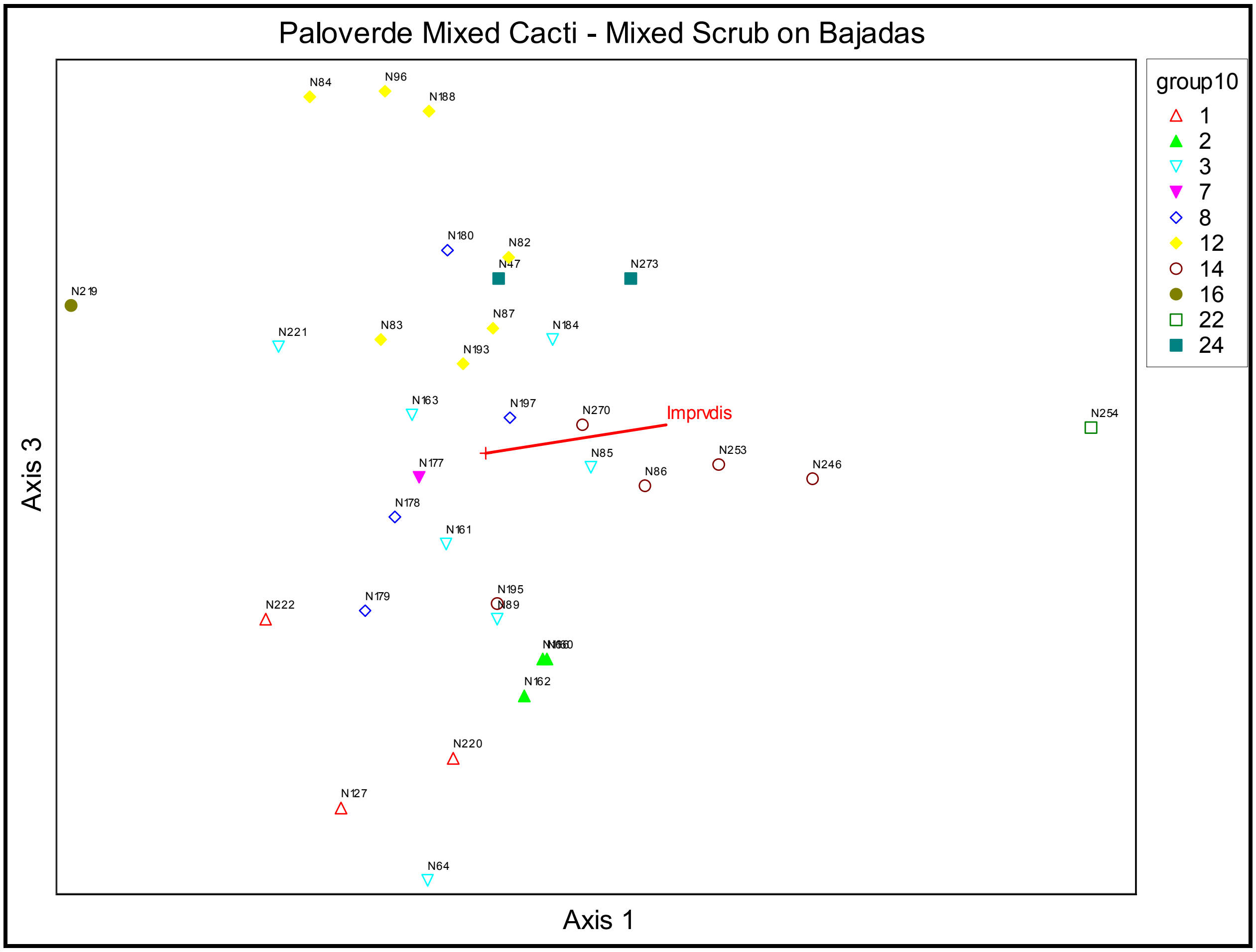


Figure 23. DECORANA graph of the distribution of plots in the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* community in relationship to Axis 1 and 3. Plot clusters are color-coded and relationships to significant secondary gradients are illustrated by red line vectors.

Variation within the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* Community

Sixty-four field ecology plots were taken within a wide range of environmental conditions within this community. These plots can be grouped by hierarchical cluster analysis into ten major groups. The first group of plots represents areas with moderate slope conditions on a variety of aspects and near average composition for this community (group 1, Figures 24 and 25). This group has only a low cover of *Schismus arabicus* and no *Erodium cicutarium* (Appendices I and J). *Encelia farinosa* is the dominant shrub and occurs in greatest abundance in this cluster group (Appendices I and J). The second cluster group of plots (group 4) represents areas with the highest cover of *Parkinsonia microphylla* (mean cover of 21.6%) of all the cluster groups (Appendices I and J).

Schismus arabicus is found in highest abundance in cluster group 15 (mean cover 28.25%) and *Erodium cicutarium* is found in highest abundance in cluster group 42 (mean cover 14.6%)

(Appendices K and L). Both of these cluster groups with high exotic cover are found primarily on more gentle slopes near the lower limits of the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community. These species are present in some other areas within this community, but only in low abundance. Other exotic species are found in low abundance in this community.

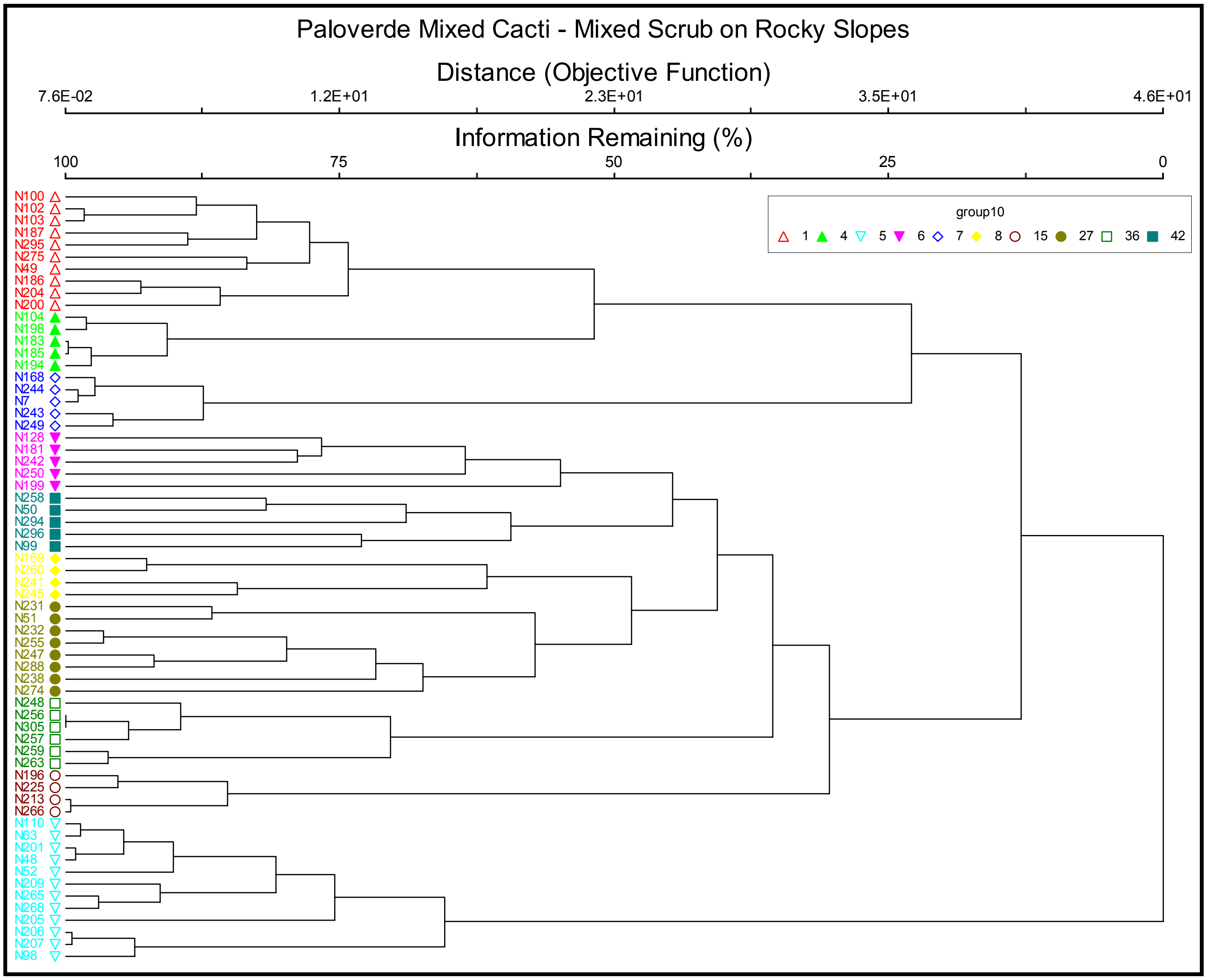


Figure 24. Hierarchical cluster analysis of the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* natural community plots divided into ten major groups based on similarity of species composition.

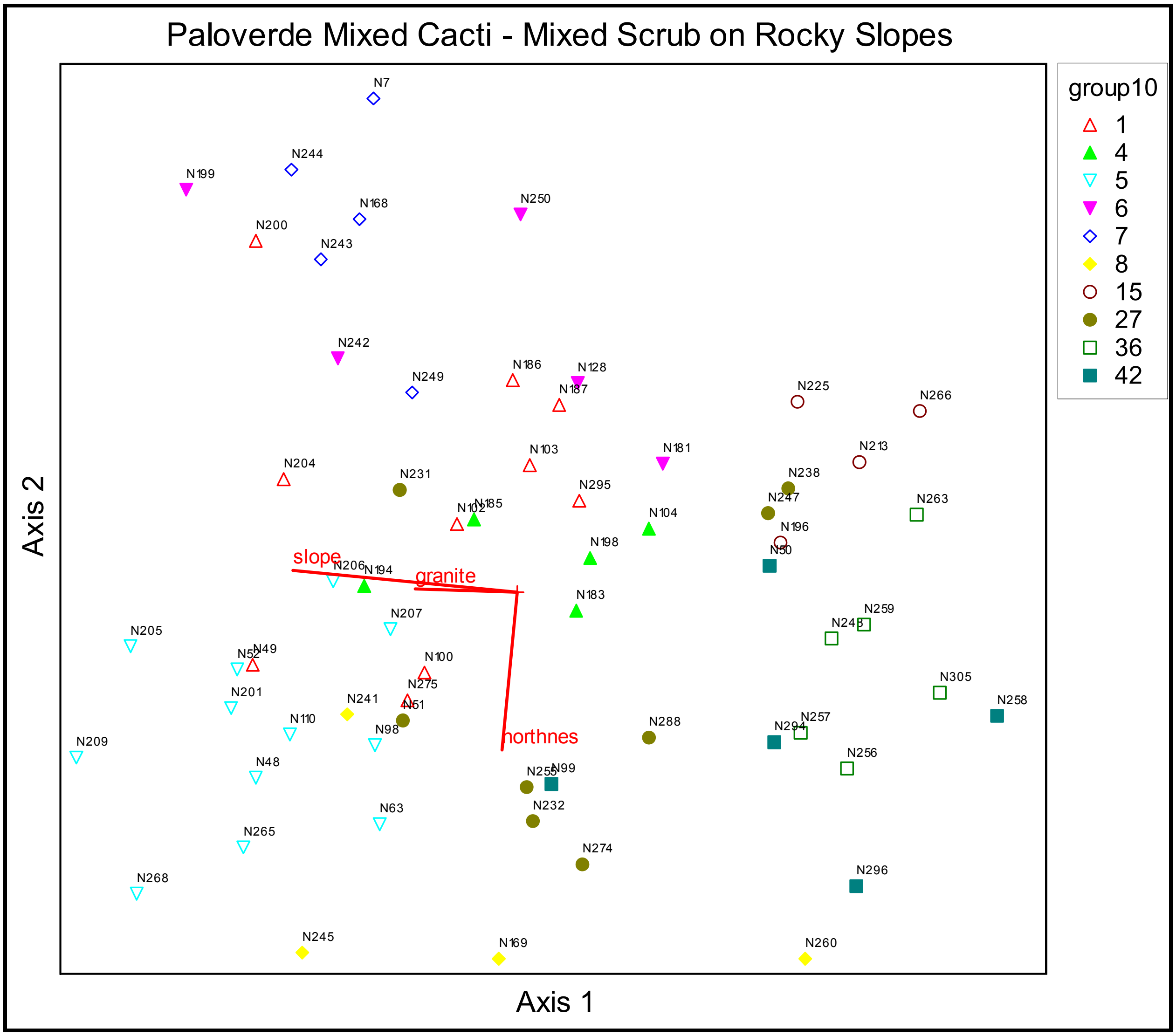
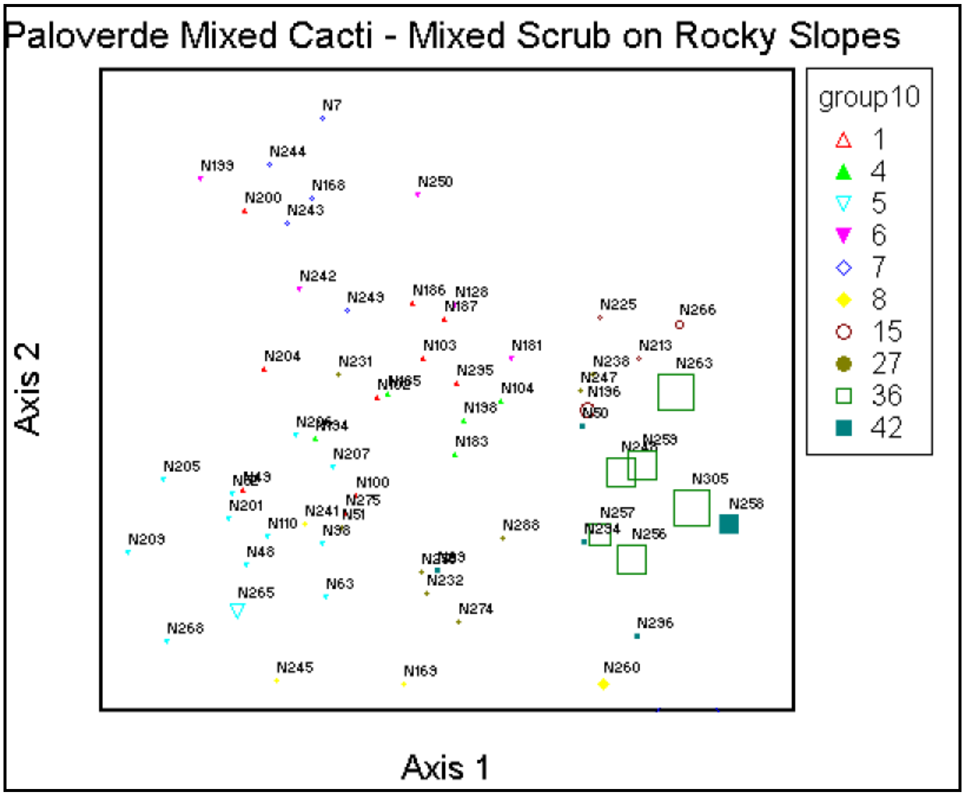


Figure 25. DECORANA graph of distribution of plots in the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community in relationship to Axis 1 and 2 with plot clusters color-coded and relationship to significant secondary gradients illustrated by red line vectors.

One of the extremes of the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community on DECORANA Axis 1 is represented by the last cluster group in the dendrogram (group 5), which is characterized by a high cover of *Selaginella arizonica* (Figure 26(b), Appendices K and L). This cluster group occurs primarily on north aspects (see Figure 27) of granitic mountains and has a mean *Selaginella* cover of 23.33%. Another extreme is represented by cluster group 36, which has a high cover of *Lesquerella gordonii* (16.17%) and *Lepidium lasiocarpum* (14.04%), diverse and abundant cacti species, low cover of *Parkinsonia microphylla* and low exotic species cover (Figure 26(a), Appendices K and L). This cluster group is found on more gentle slopes, generally without north-facing aspects.



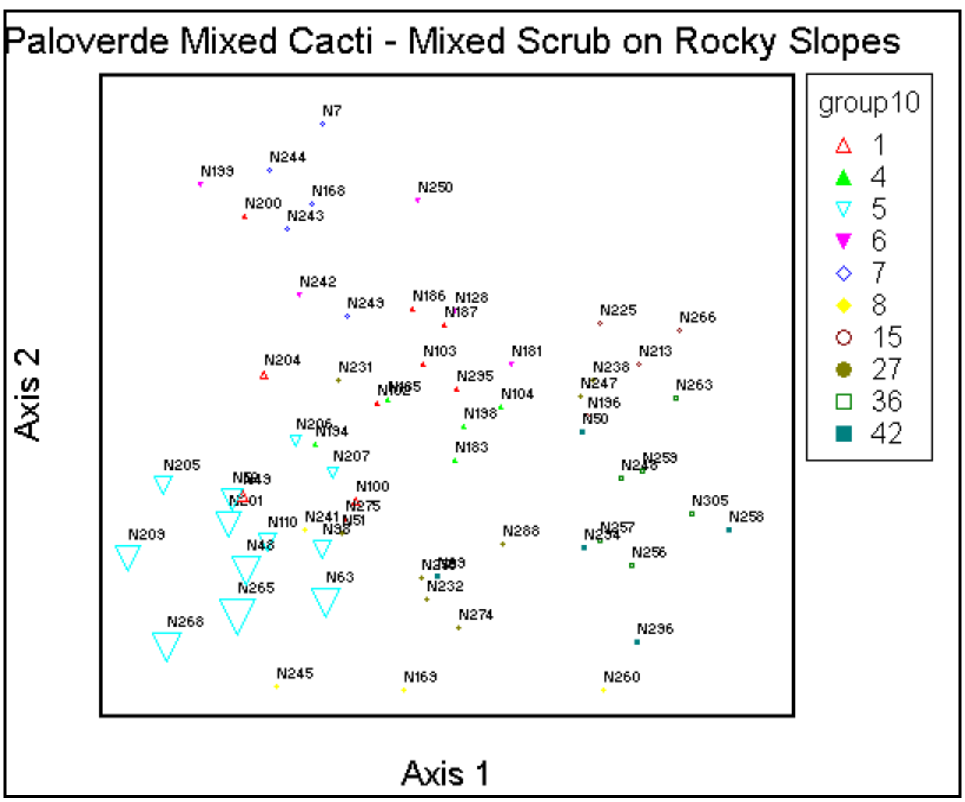


Figure 26. Distribution of plots illustrating cover of (a) (top) *Lesquerella gordonii* and (b) (bottom) *Selaginella arizonica*. Symbol size represents relative percent cover of each species. Plot symbol represents cluster group.

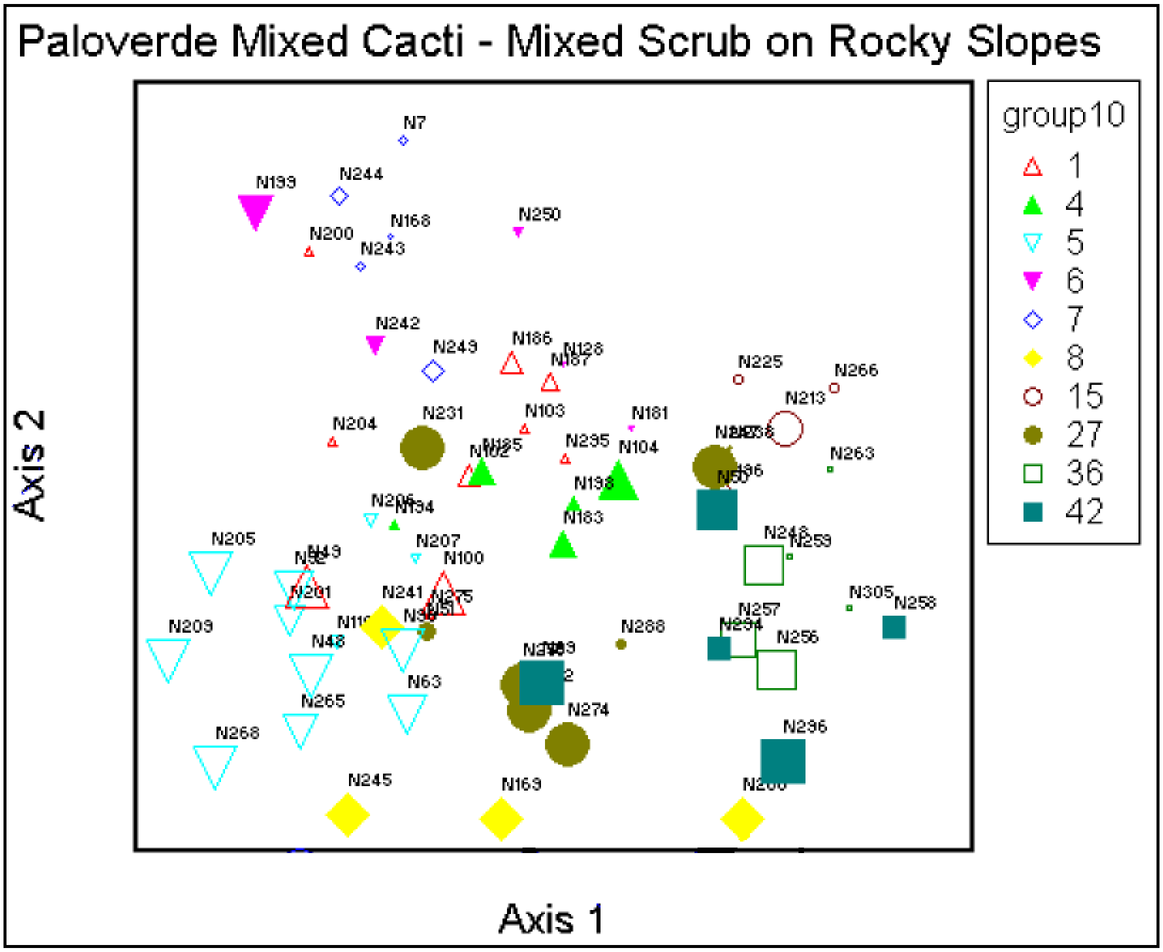


Figure 27. DECORANA graph of distribution of plots in the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community in relationship to Axis 1 and 2 with plot clusters color-coded and relationship to a "northness" gradient illustrated by proportional size of plot symbols.

One of the extremes of the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community on DECORANA Axis 2 is represented by cluster group 7, which is characterized by the highest cover of *Perityle emoryi* (mean cover 11.8%) (Figure 28(b), Appendices K and L). The other extreme is represented by cluster group 8, which contains the highest values of *Cryptantha pterocarya* (mean cover 15.5%) (Figure 28(a)).

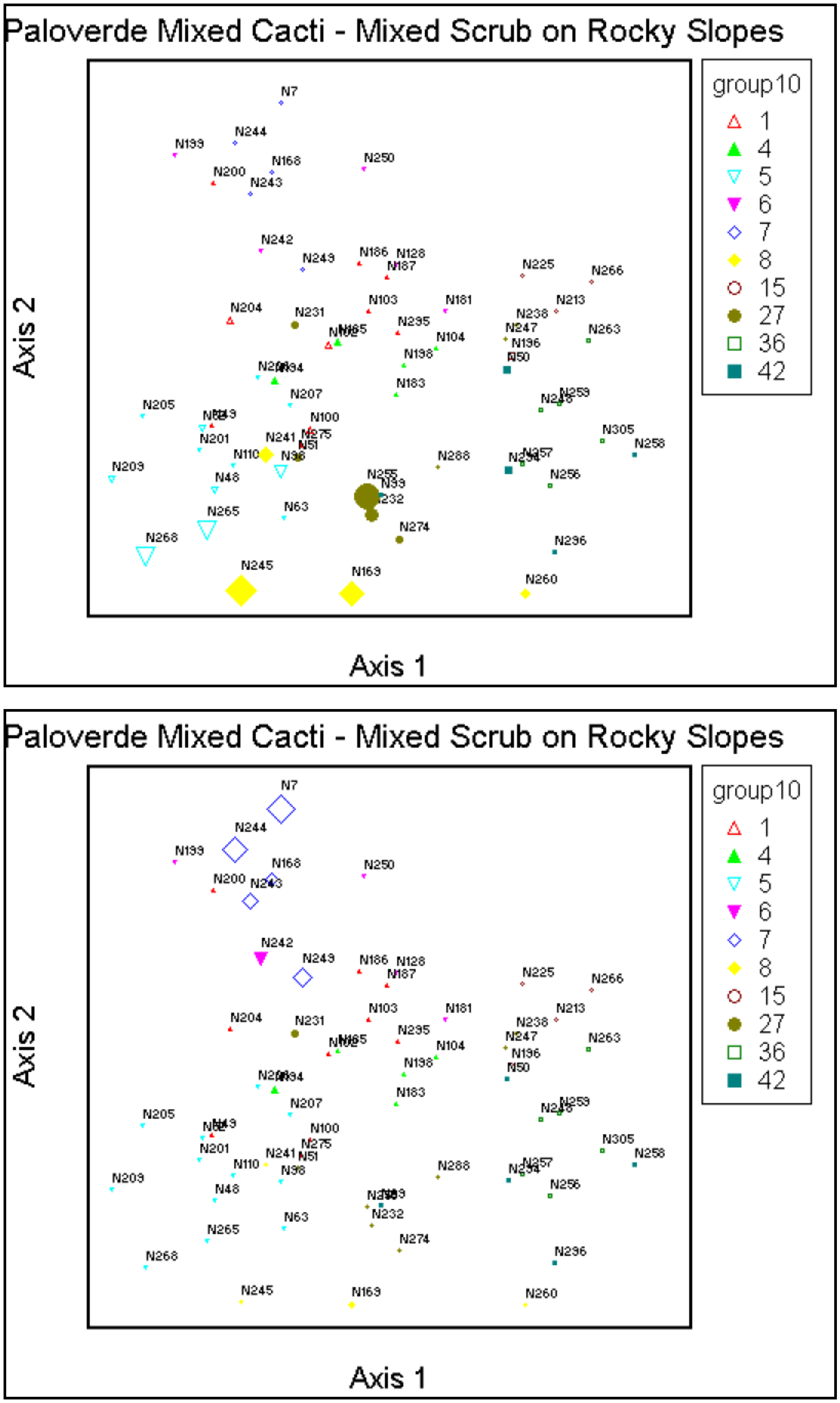


Figure 28. Distribution of plots illustrating cover of (a) (top)*Cryptantha pterocarya* and (b) (bottom) *Perityle emoryi* . Symbol size represents relative percent cover of each species. Plot symbol represents cluster group.

The *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community is the most diverse natural community in the study area with considerable variation in composition. Certain species are found in many areas within this community, but other species have strong preferences to certain sites with unique substrates, moisture and temperature characteristics (Appendices K and L). These sites can often be predicted based on aspect, slope, elevation and geology.

The primary factors influencing the variation in composition within the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community are slope steepness and presence of granitic substrate, correlated with DECORANA Axis 1, and "northness," correlated with DECORANA Axis 2 (Table 18, Figures 25 and 27). There are low correlations with human disturbance measures in this community. This finding matches our field observations that human disturbance is low and relatively uniform in this community.

Table 18. Coefficients of determination for DECORANA axes for plots within the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community and correlation to environmental and disturbance gradients.

Paloverde - Mixed Cacti-Mixed Scrub on Rocky Slopes			
Cumulative r-squared for all 3 DCA axes = .475 (based on 64 plots)			
DCA Axis:	**1**	**2**	**3**
Axis r-squared	.225	.202	.048
	r-sq	**r-sq**	**r-sq**
Elevation	.026	.029	.057
Soil texture	.177	.006	.036
Slope	.488	.046	.044
Northness	.033	.343	.047
Eastness	.020	.019	.012
Metamorphic	.002	.008	.020
Granite	.220	.005	.009
Volcanic	.112	.014	.001
Alluvium	.069	.000	.004
Livestock index	*(Inadequate variation in the factor to calculate r-squared)*		
Vehicle index	*(Inadequate variation in the factor to calculate r-squared)*		
Road distance	.026	.044	.012
Livestock congr. dist. (Imprvdist)	.079	.010	.030

Variation within the *Mountain Upland* Community

The *Mountain Upland* varies considerably in composition and structure but it is considerably less variable than the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community. This is largely due to its limited extent and fairly strict definition of community composition. The variation within this community is described in the cluster dendrogram (Figure 29) and corresponding cluster group descriptions (Appendix K).

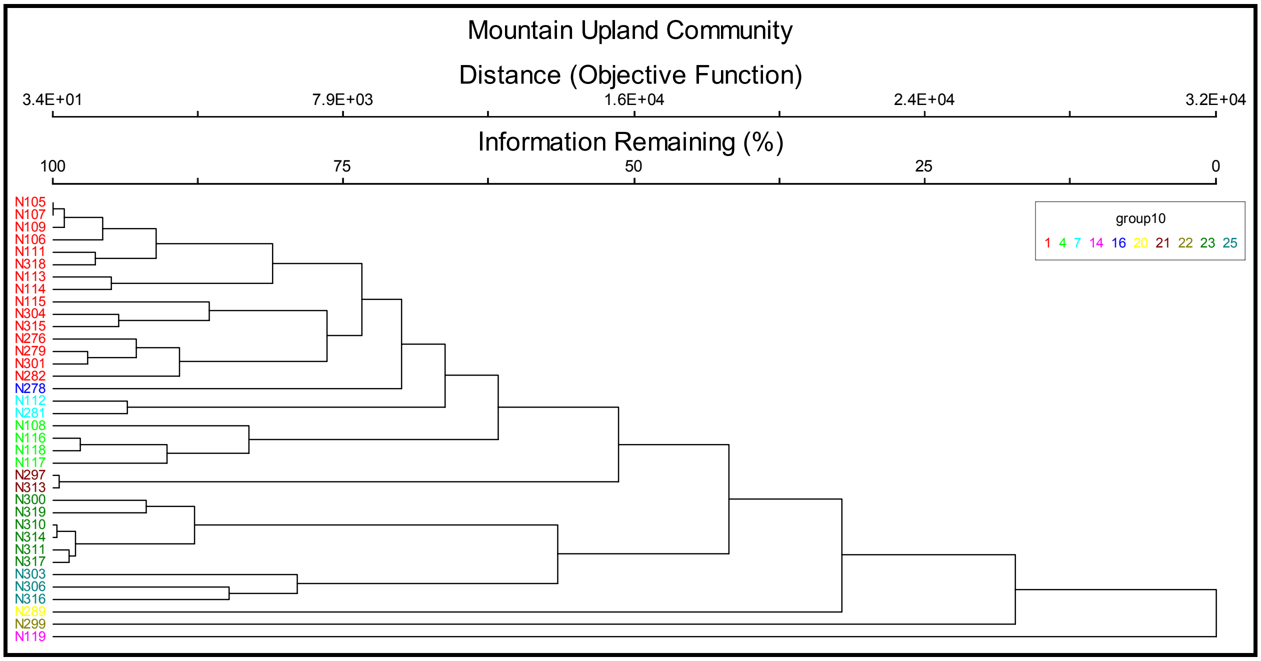


Figure 29. Hierarchical cluster analysis of the *Mountain Upland* natural community plots divided into ten major groups based on similarity of species composition.

The primary factors influencing the variation in composition within the *Mountain Upland* community are elevation, northness, and slope, all of which are correlated with DECORANA Axis 1 (Table 19 and Figure 30). Distance from road is also strongly correlated with DECORANA Axis 1, but based on our field experience; we think this finding is in error. Most of this community is at the tops of mountains and is relatively distant from roads. It is possible that errors in the roads data may be affecting this analysis. Since our field knowledge does not support this result, we have chosen not to highlight it as one of the significant factors for this community, despite its high r-squared value. Volcanic substrate and distance from potential livestock congregation areas are weakly correlated with DECORANA Axis 2 (Table 19, Figure 30). Elevation and distance from potential livestock congregation areas are highly correlated with DECORANA Axis 3 but since this axis only accounts for 6.7% of the variation in community composition, these correlations are not particularly significant.

Table 19. Coefficients of determination for DECORANA axes for plots within the Mountain Upland community and correlation to environmental and disturbance gradients.

Mountain Uplands			
Cumulative r-squared for all 3 DCA axes = .399 (based on 36 plots)			
DCA Axis:	**1**	**2**	**3**
Axis r-squared	.176	.156	.067
	r-sq	**r-sq**	**r-sq**
Elevation	.476	.001	.314
Soil texture	*(Inadequate variation in the factor to calculate r-squared)*		
Slope	.200	.000	.120
Northness	.424	.030	.010
Eastness	.014	.052	.073
Metamorphic	.042	.085	.059
Granite	*(Inadequate variation in the factor to calculate r-squared)*		
Volcanic	.067	.123	.080
Alluvium	*(Inadequate variation in the factor to calculate r-squared)*		
Livestock index	*(Inadequate variation in the factor to calculate r-squared)*		
Vehicle index	*(Inadequate variation in the factor to calculate r-squared)*		
Road distance	.612	.021	.161
Livestock congr. dist. (Imprvdist)	.168	.149	.415

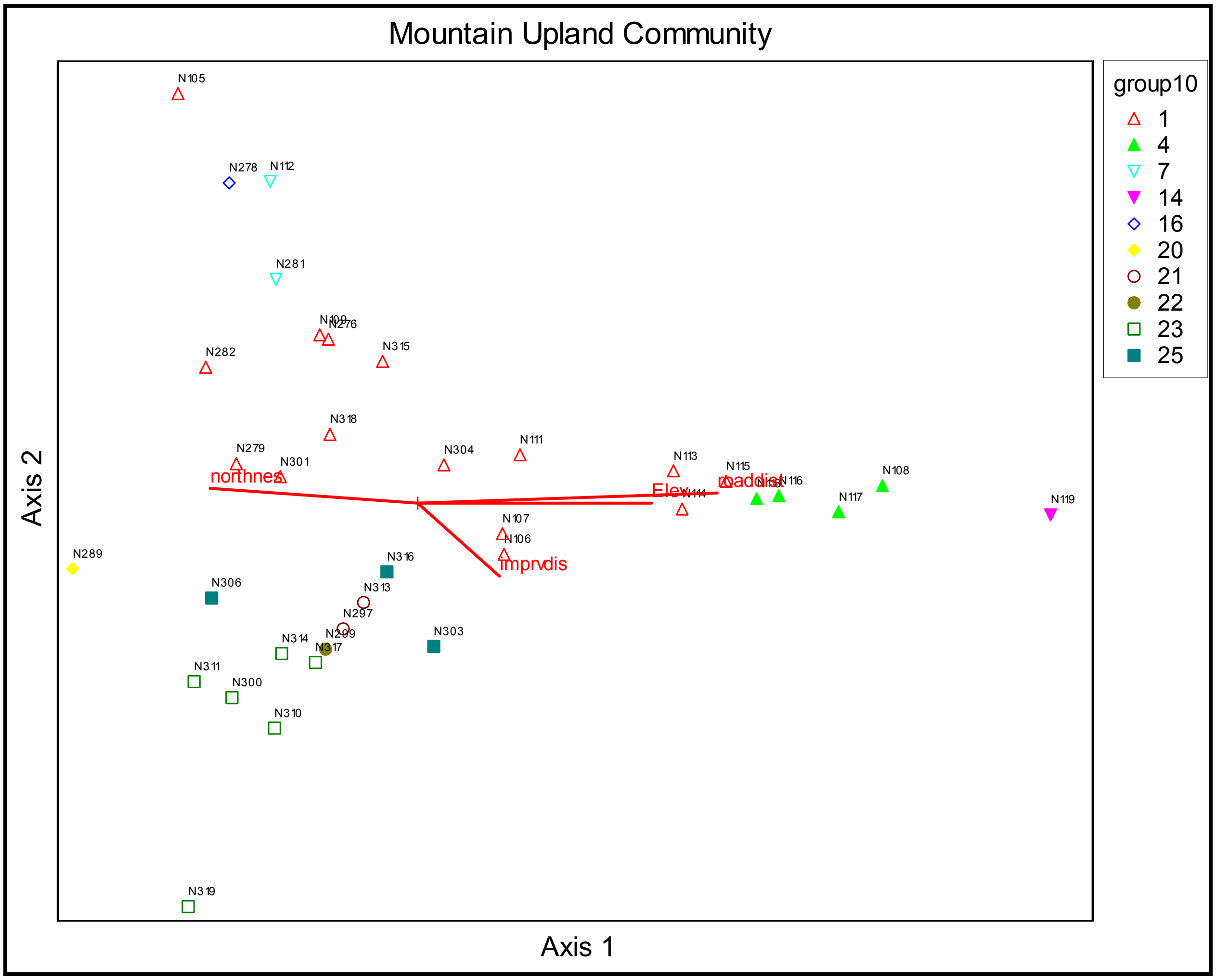


Figure 30. DECORANA graph of distribution of plots in the *Mountain Upland* community in relationship to Axis 1 and 2 with plot clusters color-coded and relationship to significant secondary gradients illustrated by red line vectors.

Variation within the *Desert Grasslands* Community

The *Desert Grassland* community as mapped and described in this project is limited to a relatively small area in the Vekol Valley and areas to the south on the TON. There is little variation within the small polygon of *Desert Grassland* that exists on the SDNM. We were not able to sample the grasslands on the TON because access permission was received well after the close of the spring field season. We will do further analysis of variation in the grassland community on both the TON and SDNM in late September or early October of this year.

Variation within the *Mesquite Woodland* Community

The *Mesquite Woodland* community varies somewhat in composition and structure but it is less variable than many of the communities in the study area. The variation in species composition within this community is represented in the cluster dendrogram (Figure 31 and Appendix L). Structural variation, perhaps the most significant factor influencing variation within this community, was not assessed in our DECORANA analysis.

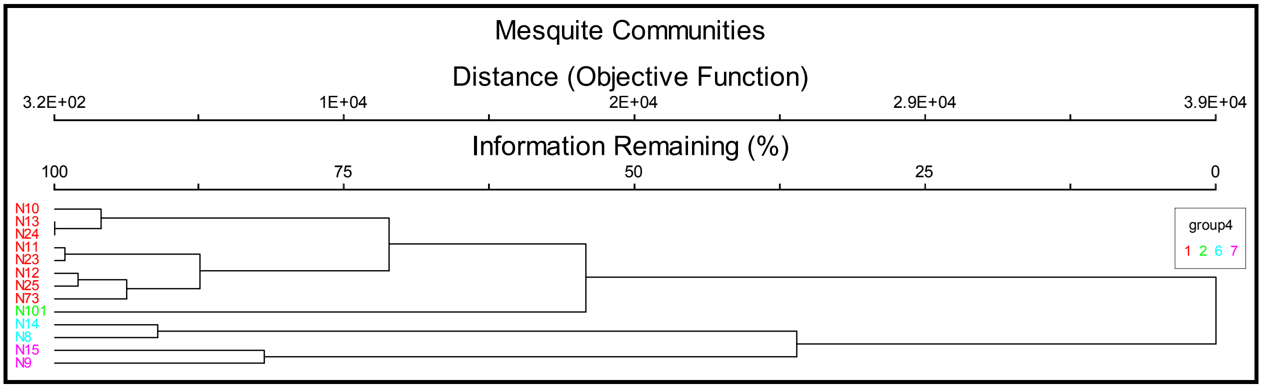


Figure 31. Hierarchical cluster analysis of *Mesquite Woodland* natural community plots divided into four major groups based on similarity of species composition.

The primary factors influencing the variation in composition within the *Mesquite Woodland* community are distance from potential livestock congregation areas and distance from roads, which are both correlated with DECORANA axis 1 (Table 20 and Figure 32). Although elevation appears to be correlated with axis 1, this is largely an artifact from the location of two plots at a different location and at notably higher elevations than the majority of the plots. Although elevation may play a part, we think that other factors related to the location of these plots explain much more of the variation in composition and therefore we have chosen not to highlight elevation as a factor.

Table 20. Coefficients of determination for DECORANA axes for plots within the Mesquite Woodland community and correlation to environmental and disturbance gradients.

Mesquite Woodlands			
Cumulative r-squared for all 3 DCA axes = .816 (based on 13 plots)			
DCA Axis:	**1**	**2**	**3**
Axis r-squared	.592	.149	.075
	r-sq	**r-sq**	**r-sq**
Elevation	.430	.050	.000
Soil texture	.084	.008	.088
Livestock index	.100	.051	.009
Vehicle index	*(Inadequate variation in the factor to calculate r-squared)*		
Road distance	.276	.017	.007
Livestock congr. dist. (Imprvdist)	.571	.126	.141

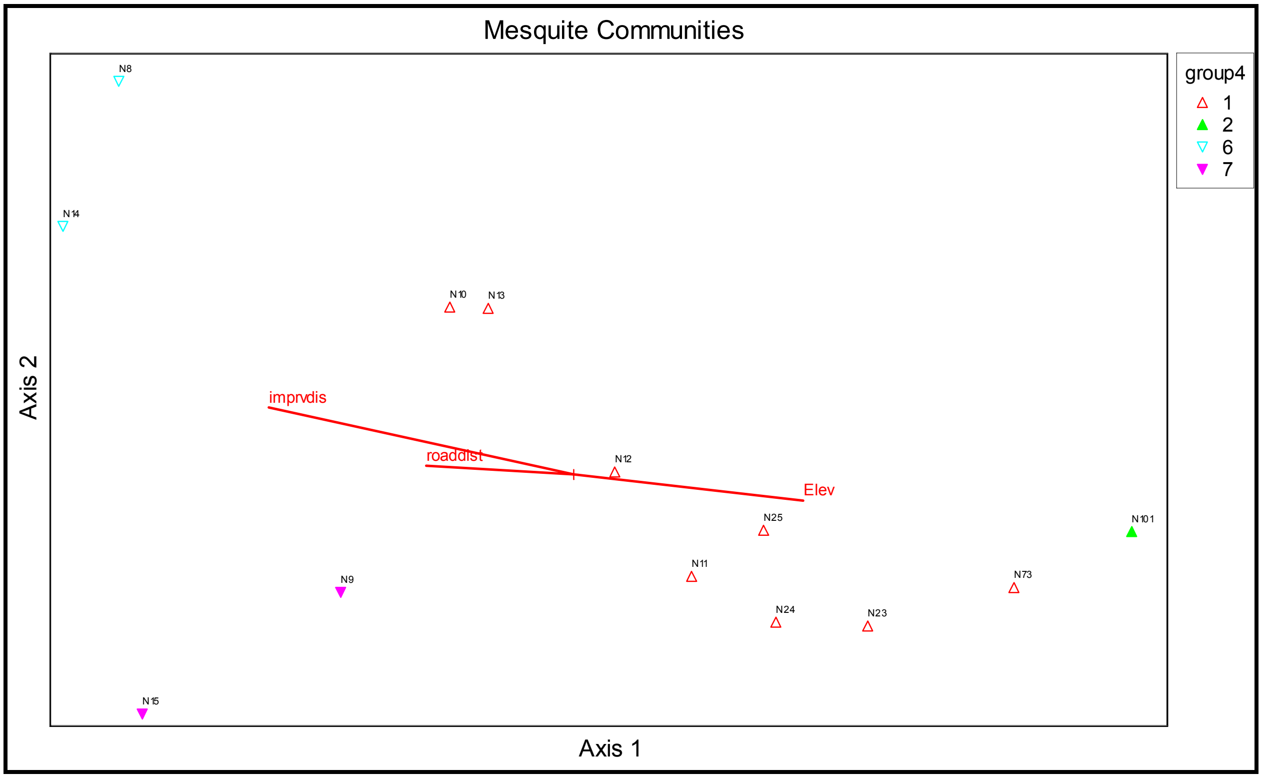


Figure 32. DECORANA graph of distribution of plots in *Mesquite Woodland* community in relationship to Axis 1 and 2 with plot clusters color-coded and relationship to significant secondary gradients illustrated by red line vectors.

Variation within the *Rock Outcrop* Community

The *Rock Outcrop* community covers the smallest spatial extent of any natural community in the study area. Because the rock outcrops are difficult and dangerous to sample due to extreme steepness and exposure, only limited sampling was done. The *Rock Outcrop* community is characterized by a low vegetative cover and presence of extensive surface rock. A description of the characteristics of this community is presented above, but no further analysis of variation was done due to the limited plot data available. Field observations revealed that variability due to human disturbance is low in this community.

Variation within the *Mountain Xeroriparian Scrub* Community

Mountain Xeroriparian Scrub communities are confined to narrow, relatively steep channels within the *Mountain Upland* and *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* communities. They are highly defined and limited in extent and therefore have less variation in composition than the surrounding communities. The cluster dendrogram for this community breaks the field plots into 6 clusters representing this variation (Figure 33). Variation in species composition within the cluster groups is presented in Appendix M.

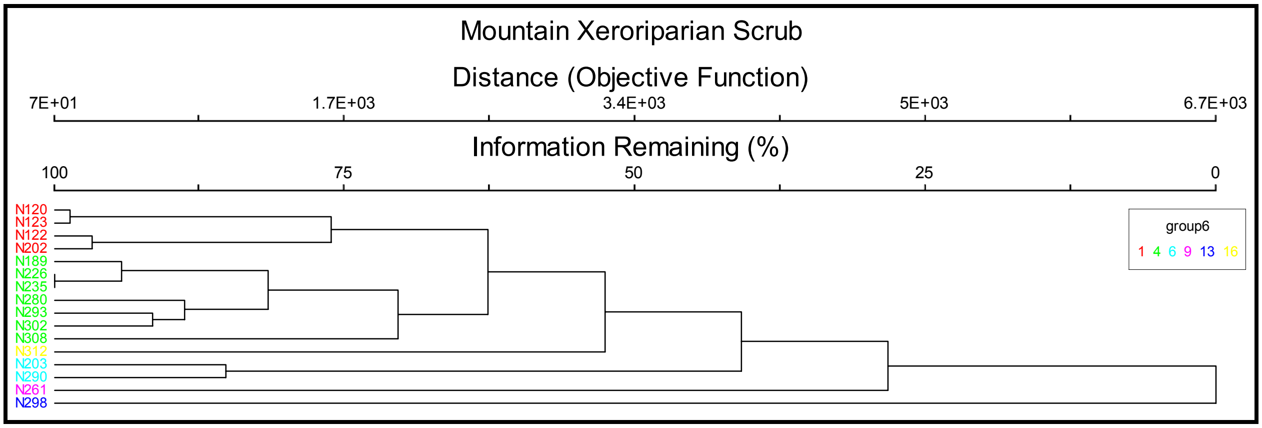


Figure 33. Hierarchical cluster analysis of the Mountain Xeroriparian Scrub community natural community plots divided into six groups based on similarity of species composition.

The primary factors influencing variation in composition within the *Mountain Xeroriparian Scrub* community are elevation, aspect (northness and eastness), and geologic substrate (volcanic and granite), all of which are correlated with DECORANA axis 1 (Table 21 and Figure 34). Although slope is weakly correlated with axis 3, this axis only accounts for 1.6% of the variation in composition, and therefore slope is not considered a strong factor. The vectors overlaying the ordination graph that represent geologic types show close to opposite directions for the influence of granite versus volcanic substrates on community composition (Figure 34). This implies that there are strong differences in vegetative composition between these two substrates.

Table 21. Coefficients of determination for DECORANA axes for plots within the Mountain Xeroriparian Scrub community and correlation to environmental and disturbance gradients.

Mountain Xeroriparian Scrub			
Cumulative r-squared for all 3 DCA axes = .367 (based on 16 plots)			
DCA Axis:	**1**	**2**	**3**
Axis r-squared	.367	-.016	.016
	r-sq	**r-sq**	**r-sq**
Alluvium	.083	.057	.012
Volcanic	.333	.001	.004
Granite	.268	.014	.184
Metamorphic	.019	.103	.046
Soil texture	.007	.088	.101
Eastness	.355	.021	.027
Northness	.284	.009	.048
Slope	.106	.020	.197
Elevation	.474	.117	.036
Livestock index	.002	.003	.168
Road distance	.042	.045	.002
Livestock congr. dist. (Imprvdist)	.005	.037	.098

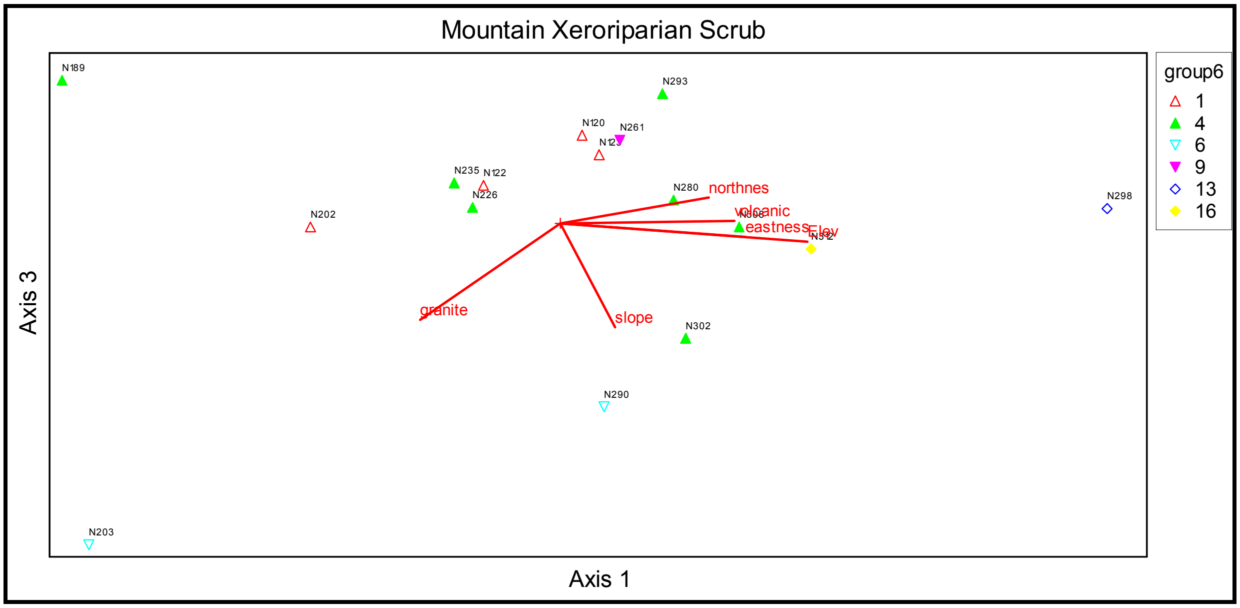


Figure 34. DECORANA graph of distribution of plots in the Mountain Xeroriparian Scrub community in relationship to Axis 1 and 3 with plot clusters color-coded and relationship to significant secondary gradients illustrated by red line vectors.

Variation within the *Valley Xeroriparian Scrub* Community

The *Valley Xeroriparian Scrub* community is confined to fairly narrow bands along stream courses that flow across the bajadas and desert flats, primarily within *the Creosotebush – Bursage Desert Scrub* and *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* communities. It occupies considerably more extent and has more variation in composition than the *Mountain Xeroriparian Scrub* community. The cluster dendrogram for this community breaks the field plots into 4 major clusters representing this variation (Figure 35). Variation in species composition within the cluster groups is presented in Appendix N.

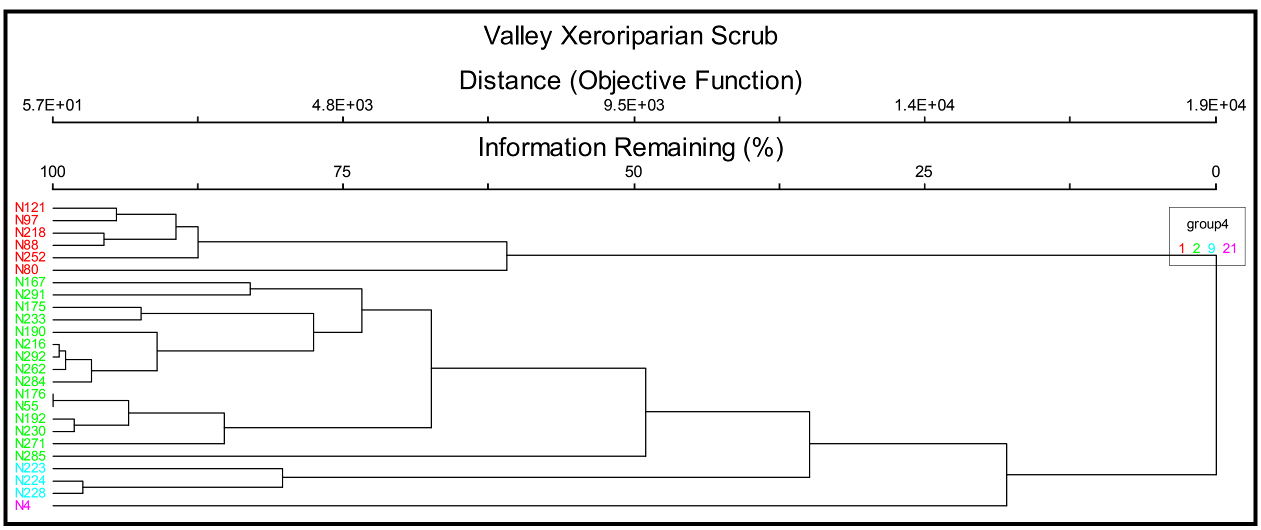


Figure 35. Hierarchical cluster analysis of the Valley Xeroriparian Scrub natural community plots divided into four major groups based on similarity of species composition.

The primary factor influencing the variation in composition within the *Valley Xeroriparian Scrub* community is elevation (Table 22 and Figure 36), which is correlated primarily with DECORANA axis 2 and to a lesser extent with axis 1. In the *Valley Xeroriparian Scrub* community the Vehicle Index values for all the plots was zero. Vehicle tracks often do not show in coarse gravel/ rock materials and are quickly erased by water in sandy washes. Since we didn't record any recent vehicle activity in the washes that we sampled, we did not include the Vehicle Index in the set of variables that we analyzed.

Table 22. Coefficients of determination for DECORANA axes for plots within the Valley Xeroriparian Scrub community and correlation to environmental and disturbance gradients.

Valley Xeroriparian Scrub			
Cumulative r-squared for all 3 DCA axes = .501 (based on 25 plots)			
DCA Axis:	**1**	**2**	**3**
Axis r-squared	.291	.172	.037
	r-sq	**r-sq**	**r-sq**
Elevation	.184	.315	.010
Livestock Index	.071	.008	.008
Road distance	.001	.129	.000
Livestock congr. dist. (Imprvdist)	.050	.045	.018

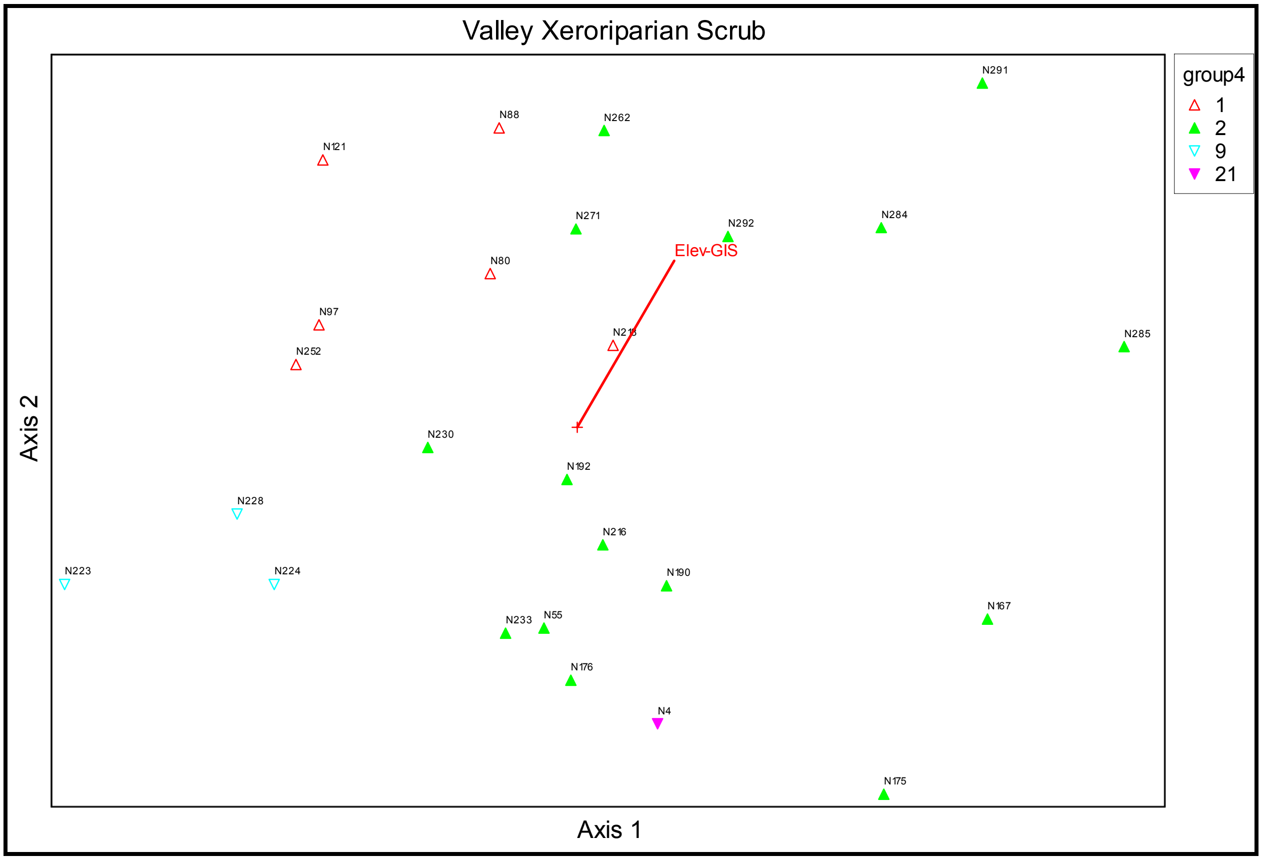


Figure 36. DECORANA graph of distribution of plots in the Valley Xeroriparian Scrub community in relationship to Axis 1 and 2 with plot clusters color-coded and relationship to significant secondary gradients illustrated by red line vectors.

Variation within the *Braided Channel Floodplain* Community

The *Braided Channel Floodplain* community is similar in many ways to the *Valley Xeroriparian Scrub* community. It occupies broad, braided channel drainage and floodplain areas that flow across the bajadas and desert flats, primarily within the *Creosotebush – Bursage Desert Scrub* and the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* communities. Because the floodplains are complexes of many sub-communities that occupy a variety of surfaces with varying disturbance histories (flooding, erosion, and deposition), variation within the *Braided Channel Floodplain* plots was high. The cluster dendrogram breaks the field plots into 5 major clusters that represent this variation (Figure 37). In all of the major cluster groups, the floodplain indicator plants *Baccharis sarothroides* and *Hymenoclea salsola* are present.

Cluster group 1 represents a single plot on a wash bank at the edge of the floodplain that is dominated by a dense shrub cover of *Lycium andersonii* (45% cover) and *Acacia greggii* (45% cover) (Appendix O). Cluster group 2 represents the wash beds that run through the floodplain area. They are largely covered by sand and gravel, but have a sparse cover of annual herbs and grasses. *Schismus arabicus* is the dominant plant in this group (5.5% cover) and *Pectocarya spp.* are also common (4.75% cover). There is a high diversity of other herbs with some shrubs and grasses in this group (Appendix N).

Cluster group 3 represents the tree dominated floodplain islands that are often part of the floodplain complex. This group is dominated by *Parkinsonia florida* (36.67% cover) along with *Olneya tesota* (18.33% cover). *Hymenoclea salsola* is the dominant shrub. *Schismus arabicus* is also abundant (43.33% cover). Overall species diversity is significantly lower than in cluster group 2.

Cluster group 5 represents floodplain border areas and islands that have a high similarity to the surrounding *Creosotebush-Bursage Desert Scrub* matrix community. *Schismus arabicus* is the dominant plant (42.83% cover). *Larrea divaricata tridentata* is the dominant shrub (2.25% cover). Cacti species are also present. There is a high diversity of herbs and high cover of herbs that are commonly associated with the *Creosotebush-Bursage Desert Scrub* community (*Pectocarya* spp., *Lepidium lasiocarpum,* and *Plantago ovata*) as well.

Cluster group 14 represents mesquite dominated (22.5% cover of *Prosopis velutina*) floodplain surfaces. This cluster group contains substantial amounts of *Larrea divaricata tridentata* (14.5% cover). *Pectocarya* spp. are also abundant (17.5% cover) as is *Schismus arabicus* (10% cover).

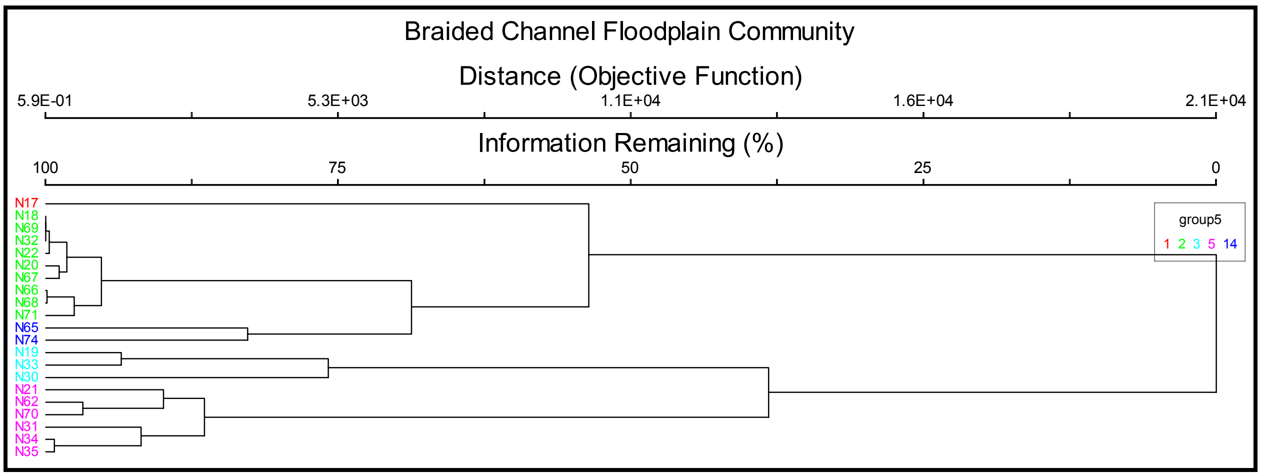


Figure 37. Hierarchical cluster analysis of the Braided Channel Floodplain natural community plots divided into five major groups based on similarity of species composition.

The primary factors influencing the variation in composition within the *Braided Channel Floodplain* community are our field survey-based livestock activity index and elevation (Table 23 and Figure 38), which are both correlated with DECORANA axis 2.

Table 23. Coefficients of determination for DECORANA axes for plots within the *Braided Channel Floodplain* community and correlation to environmental and disturbance gradients.

Braided Channel Floodplains			
Cumulative r-squared for all 3 DCA axes = .463 (based on 21 plots)			
DCA Axis:	**1**	**2**	**3**
Axis r-squared	.225	.202	.048
	r-sq	**r-sq**	**r-sq**

Elevation	.070	.420	.092
Livestock index	.070	.548	.001
Road distance	.007	.015	.013
Livestock congr. dist. (Imprvdist)	.002	.115	.039

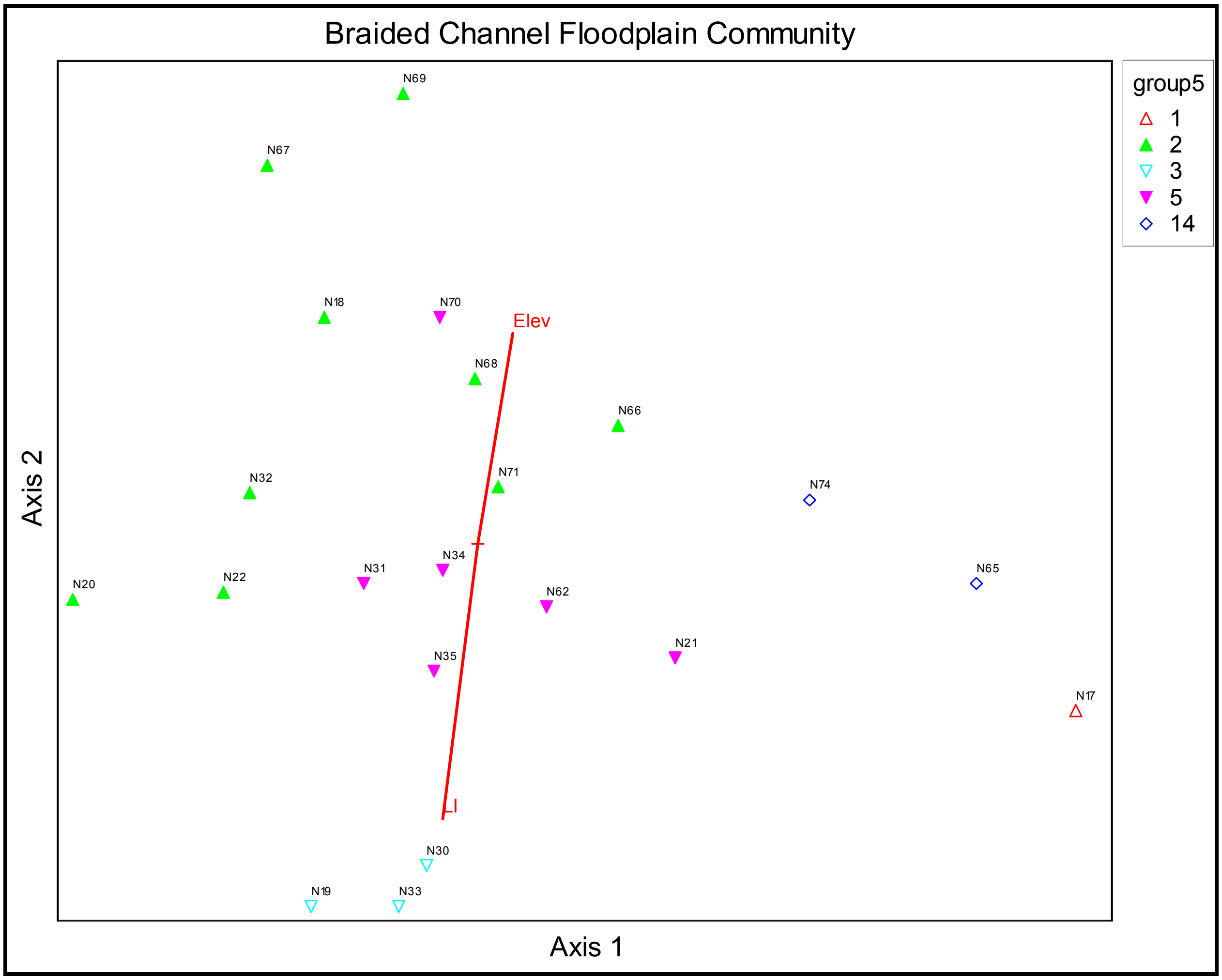


Figure 38. DECORANA graph of distribution of plots in the Braided Channel Floodplain community in relationship to Axis 1 and 2 with plot clusters color-coded and relationship to significant secondary gradients illustrated by red line vectors.

Variation within the *Desert Springs* and *Tinajas* Communities

Only two desert springs exist in the study area, both of which are of limited extent. While we sampled and described the natural community present at these two sites, the sample size was too small to analyze variation within this community. The mapped tinajas in the area were mostly man-made reservoirs or "tanks", and vegetative analysis was not done.

Ecological Condition of Natural Communities

In order to look at ecological condition we first identified a number of field-based measurements that strongly influence condition and/or quantify levels of disturbance (e.g. percent cover of native and exotic species, etc.). We used these to define and describe three levels of ecological condition. We tested whether our GIS data could be used to model and map condition by analyzing relationships of the plot-based measures of condition and disturbance to GIS-derived layers.

We used multiple sources of information to assign each natural community plot to one of the three condition classes, then used ANOVA to test how well the condition classes (as assigned to the field plots) were differentiated from each other (this was done only for the *Creosotebush – Bursage Desert Scrub* community, as an example).

We developed models for the 3 condition classes on a community-by-community basis. Finally we created a map portraying the modeled condition classes for all communities.

Levels of Ecological Eondition

We mapped three levels of ecological condition (Figure 42) based on the results of our landscape-level assessment and analysis of the natural community plot and exotic plant plot data. These three levels are described below:

> **Condition Class 1.** This condition class represents areas that have been altered to the point where the ecological condition often deviates dramatically from baseline conditions found in areas where stressors are much less prevalent. Areas characterized by Condition Class 1 often have high amounts of bare ground and/or exotic plant cover. The structure of the natural community present in Condition Class 1 areas is often significantly altered from baseline conditions. Often one or more of the structural layers may be significantly altered or even missing from the community. The composition of native vegetation is skewed toward species that can survive despite regular disturbance. Species diversity of native plants is usually low and native grass species are usually absent or in very low abundance (for a given community type). Evidence of accelerated erosion and soil compaction is often widespread and may represent a significant deviation from baseline conditions. Hydrologic alteration may often be present. Significant direct evidence of various stress factors is usually abundant. Rare plant species generally do not occur in this condition class.

> **Condition Class 2.** This condition class represents areas that show a fairly broad range of stress ranging from high to moderately low impact from a variety of stressors. Areas characterized by Condition Class 2 usually have moderate levels of exotic plant cover. The structure of the natural community present in Condition Class 2 areas is often relatively intact when compared to baseline conditions. Usually all structural layers are present, but form and stature may be altered from baseline conditions. Soil surface conditions are often intermediate between those in Condition Class 1 and Condition Class 3. Species diversity of native plants is often moderate for that community. Exotic species are usually present, but not as common or abundant as in Condition Class 1. Native grass species are often present, but usually in low abundance for that community type. Diversity of native grass species is relatively low when compared to baseline conditions. Evidence of accelerated erosion and

soil compaction may be present in certain areas, but is not dramatic and widespread. Hydrologic alteration is absent. Direct signs of stressors may be present, but not widespread or abundant. Rare plant species may be found in this condition class, but usually only at the upper end of the condition class. Rare plants that are found in this condition class are relatively tolerant of the stressors that are present.

Condition Class 3. This condition class represents areas that show the least stress within the study area and are the closest to representing baseline conditions. Areas characterized by Condition Class 3 usually have low levels of exotic plant cover, but certain sites may have localized infestations. The composition and structure of native vegetation correspond to the natural ranges of variation characteristic of the natural communities. Species diversity of native plants is often high relative to the community under consideration. Native grass species are usually present and often fairly abundant for the community type. Species diversity of native grass species is also often high. Soil compaction, accelerated erosion and hydrologic alteration are absent. Direct signs of stressors are usually absent. Certain rare plant species may only exist within this condition class.

Condition Class Modeling Assumptions

We found strong relationships between field-based measurements of condition and disturbance, and GIS-derived layers of distance from potential livestock congregation areas and distance from roads. Of 18 linear regressions of field data against GIS-derived data, 12 were highly significant [significance value of $p<.002$ (i.e. 0.05/18) was used to account for multiple regressions] (Table 24). Overall, the relationship between distance from road and the condition variables was weaker (5 of 9 regressions significant) than that of distance from potential livestock congregation areas (7 of 9 regressions significant). This difference reflects our impression from the field that, with the exception of a few major roads on the monument, the distribution of exotic species does not appear to be strongly tied to location of roads. Percent cover of native grasses and the vehicle impact index were not significantly related to either GIS-derived layer. We believe, however, that there actually is a significant correlation in the *Creosotebush-Bursage Desert Scrub* community between percent cover of native grasses and distance from potential livestock congregation areas, but we have too few plots in areas far removed from livestock influence to be able to test the statistical significance of this finding. This issue is discussed further below. Overall, the linear regression results of Table 24 provide strong support for using GIS-derived layers of distance from potential livestock congregation areas and distance from roads to model ecological condition on the SDNM.

Table 24. Linear regression results showing relationship of field-based measures of condition and disturbance to GIS-derived layers used to model condition on the SDNM.

		# of Native Species	% Cover of Native Species	# of Native Grasses	% Cover of Native Grasses	# of Exotic Species	% Cover of Exotic Species	% Cover of Sand & Soil	Livestock Impact Index	Vehicle Impact Index
Distance from Potential Livestock Congregation Areas	Regress. slope	(+)	(+)	(+)	Not Sign.	(-)	(-)	(-)	(-)	Not Sign.
	r-squared	.085	.031	.073		.037	.052	.117	.125	
	p-value	.000	.002	.000		.001	.000	.000	.000	
Distance from Road	Regress. slope	(+)	(+)	(+)	Not Sign.	Not Sign.	Not Sign.	(-)	(-)	Not Sign.
	r-squared	.07	.044	.096				.099	.071	
	p-value	.000	.000	.000				.000	.000	

Differentiation of Condition Classes

In order to test how well the condition classes were differentiated, we examined the condition classes assigned to the natural community plots in relation to the field-based factors we hypothesized were related to condition (livestock index, vehicle index, number and percent cover of native species, number and percent cover of exotic species, number and percent cover of native grasses, and percent cover of sand and soil). We did this analysis only for the *Creosotebush-Bursage Desert Scrub* community, to provide an example. Summary statistics of the condition factors for the *Creosotebush-Bursage Desert Scrub* community condition classes, based on 87 natural community plots, are provided in Table 25. The mean values for condition and disturbance factors by condition class generally reflect expected trends, with a few exceptions. Mean number of native species, percent cover of native species, and number of native grasses is higher for Condition Class 1 than Condition Class 2. In these cases, (and for most of the factors), it is worth noting the high standard deviations for Condition Class 1 versus Condition Class 2. Further detailed analysis and breakdown of plots by condition class might reveal "outlier" plots, which would strongly affect these means and might help explain the unexpected trends.

Table 25. Descriptive statistics concerning the relationship between condition and disturbance factors for the *Creosotebush-Bursage Desert Scrub* condition classes.

	Condition Class	Mean	Std. Deviation	Number of plots
Livestock Index	1	83.0	69.6	18
	2	11.0	29.0	66
	3	0.0	0.0	3
	All classes	25.5	49.7	87
Vehicle Index	1	28.9	75.4	18
	2	4.8	27.4	66
	3	0.0	0.0	3
	All classes	9.6	42.3	87
# of Native species	1	16.8	13.3	18
	2	11.4	5.9	66
	3	20.7	4.6	3
	All classes	12.9	8.3	87
# of Exotic species	1	3.3	2.4	18
	2	1.4	0.7	66
	3	1.3	0.6	3
	All classes	1.8	1.4	87
% Cover of Native species	1	48.3	28.1	18
	2	31.3	17.9	66
	3	63.3	11.7	3
	All classes	35.9	21.8	87
% Cover of Exotic species	1	26.3	19.7	18
	2	12.1	13.0	66
	3	4.1	3.6	3
	All classes	14.8	15.6	87
% Cover of Sand & Soil	1	37.7	24.7	18
	2	29.3	22.7	66
	3	6.8	2.0	3
	All classes	30.3	23.3	87
# of Native Grasses	1	0.6	0.9	18
	2	0.3	0.6	66
	3	1.7	1.5	3
	All classes	0.4	0.7	87
% Cover of Native Grasses	1	0.2	0.4	18
	2	0.6	2.2	66
	3	1.8	2.8	3
	All classes	0.5	2.00	87

Using multivariate ANOVA, we found 6 of the 9 condition/disturbance factors differed significantly (p<..05) among condition classes of the *Creosotebush-Bursage Desert Scrub* community (Table 26). The 6 factors differing among classes were livestock index, number of native species, number of exotic species, percent cover of native species, percent cover of exotic species, and number of native grasses. No differentiation could be made among the condition classes on vehicle index, percent cover sand/soil, and percent cover of native grasses.

Table 26. Multivariate ANOVA results for difference in condition classes assigned to *Creosotebush-Bursage Desert Scrub* natural community plots, by field-based measures of condition and disturbance.

Dependent Variable	Type III Sum of Squares	df	Mean Square	F	p-value	Significance at p=.05
Livestock Index	75310.693	2	37655.347	23.060	.000	Significant
Vehicle Index	8540.508	2	4270.254	2.467	.091	Not significant
# of Native species	595.158	2	297.579	4.711	.012	Significant
# of Exotic species	51.490	2	25.745	17.038	.000	Significant
% Cover Natives	6371.185	2	3185.593	7.771	.001	Significant
% Cover Exotics	3184.096	2	1592.048	7.576	.001	Significant
% Cover Sand/Soil	2703.682	2	1351.841	2.589	.081	Not significant
# of Native Grasses	6.498	2	3.249	6.868	.002	Significant
% Cover Native Grasses	6.861	2	3.431	0.862	.426	Not significant

Ecological Condition of Creosotebush - Bursage Desert Scrub

Our analysis of field data and field observations indicate that the *Creosotebush - Bursage Desert Scrub* community is one of the most disturbed communities in the study area. Significant parts of the *Creosotebush - Bursage Desert Scrub* community are in either Condition Class 1 or Condition Class 2, with only a limited portion (less than 3% of the area) in Condition Class 3. Nearly all of the developed/disturbed sites and linear disturbances mapped in our landscape-level assessment occur within this community. Most of the roads in the study area occur within this community. It has the highest level of exotic species of any matrix community (double the level in the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* community). The level of exotics was only exceeded by the *Braided Channel Floodplain* and *Mesquite Woodland* communities (which both lie within the *Creosotebush - Bursage Desert Scrub* matrix) (Appendix F).

The DECORANA analysis of stressors indicated that the field-based livestock activity index and distance from potential livestock congregation areas (GIS layer) had reasonably strong correlations with trends in community composition. Therefore, we used distance from potential livestock congregation areas as the basis for a GIS model to map ecological condition within the *Creosotebush - Bursage Desert Scrub* community (see Methods – Modeling and Mapping of Ecological Condition).

We assigned Condition Class 1 to areas within 500-meters of a potential livestock congregation area. We decided that the 500-meter distance limit represented a good balance between inclusion of most of the heavily disturbed sites and limitation of the presence of less disturbed sites. Over 76% of the plots in the *Creosotebush - Bursage Desert Scrub* community that we identified in the field as heavily disturbed sites fell within the 500-meter limit. Conversely, 53% percent of the field plots that were within 500-meters of a potential livestock concentration area were determined to be Condition Class 1 plots through analysis and interpretation of the plot data.

Likewise we determined from our analysis of the data and field observations that there were only limited areas in this community representing Condition Class 3. We used a distance of 6500-meters from a potential livestock congregation area for separating Condition Class 2 from Condition Class 3. This distance represents the average of the mean distances for plots assigned to Condition Class 2 and Condition Class 3. Based on our DECORANA analysis and field observations, we decided that we could only classify 3 of the 87 plots that we established in the *Creosotebush - Bursage Desert Scrub* community as Condition Class 3. All of our field plots that were over 6500-m from a potential livestock concentration area fell in Condition Class 3. Conversely, sixty percent of the field plots that were greater than 6500-meters from a potential livestock concentration area were determined to be Condition Class 3 plots.

In summary, the ecological condition of the *Creosotebush - Bursage Desert Scrub* community appears to be impaired by human-related stress factors. Overall, the condition appears to be most highly correlated to distance from potential livestock congregation areas. We determined that most of the *Creosotebush - Bursage Desert Scrub* community is in Condition Class 2 with lesser amounts in Condition Classes 1 and 3. Localized and often severe disturbance of the *Creosotebush - Bursage Desert Scrub* community resulting from ORV activity was observed during our fieldwork but we have not found an easy and scientifically supportable way to map or model this stress factor.

Ecological Condition of Paloverde - Mixed Cacti – Mixed Scrub on Bajadas

The ecological condition of the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* community is less impaired than the condition of the *Creosotebush - Bursage Desert Scrub* community. There is only half the level of exotic species in this community. Overall, there is more native vegetative cover, higher diversity of native plant species and more native grasses (Appendix F). We noticed much lower levels of accelerated erosion, less soil compaction and lower levels of recent livestock activity in this community. Our landscape level assessment indicated that the presence of developed/disturbed sites, linear disturbances, and roads was also much less in this community. Only very small portions of this community were mapped in Condition Class 1. Slightly over 25% of this community was mapped in Condition Class 3. Condition class 2 characterizes the dominant condition (67% of the area) of this community.

We used similar methods to those employed in the *Creosotebush - Bursage Desert Scrub* community to develop a predictive model for the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* community. Distance from potential livestock congregation areas was the primary factor that was correlated to variation in species composition within this community according to our DECORANA analysis. Therefore, we decided that this was our best spatial predictor of ecological condition within this community.

We determined that only one field plot represented a highly disturbed site within this community. Because of it's location near the boundary of this community with the *Creosotebush - Bursage Desert Scrub* community and it's highly altered vegetative composition, we excluded this plot from our DECORANA analysis as an outlier. Due to the lack of plots that represented Condition Class 1 in this community we chose to use the same model assumptions that we had used for the *Creosotebush - Bursage Desert Scrub* community to map Condition Class 1. All areas 500-meters from a potential livestock congregation area were considered Condition Class 1. Since there were few of these located within or near this community only a small portion of the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* community was mapped as Condition Class 1.

Most of our field plots were determined to represent Condition Class 2 (20 out of 35 plots). A lesser number (14) were determined to represent Condition Class 3. We determined that the best separation between Condition Classes 2 and 3 was at the average of the mean distances from potential livestock congregation areas for plots in these two classes, 3,925-meters. Ninety percent of our field plots that were assigned to Condition Class 2 fell within the mapped parameters for this class (500-m to 3,925-m). Conversely, seventy-five percent of the Condition Class 2 field plots were within these bounds. Fifty percent of our field plots that were assigned to Condition Class 3 were greater than 3,925-m and 100% of the field plots that fell within the area mapped as Condition Class 3 were classified correctly in that condition class.

In summary, the ecological condition of the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* community appears to be less impaired by human-related stress factors compared to the *Creosotebush - Bursage Desert Scrub* community. Like the *Creosotebush - Bursage Desert Scrub* community, the ecological condition appears to be most highly correlated to distance from potential livestock congregation areas. We determined that most of the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* community is in Condition Class 3 with lesser amounts in Condition Classes 2 and 1. Some disturbance resulting from ORV activity was observed during our fieldwork but this appears to be a fairly insignificant impact at this time.

Ecological Condition of Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes

The ecological condition of the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community is significantly less impaired than the condition of the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* community. The level of exotic species cover is about 36% less in this community than on the bajadas. Overall, there is a higher diversity of native plants species on the rocky slopes, more native vegetative cover, nearly 10 times the cover of native grasses and 78% higher diversity in native grass species (Appendix F). In our field observations we did not encounter accelerated erosion, soil compaction, or much recent sign of livestock activity within this community. Our landscape level assessment indicated few developed/disturbed sites, linear disturbances, or roads in this community.

Our DECORANA analysis of variation in this community coincided with our field observations. This analysis revealed that measures of human-related stress factors were not significant in explaining variation in composition. A more complex analysis may indicate that the more gently sloping parts of this community that border bajadas or desert flats have an altered composition resulting from human-related stress factors. Our analysis of cluster groups indicated that plots within cluster group 15 and cluster group 42 had much higher levels of two exotic plants than the rest of the plots within this community. These plots appear to fall largely within the more gently sloping areas that border bajadas or desert flats.

Due to the lack of significant correlation between community composition and human-related stress factors, combined with our field observations, we decided that this entire community should be mapped as Condition Class 3 in our model, except for the presence of developed/disturbed areas, linear disturbances or roads. Therefore, essentially all of the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community is mapped as Condition Class 3.

Ecological Condition of the Mountain Upland Community

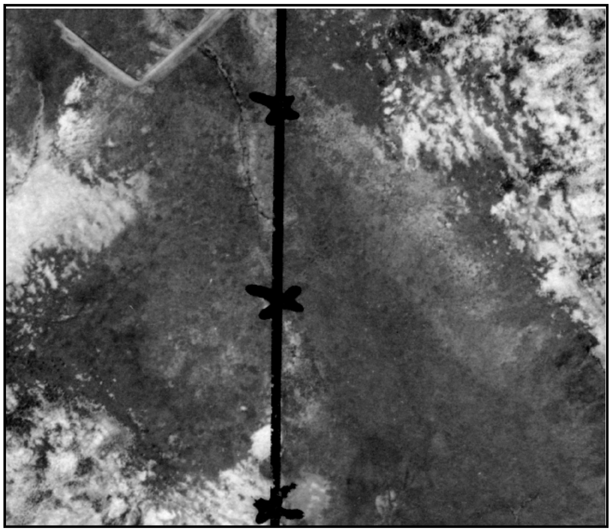
The ecological condition of the *Mountain Upland* Community is better than that of the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community and significantly less impaired than the ecological condition of *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* community. The level of exotic species cover is significantly less in this community than on the lower rocky slopes and bajadas. There is a significantly higher diversity of native plants species in this community as well as more native vegetative cover. The cover of native grasses is 370% higher than on the lower rocky slopes and there is a 70% higher diversity in native grass species here than on the lower rocky slopes (Appendix F). In our field observations we did not encounter accelerated erosion, soil compaction or recent sign of livestock activity. Our landscape level assessment indicated few developed/disturbed sites, linear disturbances, or roads.

Our DECORANA analysis of variation coincided in part with our field observations. While there appeared to be a high correlation between community composition and distance from roads and a weak correlation between community composition and distance from potential livestock congregation areas, we determined that these correlations are an artifact of the high degree of correlation between elevation and these disturbance measures. Elevation and “northness” explain most of the variation within this community. Our analysis of the *Mountain Upland* community indicated that measures of human-related stress factors were not significant in explaining variation within this community.

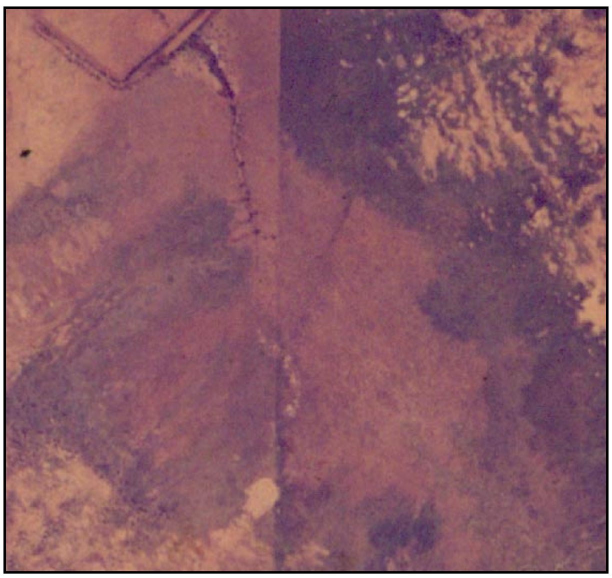
Due to the lack of a significant correlation between community composition and human-related stress factors combined with our field observations we decided that this entire community should be mapped as Condition Class 3 in our model, except for the presence of developed/disturbed areas, linear disturbances, or roads. For this reason, essentially all of the Mountain Upland community is mapped as Condition Class 3.

Ecological Condition of Desert Grassland Communities

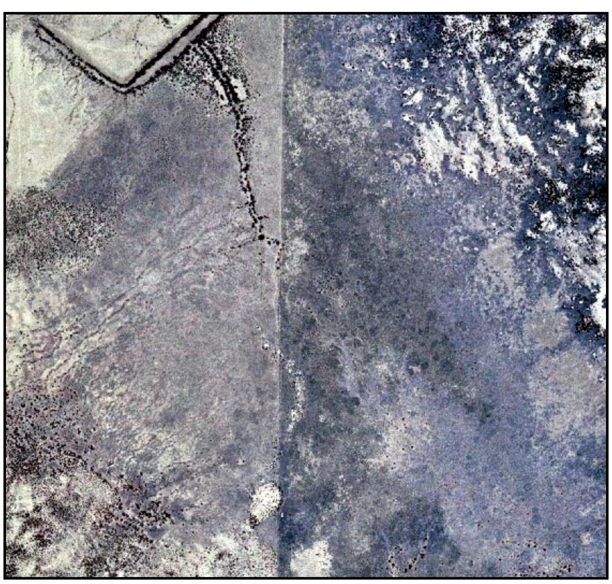
The community condition assessment of the *Desert Grassland* community in the study area was greatly restricted due to sampling constraints on the TON, where a majority of the desert grassland community is located. Sampling done on the SDNM portion of the grassland community indicates that this community has been highly disturbed by hydrologic alterations and intensive grazing. Examination of historical aerial imagery shows that significant changes have taken place in this community in the last half-century. Figure 39 illustrates some of the landscape-level changes over time in this community. Inspection of a sequence of Landsat satellite images reveals similar findings. Assessment of all these images reveals a progressive distinction between the vegetative cover in the BLM portion of the grasslands compared to the TON portion of the grasslands. Over time, the BLM portion of the grasslands has less and less vegetative cover, while the TON portion of the grasslands appears to maintain its vegetative cover (Figure 39). Our field observations coincided with these findings (Figures 40 and 41).



1958 Scanned panchromatic paper print.
One color band image.
The thick black lines appearing on the image were on the paper original provided by the BLM. This line depicts the border between the SDNM and TON. Note the similar appearance of the grassland community in the center of the photograph on both sides of the border fence.



1968 Scanned CIR color transparency.
Three band color infrared image.
Notice that the main body of the grasslands through which the border fence cuts is somewhat similar on both sides of the fence, but the slightly darker color on the TON side of the fence and the clearly visible fence line from this high elevation spy plane photograph.



1996 CIR DOQQ (Little Table Top).
Three band color infrared image.
In this image there is a markedly different texture and color to the grasslands on the TON side of the fence compared to the SDNM side. The sequence of change seen in these aerial photos correlates with what was witnessed on the ground during field surveys. This is clear evidence that in 1996 there is much higher vegetative cover on the TON side of the fence.

Figure 39. Vekol Valley grassland aerial photographs covering a span of 38 years.

Figure 40. The border fences heading south between the TON (on left) and the SDNM (on right). Notice the differences in native grass cover between the two sides of the fence.

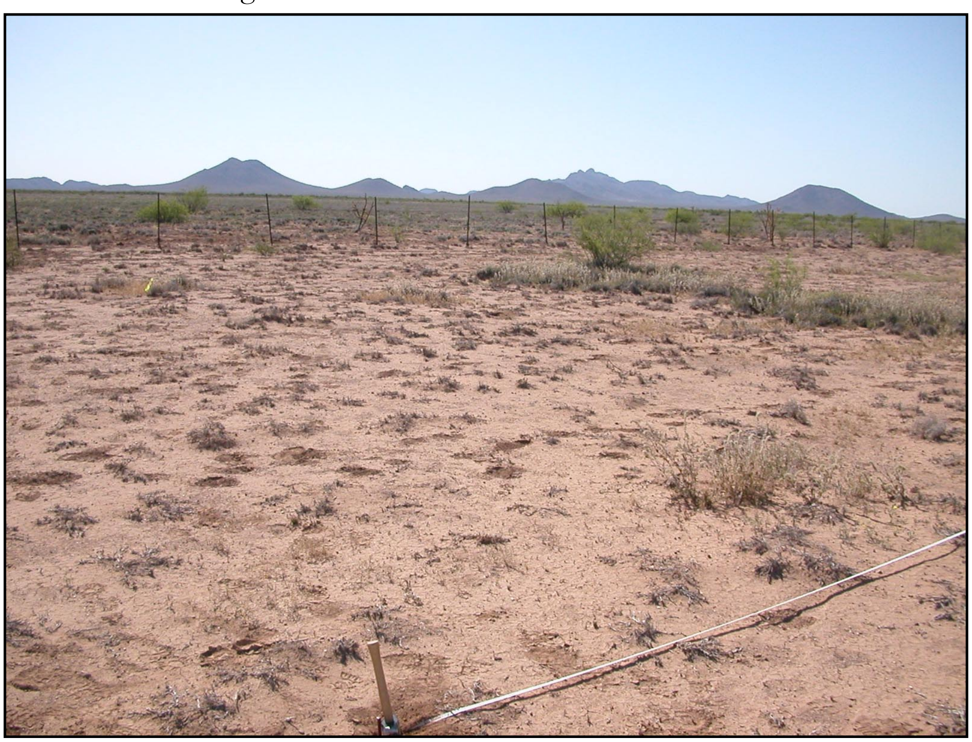


Figure 41. A field plot on the SDNM side of the grassland community. This is a highly disturbed site with low total vegetation cover. Notice the TON grassland in the background appears more vegetated with native grasses.

Due to the close proximity of the SDNM grasslands to significantly disturbed areas, the high rating of our desert grassland plots in the livestock disturbance index, and the landscape-level analysis presented above, the SDNM portion of this community was mapped as being in Condition Class 1. The portion of the grasslands on the TON side is mapped as Condition Class 2.

Ecological Condition of Mesquite Woodland Communities

Because the *Mesquite Woodland* community consists of small patches within the larger *Creosotebush – Bursage Desert Scrub* matrix community, conditions are heavily influenced by the conditions of the matrix. Most of the *Mesquite Woodland* community in the study area is in or near *Creosotebush-Bursage Desert Scrub* mapped as Condition Class 1.

Not only is the surrounding matrix community's condition indicative of a given *Mesquite Woodland* patch's condition, analysis of the natural community plot data suggests that condition characteristics meriting Condition Class 1 are accentuated in *Mesquite Woodlands* when compared to the surrounding matrix community's conditions. The mean cover of exotic species is 170% higher in the *Mesquite Woodland* community (40.2% mean cover) than the *Creosotebush-Bursage Desert Scrub* community (Appendix F).

Our DECORANA analysis of environmental factors and stressors indicated that distance from potential livestock congregation areas was strongly correlated with trends in community composition (road distance was correlated to a lesser degree). Therefore, we used distance from potential livestock congregation areas as the basis for a GIS model to map ecological condition within the mesquite community. We had previously determined that three plots were in Condition Class 2 while ten plots were in Condition Class 1. There was little overlap in distance from potential livestock congregation areas between the plots in Condition Classes 1 and 2. All the Condition Class 2 plots were at least 1,420-m from a potential livestock congregation area and this value was used to model the break between condition classes.

The mean distance from potential livestock congregation areas for all the *Mesquite Woodland* patches is low (Appendix F), and the mean distance from roads is even lower. Almost all of the *Mesquite Woodland* community in the study area is considered to be in Condition Class 1 or 2. We did not find any *Mesquite Woodland* patches that would qualify as Condition Class 3.

Ecological Condition of Rock Outcrops

The *Rock Outcrop* community has the lowest average percent cover of exotic species of any natural community occurring in the study area (0.3%) (Appendix F). This community also has some of the highest average elevations and average distances from potential livestock congregation areas within the study area. There were no indications of cattle or vehicle disturbances recorded in this community during Phase 2 fieldwork. Much of this community is inaccessible to humans without proper climbing equipment (due to the steepness and magnitude of the rock faces), therefore not much human disturbance has occurred in this community. In general rock climbing is not a common activity in the study area because of the friable nature of most of the rock. All of the *Rock Outcrop* community was determined to be in Condition Class 3.

Ecological Condition of Mountain Xeroriparian Scrub

Analysis of the factors that might affect the composition of the *Mountain Xeroriparian Scrub* community indicated that only topographic factors (elevation, eastness, northness) and geologic substrate were significant. This coincides with our field observations and the results from the matrix communities in which this community is situated. Little sign of human disturbance or livestock activity was recorded in this community. Low levels of exotic species, high cover and diversity of native species, and high cover and diversity of native grasses all indicate that this community is in relatively good condition (Appendix F). Therefore, all of this community was classified in Condition Class 3.

Ecological Condition of Valley Xeroriparian Scrub

Analysis of the factors that might affect the composition of the *Valley Xeroriparian Scrub* community indicated that only elevation was significant. In contrast to the *Mountain Xeroriparian Scrub* community, evidence of human-related stress factors was fairly abundant in this community. This community had a relatively high level of exotic plant cover and frequent signs of recent livestock activity and vehicle activity (Appendix F). We postulate that the lack of a strong correlation with human-related stress factors is due to the fact that livestock is attracted to the *Valley Xeroriparian Scrub* community and often travel fairly long distances to this community from livestock concentration centers. This was frequently observed during our fieldwork. Vehicles often use washes as travel routes, and like livestock are "attracted" to this community. This dispersal of human-related disturbance in this community results in a low correlation with our spatial disturbance distance measures.

We classified the condition of this community using the same methods as for the *Creosotebush – Bursage Desert Scrub* community - the matrix community in which most of this community lies. Most of this community is in Condition Class 2 with lesser amounts in Condition Classes 1 and 3.

Ecological Condition of Braided Channel Floodplains

The *Braided Channel Floodplain* communities are similar to the *Valley Xeroriparian Scrub* communities and the discussion above applies. We did find a high correlation with our field-based livestock activity index with axis 2 of our DECORANA analysis, but only a weak correlation with distance from potential livestock congregation areas. This community has the second highest level of exotic plants in our study (Appendix F).

We classified the condition of this community using the same methods as for the *Creosotebush – Bursage Desert Scrub* community - the matrix community in which most of this community lies. Most of this community is in Condition Class 2 with lesser amounts in Condition Classes 1 and 3.

Ecological Condition of Desert Springs and Tinajas

All of the *Desert Spring* communities in the study area have experienced high levels of development, therefore the *Desert Spring* community was determined to be in Condition Class 1. This classification is supported by the fact that according to our exotic species data, the *Desert Spring* community is listed as having the fifth highest average exotic species cover (10.4%) of all communities in the study area, and the highest average exotic species cover of any other community located in the upper elevations of the study area (Appendix F). Because we did not collect vegetation data for *Tinajas*, there is no information to describe the ecological condition.

Comparison of Ecological Condition Between Community Types

The ecological condition of the natural communities in the study area can be ranked from least altered condition to most altered condition. In the list below the least altered community is listed first and the most altered community is listed last. It is important to note that there is considerable variation in some of these communities and a simple comparison may not apply at any given site.

1. *Rock Outcrops*
2. *Mountain Uplands*
3. *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes*
4. *Mountain Xeroriparian Scrub*
5. *Tinajas*
6. *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas*
7. *Valley Xeroriparian Scrub*
8. *Braided Channel Floodplains*
9. *Creosotebush – Bursage Desert Scrub*
10. *Desert Grassland*
11. *Desert Springs*
12. *Mesquite Woodlands*

This ranking is based on the analyses presented above. Abundance of exotic plants (Figure 15) was a primary factor used to determine the natural community condition. The proportion of the natural community in each condition class (Figure 43) was another factor that was used to determine rank. Field observations were also incorporated into this ranking.

Over 95% of the area concerning the first five natural communities in this list are mapped as Condition Class 3. Of these natural communities, *Rock Outcrops* are probably the least altered from baseline conditions, as few stressors were found to influence this community. *Rock Outcrops* also have the lowest level of exotic plant cover. The *Mountain Uplands* are isolated from most stress factors affecting the lowland communities, and community conditions are more pristine with few exotic plants. The *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community is mapped as being slightly degraded on its lower margins by stressors that affect the lowlands. Likewise, the *Mountain Xeroriparian Scrub* and *Tinajas* communities are mapped as Condition Class 3, but may be slightly degraded along their lower margins.

The next four natural communities in the ranking list have significantly lower areas mapped as Condition Class 3 (and more exotic plants) than the first five communities, but these communities still retain over 10% of their areas in Condition Class 3. The last three natural communities in the list do not contain any area mapped Condition Class 3 and are considerably degraded from baseline conditions.

Map of the Ecological Condition of the Study Area

The ecological condition of the study area was mapped based on the parameters described above and in the methods section, and the results of our landscape-level analysis of condition. The GIS layers used and methods used in development of this map are described in detail in the Methods section of this report. Figure 42 was developed through integration of the results of the coarse-scale and fine-scale condition assessment work described above.

The charts in Figures 43 and 44 illustrate the amount of area in each condition class for the natural communities. These figures show the clear dominance of the matrix communities in terms of total area within the study area. They also show the contrast in overall condition between the lower elevation and upper elevation communities. Notice that the *Rock Outcrops, Mountain Uplands,* and *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* communities are mostly in Condition Class 3 (dark green), while the other lower elevation (and gentler slope) communities are mostly in Condition Classes 1 and 2.

The Valley *Xeroriparian Scrub, Mountain Xeroriparian Scrub, Desert Spring*, and *Tinaja* communities were not included in figures 43 and 44 because we believe the current mapped extent of these communities significantly underestimates their extent. As noted in Appendix A and in the Recommendations section of this report, the two xeroriparian communities were mapped using 1:100,000-scale hydrography data produced by the USGS. The extent of these communities is much greater than delineated in the 1:100,000-scale data. Mapping of the *Desert Spring*, and *Tinaja* communities comes from GIS point data that doesn't contain or express any information related to spatial extent.

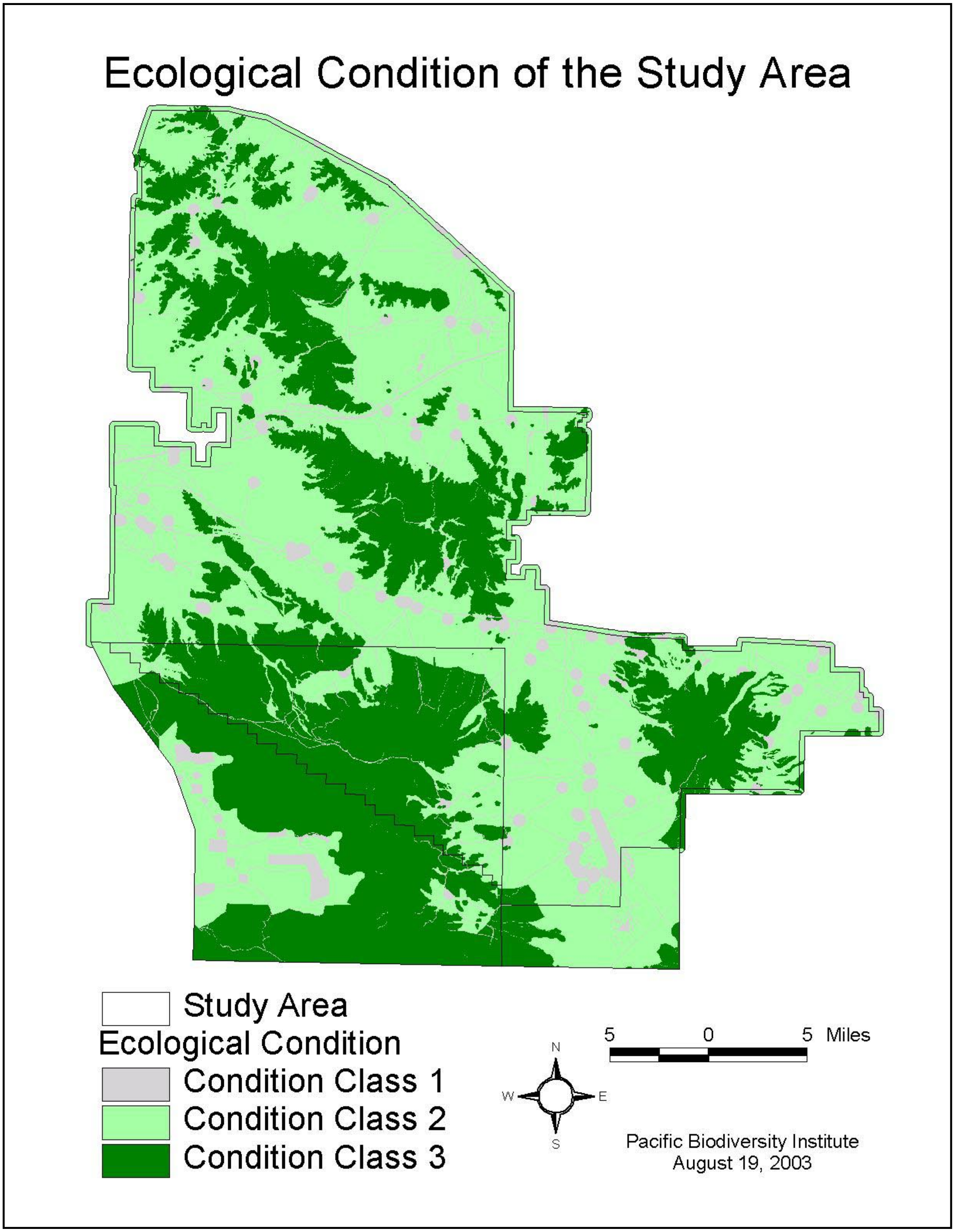


Figure 42. Map of ecological condition classes in the study area.

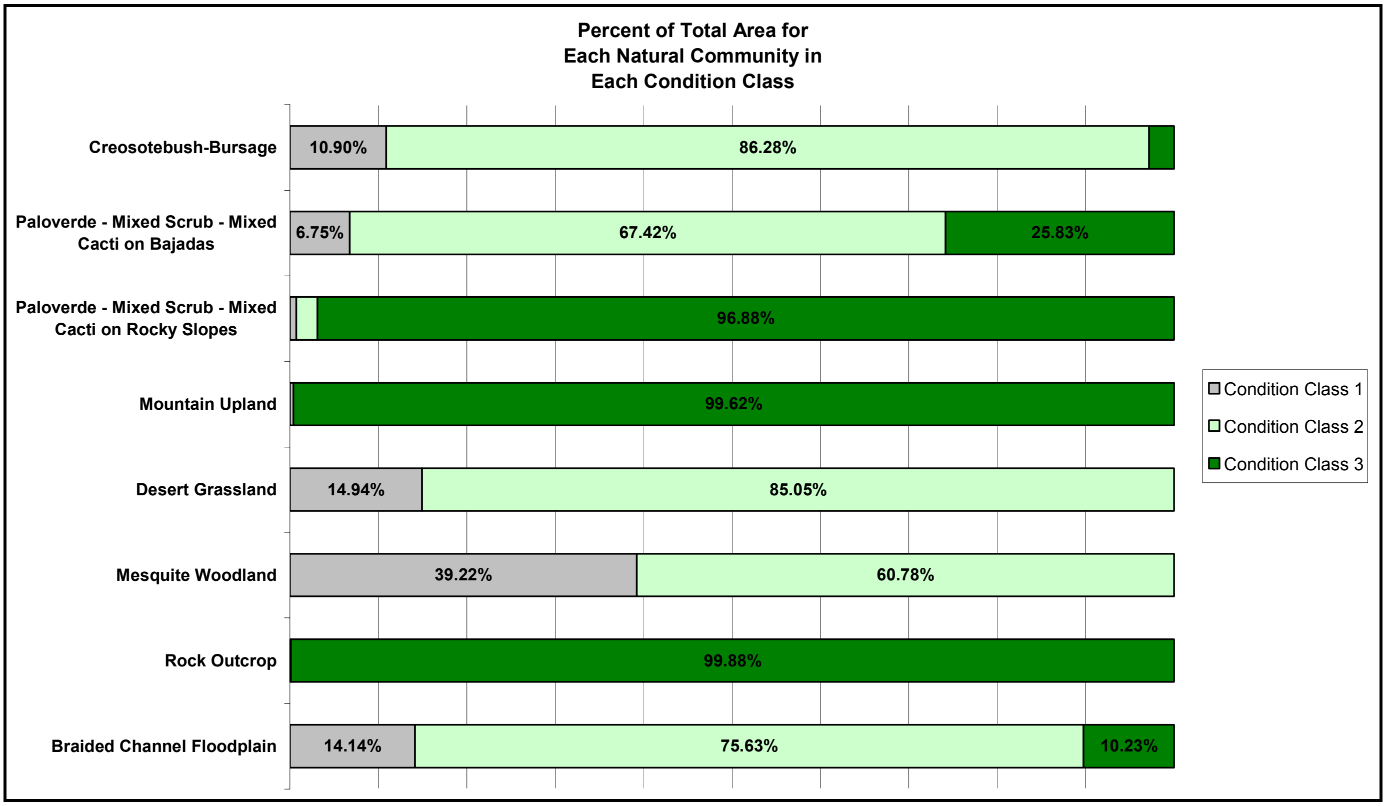


Figure 43. Proportion of natural communities assigned to each condition class.

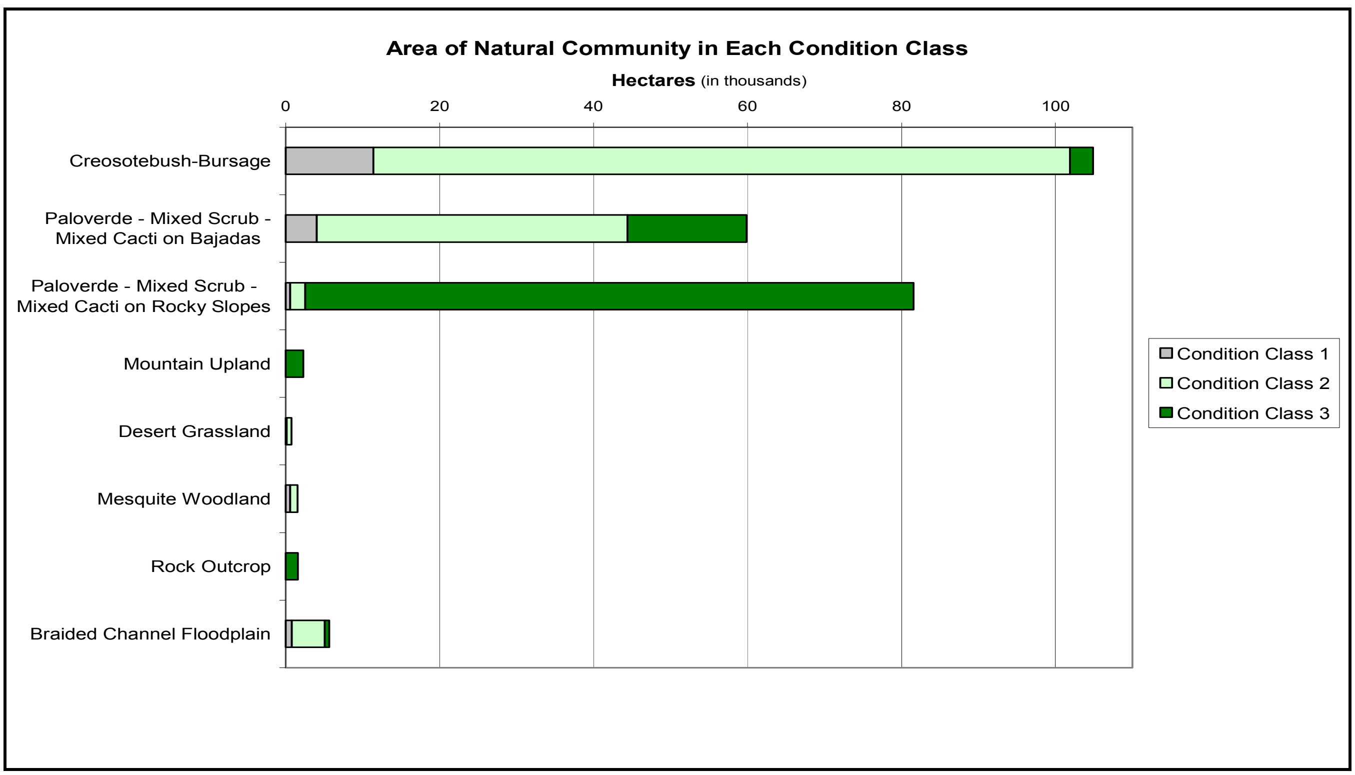


Figure 44. Area (in hectares) of the natural communities in each condition class.

Comparison of Natural Communities and Ecological Sites

We performed an analysis to describe the relationship of natural community classes to USDA NRCS ecological sites (this work was conducted during Phase 1 and is based on the Phase 1 Natural Community map). Ecological sites, which are used by the BLM in assessing and managing rangelands, are based primarily on soil differences. Natural communities are based on a combination of vegetation and physical factors, and are used by The Nature Conservancy to assess and manage ecosystems. Natural communities are a slightly coarser classification scheme than ecological sites, with eight natural communities mapped for the SDNM versus 15 ecological site classes. While the classification systems are based on slightly different criteria, they are complementary. Depending on the specific resource question at hand, one or the other system may prove more useful.

We used the NRCS Soil survey geographic database (SSURGO) GIS layers to map ecological sites. The SDNM falls within three state soil survey areas. The southwest portion of the monument, including much of the Sand Tanks and Javelina Mountain, is not mapped (Figure 45).

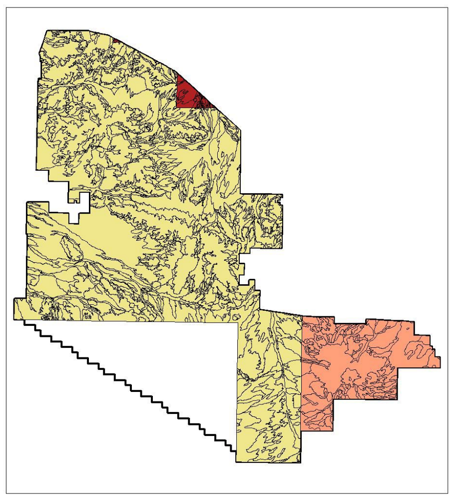


Figure 45. SDNM boundary with three soil survey areas and soil polygon outlines.

A complicating factor in our analysis is that the SSURGO data of the soil survey area covering most of the SDNM is based on a different data/coding structure than the other two areas. While the map line work generally appears continuous across the boundaries, the ecological site classifications often change abruptly (this can easily be seen in Figure 46).

We merged the SSURGO data from three soil areas into a single layer, and cross-walked data codings to arrive at a common list of 15 ecological site classes. Each mapped polygon represents a complex of these ecological site classes [e.g. Limy Fan (2-10" p.z.) 65% and Sandy Bottom (2-10" p.z.) 35%]. Thus, there are a large number of unique ecological site complexes. In order to limit the number of classes for analysis, we classified each complex type into one of 15 dominant classes and one of 29 subdominant classes. This reclassification is shown in Table 27. Once the data were reclassified, we intersected the ecological site map with the natural community map, floodplain and developed area overlays, and created summary tables.

Our analysis shows that most of the ecological site classes are comprised of multiple natural community types and vice versa. However, the ecological site classes do tend to be dominated by one or two natural community types, and five of the high elevation/more unique ecological site classes consisted primarily of only one natural community type. These types were basalt hills, granitic hills, and schist hills (mostly *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* communities), loamy bottom and saline loam (pure *Creosotebush–Bursage Desert Scrub* community). Limy fan, the most abundant ecological site class, is dominated by the *Creosotebush–Bursage Desert Scrub* community (85%), with *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* making up an additional 14%.

As natural communities are a coarser classification than ecological site classes, each community typically encompassed multiple ecological sites. However, the more unique types corresponded strongly with just one or two ecological site classes each. For example, the *Desert Grassland* community is dominated by limy upland, as well as deep, sandy loam upland. The *Mountain Upland* community is dominated by basalt hills, and the *Rock Outcrop* community corresponds strongly with granitic hills. In addition, the *Braided Channel Floodplain* community shows a strong correspondence with sandy bottom (77% of the floodplains were in the sandy bottom class).

The relationships among all of the classes can be seen in the tables and maps below (Tables 28 and 29 and Figures 46 and 47). The ecological site dominant and subdominant class codes correspond to those listed in Table 27. Floodplains and developed areas appear on the right side of the tables and do not contribute to totals. These classes were analyzed separately as they are overlays (during Phase 1) on the natural community map, rather than exclusive community types.

Given the differing purposes and criteria for classification of ecological sites and natural communities, it is not expected or desired that mapped units using the two systems should be the same. However, this analysis has shown a moderate to strong correspondence of the classifications as mapped on the SDNM, depending on community type.

Table 27. Reclassification of SDNM ecological site complexes into 15 dominant and 29 subdominant classes.

** Numbers in parentheses following each subdominant class are the number of complexes grouped to create that class. Many classes do not total 100% - this was a problem inherent in the original SSURGO data tables.*

1. Basalt Hills (2-10" p.z.)
    - 1.a. – Basalt Hills (2-10" p.z.) 55% (2)
2. Clay Loam Upland (7-10" p.z.)
    - 2.a. – Clay Loam Upland (7-10" p.z.) 90% (1)
3. Clayey Bottom (7-10" p.z.)
    - 3.a. – Clayey Bottom (7-10" p.z.) 90% (1)
4. Granitic Hills (2-10" p.z.)
    - 4.a. – Granitic Hills (2-10" p.z.) 50-60% (2)
5. Limy Fan (2-10 " p.z.)
    - 5.a. – Limy Fan (2-10" p.z.) 65%-100% (13)
    - 5.b. - Limy Fan (2-10" p.z.) 45-60% and Sandy Bottom (2-10" p.z.) 20-25% (2)
    - 5.c. - Limy Fan (2-10" p.z.) 40%, Limy Upland (2-10" p.z.) 25%, and Sandy Bottom (2-10" p.z.) 15%
    - 5.d. - Limy Fan (2-10" p.z.) 60% and Loamy Bottom (2-10" p.z.) 30% (1)
6. Limy Hills (2-10 " p.z.)
    - 6.a. - Limy Hills (2-10" pz) 35%, Shallow Upland (2-10" pz) 29%, and Limy Upland, Deep (2-10" pz) 15%
7. Limy Slopes (2-10 " p.z.)
    - 7.a. - Limy Slopes (2-10" p.z.) 50% and Limy Upland (2-10" p.z.) 25% (1)
8. Limy Upland (2-10 " p.z.)
    - 8.a. – Limy Upland (2-10" p.z.) 80-90% (4)
    - 8.b. – Limy Upland (2-10" p.z.) 60% and Limy Upland Deep (2-10" p.z.) 15% (1)
    - 8.c. – Limy Upland (2-10" p.z.) 50% and Limy Fan (2-10" p.z.) 30% (1)
9. Limy Upland, Deep (2-10 " p.z.)
    - 9.a. - Limy Upland Deep (2-10" p.z.) 80% (1)
    - 9.b. - Limy Upland Deep (2-10" p.z.) 80% and Sandy Bottom (2-10" p.z.) 15% (1)
    - 9.c. - Limy Upland Deep (2-10" p.z.) 50% and Limy Upland (2-10" p.z.) 25% (2)
    - 9.d. - Limy Upland Deep (2-10" pz) 45%, Sandy Bottom (2-10" pz) 20%, and Limy Fan (2-10" pz) 20% (1)
    - 9.e. - Limy Upland Deep (2-10" p.z.) 40% (1)
10. Sandy Bottom (2-10" p.z.)
    - 10.a. - Sandy Bottom (2-10" p.z.) 75%-100% (3)
    - 10.b. - Sandy Bottom (2-10" p.z.) 65% and Limy Upland Deep (2-10" p.z.) 25% (1)
11. Sandy Loam, Upland (2-10" p.z.)
    - 11.a. - Sandy Loam, Upland (2-10" p.z.) 90% (1)
    - 11.b. - Sandy Loam, Upland (2-10" p.z.) 50-60% and Sandy Bottom (2-10" p.z.) 20-25% (2)
    - 11.c. - Sandy Loam, Upland (2-10" p.z.) 50% and Loamy Bottom (2-10" p.z.) 30% (1)
12. Loamy Bottom (2-10" p.z.)
    - 12.a. - Loamy Bottom (2-10" p.z.) 85% (1)
13. Schist Hills (2-10" p.z.)
    - 13.a. – Schist Hills (2-10" p.z.) 35% and Limy Hills (2-10" p.z.) 20% (1)
14. Saline Loam (7-10" p.z.)
    - 14.a. – Saline Loam (7-10" p.z.) 40% and Limy Fan (2-10" p.z.) 35% (1)
    - 14.b. – Saline Loam (7-10" p.z.) 40% and Limy Upland, Deep (2-10" p.z.) 35% (1)
15. Shallow Upland (2-10" p.z.)
    - 15.a. - Shallow Upland (2-10" p.z.) 55% (1)
    - 15.b. - Shallow Upland (2-10" pz.) 40%, Sandy Loam, Upland (2-10" p.z.) 20%, and Sandy Bottom (2-10" p.z.) 15% (1)

Table 28. Distribution of dominant ecological site class by natural community type.

Dominant Class	Creosotebush-Bursage Desertscrub (CB) (ha.)	% of Class in CB	Desert Grasslands (ha.)	% of Class in Desert Grasslands	Mesquite Woodlands (ha.)	% of Class in Mesquite Woodlands	Mountain Uplands (ha.)	% of Class in Mountain Uplands	Paloverde - Mixed Cacti-Mixed Scrub (PV MC_MS) on Bajadas (ha.)	% of Class in PV MC-MS on Bajadas	Paloverde - Mixed Cacti-Mixed Scrub (PV MC-MS) on Rocky Slopes (ha.)	% of Class in PV MC-MS on Rocky Slopes	Rock Outcrops (ha.)	% of Class in Rock Outcrops	TOTAL (ha.)	Braided Channel Floodplains (BCF) (ha.)	% of Class comprising all BCF	Developed Areas (ha.)	% of Class comprising all Developed
1	27	0	0	0	1	0	177	3	163	3	5791	93	66	1	6225	0	0	10	2
2	0	0	0	0	0	0	0	0	24	83	5	17	0	0	29	0	0	0	0
3	80	29	77	28	120	43	0	0	0	0	0	0	0	0	277	0	0	172	27
4	48	0	0	0	2	0	57	0	548	2	30915	97	425	1	31995	16	0	0	0
5	43052	85	0	0	274	1	0	0	7177	14	142	0	2	0	50647	801	19	146	23
6	0	0	0	0	0	0	0	0	80	49	83	51	0	0	163	0	0	0	0
7	82	6	0	0	0	0	0	0	995	78	193	15	0	0	1270	0	0	1	0
8	6622	33	0	0	18	0	19	0	12193	61	1264	6	4	0	20120	57	1	82	13
9	21955	66	163	0	86	0	0	0	10195	31	720	2	1	0	33120	73	2	108	17
10	3823	65	0	0	267	5	0	0	1781	30	31	1	0	0	5903	3322	77	19	3
11	7415	62	212	2	245	2	0	0	3957	33	177	1	0	0	12005	25	1	105	16
12	1	100	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	2977	100	5	0	2982	0	1	0	0
14	48	100	0	0	0	0	0	0	0	0	0	0	0	0	48	0	0	0	0
15	700	17	0	0	0	0	0	0	2609	62	891	21	0	0	4200	10	0	1	0
TOTAL	83852		452		1013		253		39720		43190		505		168984	4304	101	644	100

Table 29. Distribution of subdominant ecological site class by natural community type.

Sub Class	Creosotebush-Bursage Desertscrub (CB) (ha.)	% of Subclass in CB	Desert Grasslands (ha.)	% of Subclass in Desert Grassland	Mesquite Woodlands (ha.)	% of Subclass in Mesquite Woodlands	Mountain Uplands (ha.)	% of Subclass in Mountain Uplands	Paloverde - Mixed Cacti-Mixed Scrub (PV MC_MS) on Bajadas (ha.)	% of Subclass in PV MC-MS on Bajadas	Paloverde - Mixed Cacti-Mixed Scrub on Rocky Slopes (PV MC-MS on RS) (ha.)	% of Subclass in PV MC-MS on RS	Rock Outcrops (ha.)	% of Subclass in Rock Outcrops	TOTAL (ha.)	Braided Channel Floodplain (BCF) (ha.)	% of Subclass comprising all BCF	Developed Areas (ha.)	% of Subclass comprising all Developed
1a	27	0	0	0	1	0	177	3	163	3	5791	93	66	1	6225	0	0	10	2
2a	0	0	0	0	0	0	0	0	24	83	5	17	0	0	29	0	0	0	0
3a	80	29	77	28	120	43	0	0	0	0	0	0	0	0	277	0	0	172	27
4a	48	0	0	0	2	0	57	0	548	2	30915	97	425	1	31995	16	4	0	0
5a	5169	97	0	0	9	0	0	0	172	3	1	0	0	0	5351	2	0	39	6
5b	1040	39	0	0	21	1	0	0	1555	58	64	2	0	0	2679	342	8	15	2
5c	29399	84	0	0	36	0	0	0	5320	15	75	0	2	0	34833	399	9	56	9
5d	7445	96	0	0	207	3	0	0	130	2	2	0	0	0	7784	58	1	36	6
6a	0	0	0	0	0	0	0	0	80	49	83	51	0	0	163	0	0	0	0
7a	82	6	0	0	0	0	0	0	995	78	193	15	0	0	1270	0	0	1	0
8a	845	14	0	0	4	0	19	0	3925	67	1065	18	0	0	5859	17	0	3	0
8b	3752	40	0	0	9	0	0	0	5583	59	139	1	4	0	9486	21	0	3	0
8c	2026	42	0	0	5	0	0	0	2684	56	61	1	0	0	4775	19	0	75	12
9a	190	6	0	0	0	0	0	0	3071	94	15	0	0	0	3275	11	0	10	2
9b	6019	75	0	0	1	0	0	0	1922	24	37	0	0	0	7978	4	0	2	0
9c	3303	47	0	0	0	0	0	0	3035	43	640	9	1	0	6979	11	0	4	1
9d	3939	86	163	4	78	2	0	0	409	9	0	0	0	0	4588	16	0	48	7
9e	8505	83	0	0	7	0	0	0	1759	17	28	0	0	0	10300	30	1	44	7
10a	35	100	0	0	0	0	0	0	0	0	0	0	0	0	35	0	0	2	0
10b	3788	65	0	0	267	5	0	0	1781	30	31	1	0	0	5868	3323	77	18	3
11a	296	97	0	0	6	2	0	0	2	1	0	0	0	0	304	0	0	0	0
11b	4122	50	0	0	8	0	0	0	3955	48	177	2	0	0	8261	25	1	13	2
11c	2998	87	212	6	231	7	0	0	0	0	0	0	0	0	3440	0	0	92	14
12a	1	100	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
13a	0	0	0	0	0	0	0	0	0	0	2977	100	5	0	2982	0	0	0	0
14a	13	100	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0
14b	35	100	0	0	0	0	0	0	0	0	0	0	0	0	35	0	0	0	0
15a	32	2	0	0	0	0	0	0	789	52	691	46	0	0	1512	8	0	1	0
15b	668	25	0	0	0	0	0	0	1820	68	200	7	0	0	2688	2	0	0	0
TOTAL	83852		452		1013		253		39720		43190		505		168984	4304	101	644	100

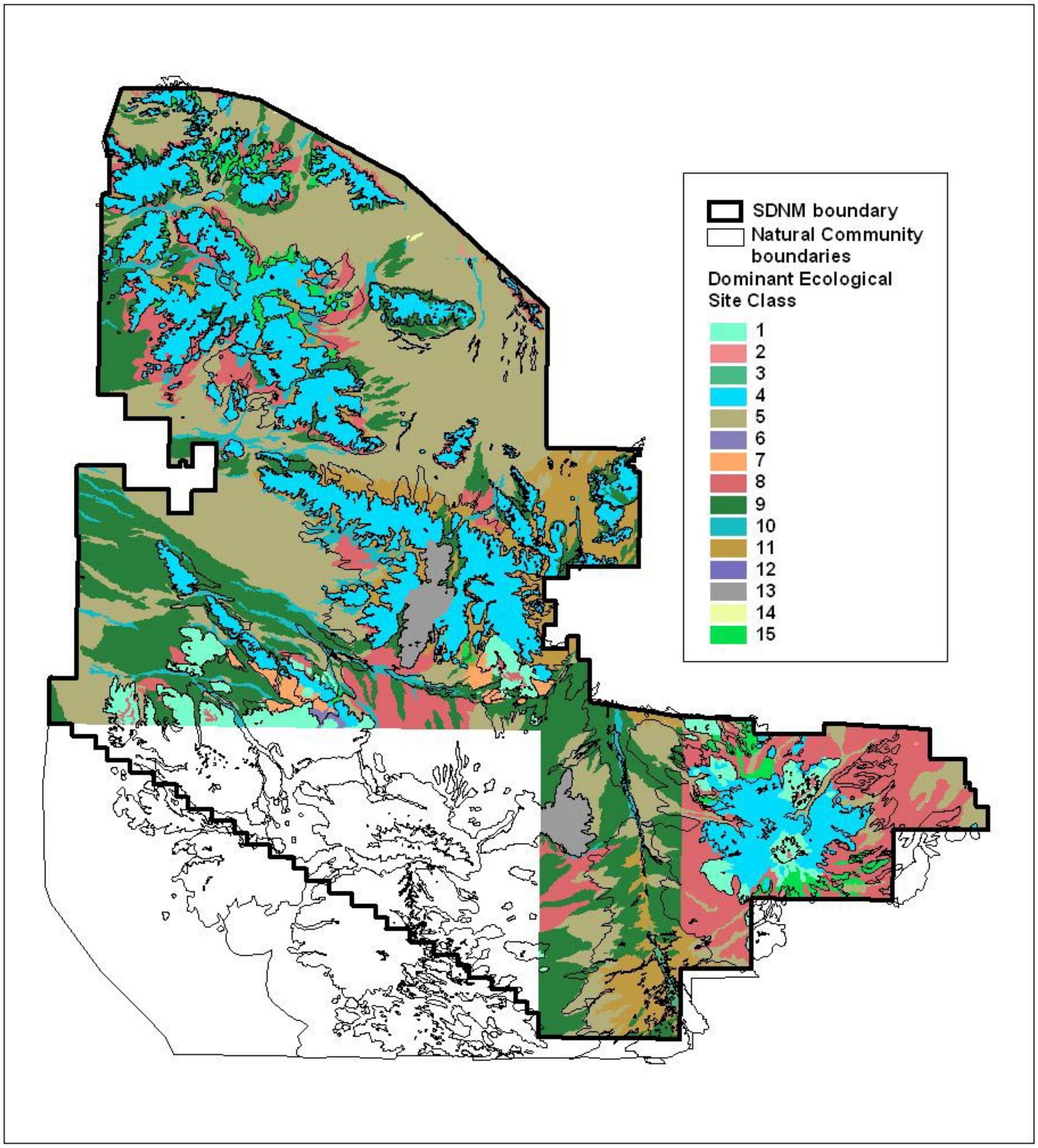


Figure 46. Dominant ecological site classes with natural community boundaries.
Map shows generally high correspondence of the higher elevation ecological site classes - granitic hills (class 4), basalt hills (class 1), and schist hills (class 13) - with natural community boundaries overlaid (black lines). Coding differences between soil survey areas can be seen by the strong vertical boundary line in the southeast portion of the map.

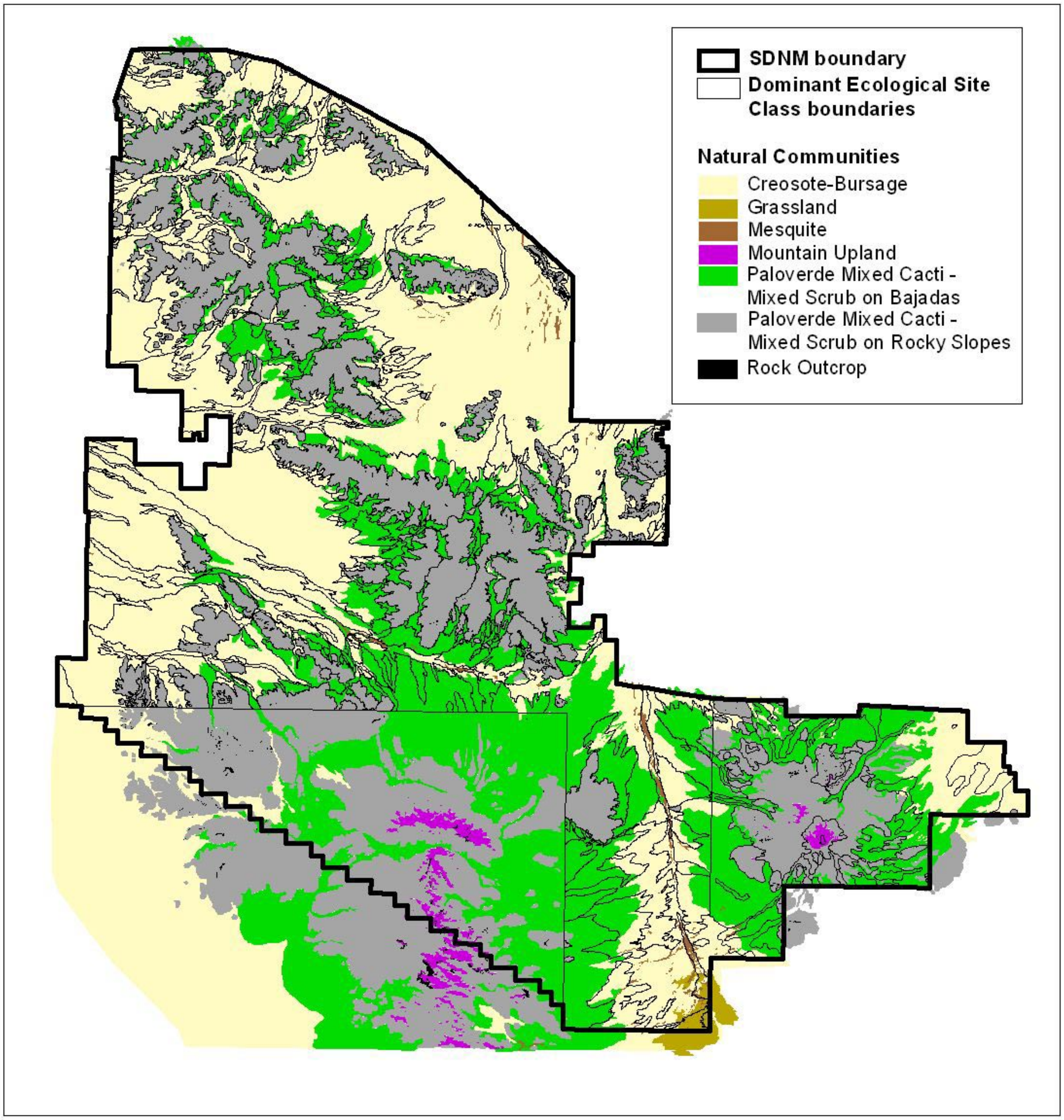


Figure 47. Natural communities with dominant ecological site class boundaries. Map shows generally high correspondence of mapped boundaries for the *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* community.

Discussion

Distribution of Exotic Plants

Exotic plants are more prevalent in some communities than in other communities. We found that the areas closest to disturbed areas had the highest exotic plant cover and the highest diversity of exotic plants. But some exotic plants (notably *Schismus arabicus, Erodium cicutarium*, and *Bromus rubens*) were found in all the natural communities, and they occurred in even the remotest locations far from disturbed areas.

We found that distance from roads was not a significant factor influencing the distribution of exotic plants. This contradicts our findings in the Pacific Northwest where we discovered a high correlation with distance from road (Morrison et. al 2003). However, we have preliminary indications that support the findings of Gelbard and Belnap (2003), who reported that exotic plant cover and exotic species richness is correlated with road type in a semi-arid environment. We often found that the few paved roads in the study area had relatively high levels of exotic plant cover and diversity immediately adjacent to the pavement. But we found that areas next to graded and unimproved dirt roads usually did not have significantly different exotic plant covers compared to the surrounding landscape. It is not yet clear whether the exotic species found along the paved roads will move out eventually into the surrounding landscape.

The presence of exotic plants in all of the natural communities indicates that the entire study area is somewhat altered from pre-settlement conditions, and no natural community is in pristine condition.

Ecological Condition of the Natural Communities

Overall, the ecological condition of the study area is moderately good. However, ecological conditions within the natural communities vary considerably from one location to another. Some communities appear to be experiencing high levels of human-related stresses, while other communities experience little. Tangible measures of stressors were observed in this study. These measures are: species richness in native vs. exotic plants, ground cover of native vs. exotics plants, amount of bare ground (sand and soil), diversity of native grass species, and abundance of native grass species. Evidence of accelerated soil erosion and soil compaction are also related to these stress factors. We found strong relationships between these field-based measurements of condition and disturbance and GIS-derived layers of distance from potential livestock congregation areas and distance from roads. These strong relationships provided support for using the GIS layers in developing the ecological condition map.

Analysis of data collected in the *Creosotebush – Bursage Desert Scrub* community, the primary matrix community of the Lower Colorado River subdivision of the Sonoran Desert, reveals that ecological condition is most strongly determined by gradients in distance from livestock water source, a livestock influence index, and an elevation gradient. Areas in close proximity to water sources or other substantial range improvements often have highly altered vegetative compositions and structures and altered soil surface conditions. The influence (stresses) of livestock extends throughout most of the community, as few of the regions we visited within the study area are without some indication of livestock influence. This stressor exhibits a predictable gradient of influence related to distance from water sources.

Stresses related to vehicle use were observed during fieldwork but were not as statistically significant as stresses related to livestock use. At the current time, stresses related to vehicle use are much more localized than stresses related to livestock use. We feel that a more detailed analysis of selected parts of the study area may help to clarify the extent of impact of vehicle stresses.

Stresses related to undocumented alien and drug traffic were observed to significantly impact the southern part of the study area. We did not collect data on these stressors but increases in these activities warrant further research on their ecological effects.

The ecological conditions of the natural communities within the study area have been affected by a long-term regional drought. Further study is needed during wetter periods to determine how natural communities will respond to more normal moisture levels.

Application of Results of this Study to BLM Standards for Rangeland Health

The Arizona BLM's *Standards For Rangeland Health And Guidelines For Grazing Administration* (1997) describes a set of rangeland health standards that are measurable and attainable, and that comply with various Federal and State statutes. These standards are a response to the Grazing Administration Regulations, at §4180.1 (43 Code of Federal Regulation [CFR] 4180.1), Federal Register Vol. 60, No. 35, pg. 9970, which directs that the authorized officer ensure that the following conditions of rangeland health exist:

(a) Watersheds are in, or are making significant progress toward, properly functioning physical condition, including their upland, riparian-wetland, and aquatic components; soil and plant conditions support infiltration, soil moisture storage, and the release of water that are in balance with climate and landform and maintain or improve water quality, water quantity, and timing and duration of flow.

(b) Ecological processes, including the hydrologic cycle, nutrient cycle, and energy flow, are maintained, or there is significant progress toward their attainment, in order to support healthy biotic populations and communities.

(c) Water quality complies with State water quality standards and achieves, or is making significant progress toward achieving, established BLM management objectives such as meeting wildlife needs.

(d) Habitats are, or are making significant progress toward being, restored or maintained for Federal threatened and endangered species, Federal Proposed, Category 1 and 2 Federal candidate and other special status species.

The Arizona BLM's standards then state, "These fundamentals focus on sustaining productivity of a rangeland rather than its uses. Emphasizing the physical and biological functioning of ecosystems to determine rangeland health is consistent with the definition of rangeland health as proposed by the Committee on Rangeland Classification, Board of Agriculture, National Research Council (Rangeland Health, 1994, pg. 4 and 5)."

Our ecological assessment of the condition of natural communities in the study area is designed to provide information relevant to "the physical and biological functioning of ecosystems" and to whether they are maintaining their productivity and diversity. The ecological assessment of natural communities and the exotic plant survey that we have conducted can be used to determine if conditions (b) and (d) above are met in the SDNM and adjacent areas. To a lesser extent the data we have collected can be used to assess the degree to which condition (a) above is met in the study area.

For example, rangeland health condition (b) involves the maintenance of ecological processes that result in healthy biotic populations and communities (or at least progress toward attainment of this condition). BLM can evaluate the condition classes that we have established in this study to determine which condition classes meet rangeland health condition (b). Ecological Condition Class 3 areas are likely the closest to meeting rangeland health condition (b). Condition Class 2 may or may not meet this condition depending on a variety of factors and interpretations. Condition Class 1, which represents areas with a substantially degraded ecological condition, where biotic populations and communities are highly altered, probably does not meet rangeland health condition (b).

Likewise, rangeland health condition (d) involves the maintenance of habitats for Federal threatened and endangered (T&E) species, Federal Proposed, Federal candidate and other special status species (or the making of significant progress toward being restored for these ends). The data we collected for this report can be used to help evaluate if adequate habitat conditions exist for T&E and associated species in the study area. Habitat conditions for each T&E species is unique and determination whether these habitat conditions have been maintained requires an intensive species-specific evaluation. However, it may prove useful to incorporate our condition-class assessment and mapping in the evaluation of habitat conditions for some of these rare species. It is possible that some of the areas mapped as Condition Class 3 have retained habitat conditions for T&E species similar to those present during presettlement times. Patch size of suitable habitat and connectivity are important factors that need to be evaluated for many species. Condition Class 2 areas may or may not retain adequate habitat for various rare species depending on a wide variety of factors and interpretations. For many rare species, areas in Condition Class 1 probably have a higher likelihood of failing to provide adequate habitat conditions. These areas are at a higher risk of not meeting rangeland health condition (d) for many species of concern due to the substantial habitat modification that is present in these areas.

The Arizona BLM's *Standards For Rangeland Health And Guidelines For Grazing Administration* (1997) set forth the following standards to be used in determining if the above rangeland health conditions area being met. The standards are:

> "Standard 1: Upland Sites. Upland soils exhibit infiltration, permeability, and erosion rates that are appropriate to soil type, climate and landform (ecological site).
>
> Standard 2: Riparian-Wetland Sites. Riparian-wetland areas are in properly functioning condition.
>
> Standard 3: Desired Resource Conditions. Productive and diverse upland and riparian-wetland plant communities of native species exist and are maintained."

The data we have collected and our analysis of these data can be used to gauge whether these standards are met. With regard to Standard 1, we have collected information on soil conditions and erosion where it was observed in our assessment plots. Plots where significant erosion or degraded soil conditions were observed may not be meeting this standard.

Our assessment of ecological condition of the natural communities of the SDNM and adjacent areas and our exotic plant survey is most applicable to assessment of whether ecological sites are meeting Standard 3, which calls for the maintenance of "productive and diverse upland and riparian-wetland plant communities of native species." BLM's rangeland health standards explain that the criteria for whether this standard is met or not is indicated by such factors as: composition, structure and distribution of vegetation. Extensive information on all of these factors for upland and riparian-wetland communities was collected in this study.

Areas in Condition Class 3 are very likely to meet Standard 3 since we determined that they currently have "productive and diverse upland and riparian-wetland plant communities of native species". Areas in Condition Class 2 may or may not meet this standard depending on a variety of factors and interpretations. Some Condition Class 2 areas may not meet rangeland health standards due to the abundance of exotic plants. Other Condition Class 2 areas may not meet the rangeland health standards due to the lack of native grasses or other important components of the natural community. Areas in Condition Class 1 are at a high risk of not meeting this standard because of the lack of native diversity present on these sites, the prevalence of exotic plants, and the relative low overall productivity of many sites because of their degraded condition.

Although, there are significant differences between the approach set forth in the BLM's rangeland health standards and guidelines compared to the ecological condition assessment that we have conducted, the two approaches are complementary. Our assessment can lend weight to conclusions derived using the traditional approach of assessing rangeland health. It can also be used directly to determine whether many of the rangeland health conditions and standards are met, or whether progress is being made toward their attainment.

Recommendations

Follow-up Workshop

We recommend a follow-up workshop with BLM, TON, BMGR, and TNC staff to facilitate the interpretation of the results and conclusions of this study. This workshop would include a demonstration and discussion of the field methods employed as well as a thorough explanation, demonstration and discussion of the analytical techniques used. The workshop would provide an excellent opportunity to discuss how the results of this study relate to more traditional measures of rangeland health.

Improvement of Base GIS Data

Several base data layers need substantial improvement. The road data sets that are currently available are all somewhat inadequate. The most current BLM road GIS layer is missing some significant roads in the BLM portion of the study area. Ironically, some of these roads are present in an earlier BLM road layer. We had to combine three road layers to get relatively complete coverage of the roads. However, during our creation of the linear disturbance layer we discovered that there are still many roads or significant vehicle routes that are not in any of the existing road layers. We recommend a complete reevaluation of the adequacy of the road GIS data for the study area.

The BLM range improvement GIS data also needs substantial improvement. The spatial location of range improvements is often only approximate. Many significant range improvements are not mapped and other range improvements that are shown are not apparent on the ground. The biggest improvement in this data set would be to attribute the range improvements, particularly the livestock water sources, with their current status and level of use. Some of the livestock water sources in this layer are defunct and no longer in use (or may have never been used). There are other livestock water sources (developed tanks) that exist but are not in this GIS layer. We could build better models of ecological condition of the natural communities if this data layer was improved.

Improvement in the Accuracy of the Ecological Condition Map and Model

The accuracy of the ecological condition map and model could be improved by the incorporation of better information about the location and status of range improvements and roads as discussed above. We could also modify the model so that it incorporates information on the levels of use of livestock water sources and the levels of use on roads. This model modification would probably result in a substantial improvement in the predictive accuracy of the model. Collection of additional field data in certain locations (e.g. areas near the boundary between condition classes) would also help to refine the input data and improve the predictive accuracy of the model.

Additional Analyses Based on Existing Data

A great wealth of data was collected during this study. Further analysis of these data would produce products that would be useful to BLM's management of the SDNM and to others that have interest in the management of the larger study area. Some of the possibilities for further study using existing data are listed below.

Improved Landscape-level Assessment

Further analysis of the information developed during the landscape-level assessment may yield useful information that can help guide land management within the study area. This analysis could include:

- Analysis of the amount of landscape-level disturbance occurring in each natural community type.
- Analysis of the amount of landscape-level disturbance in relation to human population centers, major transportation routes and other factors.
- Analysis of the fragmentation caused by landscape-level disturbances, including identification of the patch distribution in each community and the geographic factors controlling fragmentation. This analysis would lead to an additional measure of ecological condition. It could help identify the best management opportunities for the maintenance of unfragmented landscapes.
- Analysis of the effects of fragmentation on exotic species distributions, rare plant populations, and ecological condition of natural communities.

Exotic Plant Distribution and Dynamics

Further analysis of the exotic plant species distributions is possible and may yield information that is useful to land management opportunities and risks within the study area. This analysis could include:

- Ranking of exotic plant species by percent cover and constancy by natural community and within the study area as a whole. This will help determine exotic species management priorities within each natural community.
- Analysis of exotic species distributions in relationship to use-levels and surface types of the transportation routes within the study area.
- Development of a set of recommendations for exotic plant management within the study area.

Occurrence and Distribution of Rare Plant Species

During the field assessment phase of this project we recorded information on all vascular plant species that occurred in our field plots. We also noted the occasional occurrence of rare plants in our field notes. Voucher specimens were collected in many instances and have been identified by experts in Sonoran Desert flora. Further analysis and synthesis of our plant database and field notes could yield useful information on the distribution of rare plant species. It would be useful to compare the lengthy plant species list with Heritage Global Ranks and the current state and federal T&E plant list to determine if there are additional globally rare species on the SDNM. We recommend further data analysis, mapping, and reporting based on the information collected in this project. This would result in the following products that could help guide the management of rare species:

- A list of rare plants found in the study area and their state, federal and global status.
- Maps of the occurrences of each rare species encountered in this project.
- Analysis of factors that influence the distribution of rare species and development of predictive models for the distribution of rare species. This could result in a set of maps that indicate the probability of occurrence for each species throughout the study area.
- Development of a set of management recommendations for the maintenance of rare plant populations within the study area.

Preparation of Voucher Specimens for Herbarium Collections

Numerous voucher specimens were collected of vascular plants observed in the study area. Botanical experts have recognized many of these specimens as important collections that could add considerably to the knowledge base on the distribution of Sonoran Desert flora. They have recommended that work be undertaken to prepare these specimens and accompanied data about their occurrence, so that they can be added to a herbarium collection at either the University of Arizona or Arizona State University. Both herbariums have indicated interest in receiving these specimens.

Evaluation of Native Grass Conservation Elements

Native grasses were determined during a meeting about Conservation Elements of the Sonoran Desert National Monument in May 2003 to be an important conservation element. We identified that native grass diversity and abundance were an important indicators for natural community ecological conditions. Further analysis of the data collected in this project on native grass species is recommended. This would yield the following products that would help determine land management strategies within the study area:

- Maps of the occurrence and relative abundance of each native grass species.
- A map of the best representations of native grass aggregations.
- Further analysis of the factors that influence the distribution and abundance of native grass species.
- Ranking of the native grass species by rarity and sensitivity to disturbance factors
- Development of a set of management recommendations for maintenance of native grass diversity within the study area.

Further Analysis of Mesquite Woodlands

Due to time and budget constraints, not all of the *Mesquite Woodland* community data gathered during the fieldwork and landscape-level analysis phases of this project was analyzed. Information on tree diameters and heights was collected for some stands in the study area. Some of the information collected in Mesquite Woodland Condition and Extent Plots was also not analyzed. Along with such field-based data, some of the GIS attribute data created during the aerial imagery chronosequence analysis was not analyzed in this report. Further analysis of all these data sets along with our completed ecological condition analyses could help better our understanding of mesquite stand ages and growth patterns related to disturbances and natural conditions in the study area.

Comparison with Other Studies

Comparisons of the findings of this study with other Sonoran Desert vegetation studies would help put our findings into context relative to these other studies, both methodologically and with respect to our findings. A comparison with comparable studies could yield further insight into the broader distribution and characteristics of the natural communities described in this report. Likewise, a comparison with other attempts at ecological condition assessment would yield further insight into the trends we observed in this study.

Further Analysis and Comparison of Natural Variation Across All Communities

We recommend further analysis of variation in vegetation composition and structure across all communities. This should include a cluster analysis that spans all communities. This would yield useful insight into the delineation and characterization of the natural communities. It could be used to test whether the natural communities that we have identified are less variable across the plots that we used to characterize them than between each other (that is, are the natural communities, as we have defined them, logical natural groupings in and of themselves).

Further Characterization and Subdivision of Natural Communities

Further analysis of the substantial body of data collected during this project would likely yield additional insights into the ecological condition of the natural communities. These communities are defined rather broadly, and further characterization into variants would be illuminating. Our preliminary analysis of the data using cluster analysis and DECORANA indicated that many of the communities could be fruitfully subdivided into several variants. The ecological condition of each variant may be quite unique and this information could be useful in determining management directions for various parts of the SDNM and adjacent areas.

Study of Saguaro Demographics

Further analysis of the ecology data collected during our study may reveal significant trends in saguaro (*Carnegiea gigantea*) recruitment and demographics that may be related to ecological condition and other factors. This analysis was beyond the time and fiscal constraints of this project, but significant demographic data were collected on the number of saguaros in each natural community plot and their height. We recommend further analysis of the saguaro demographic data and the relationship of the saguaro population demographics to natural community cluster groups, environmental gradients, and disturbance gradients. Our hypothesis developed during our field observations is that the distribution of small saguaros is closely associated with certain cluster groups and is influenced by the level of livestock activity. This hypothesis needs to be tested through a rigorous examination of the demographic data in relationship to the other data collected in this project.

Cataloging and Labeling of Photo Collection

An extensive collection of photos was developed during this project. These photos include plot photos, photos of natural communities, photos of disturbance factors and stress elements, photos of exotic species occurrences, photos of rare species occurrences, and other events. Some of these photos have been incorporated into this report. But the photo collection may prove useful in many future circumstances. For example, photos exist of each field plot established during this study. These will be useful resources for future studies because they can aid in relocation of the plots as well as provide visual information that can aid in the comparison of conditions between sample dates. To be useful to the BLM or TNC, this extensive collection of over 7000 photos needs to be labeled, catalogued, and entered into a database.

Future Research Requiring Additional Data Collection

This study has identified data gaps and areas where future research is needed. Future research that expands the results of this study would be useful to the BLM's management program for the SDNM, and to others that have interests in the management of the larger study area. Some of the possibilities for future research are listed below.

Further Assessment of Mesquite Woodlands

Analysis of aerial photos and satellite imagery revealed an extensive distribution of potential *Mesquite Woodland* patches in the Tohono O'odham Nation portion of the study area. Due to the differences of landscape management techniques already discussed in this paper, we recommend repeating the data collection methods used on the SDNM *Mesquite Woodlands* in the TON. Comparative analysis could provide useful insight into the status and trends within the mesquite woodlands on the SDNM. Specifically, further data gathering on both the SDNM and TON in mesquite patches around the Vekol Valley grassland should be considered a priority in order to better understand the community interactions and changes taking place there. Because a majority of both the mesquite and grassland communities are on the TON, it is important that more field information be gathered there. This will enable a much more comprehensive analysis to be done on the ecological conditions of these two communities.

Further Assessment of Desert Grasslands

Similarly, the greatest extent of the Desert Grassland community is located in the TON portion of the study area. Collection of additional data on both the TON and SDNM during different seasons would facilitate a better understanding of the factors influencing ecological conditions and variations in composition and structure in this natural community. The influence of disturbance factors and stressors needs further examination in this community, and an analysis that compares management practices and levels of disturbance across ownership and land management boundaries could be helpful in determining future land management strategies.

Exotic Plant Distribution and Dynamics

Exotic plant distributions may vary significantly from year to year, depending on moisture levels, other climatic factors, and management activities. We recommend repeat sampling and the expansion of the exotic plant plots established in this study into new areas. This would help create a more comprehensive view on the population dynamics of exotic plant species. We are midway through a multi-year evaluation in Washington State that has already shed significant light on the dynamics of exotic plants and relationships to other stress elements (Morrison et. al. 2003). We recommend a similar study in the Sonoran Desert.

Further Evaluation of Factors Causing Variation in Natural Community Composition and Structure

In many of the natural communities we found considerable inner-community variation in composition that was not readily explained by the factors that we analyzed. Some of the community variation may be explained by variation in age of the landform surface and composition of the substrate. Other variation may be explained by landscape history, environmental variables or disturbance factors not yet identified. Further collection of data on surface and substrate characteristics, landscape history and other factors combined with repeat sampling of natural community plots may shed light into the more elusive factors which affect natural community compositions.

Landscape-level Assessment

The landscape-level assessment could be improved through the use of an enhanced historical aerial photograph chronosequence, including photos from the National Archives. The landscape-level assessment conducted in this project was based on analysis of available aerial imagery that spanned the interval from 1958 to 1996. The imagery used varied considerably in scale, image type, and overall quality. The inclusion of both earlier and later imagery as well as more consistent imagery would improve the landscape level assessment. Ideally, this assessment would include imagery from the late 1940's, or any other period containing imagery of the study area before significant alterations were made (i.e. creation of Vekol spreader dikes).

Refined mapping and analysis of livestock congregation areas, livestock trails and the High-Density Cow Trail Areas would be possible if more current, higher resolution imagery was used. We were limited to the 1996, 1-meter resolution CIR DOQQs in this study. We recommend the use of color or CIR aerial photography at a scale of at least 1:15,000 for this enhancement.

Improvements to Mapping of Natural Communities

Xeroriparian Natural Community Mapping

As noted in Appendix A, the xeroriparian communities were mapped using 1:100,000-scale hydrography data, which was the only data available at the time this work was completed. The extent of the xeroriparian communities is seriously underestimated using this data layer. Our field sampling and analysis of the CIR DOQQs indicates that the actual number and extent of xeroriparian areas is more than 3 times that which was mapped using existing hydrography data. This results in a significant underestimation of the extent of these important natural communities.

We recommend that work be undertaken to rectify this deficiency. This could be accomplished through two approaches. The first approach would be to use 1:24,000 scale hydrography data, once this data is available from the USGS or other sources. The use of this data will rectify at least part of the problem, as it will more accurately delineate the intermittent streams and will include some of the smaller streams. The usefulness of 1:24,000 scale hydrography data depends in large part on the accuracy and currentness of the source data used in its development. The second approach would be based on a combination of automated and manual interpretation of CIR DOQQs using a new image processing approach we have developed to extract this information from the DOQQs. This new approach would probably yield more accurate and current delineation of the xeroriparian communities than the use of standard 1:24,000-scale hydrography data.

Improved Separation of *Creosotebush – Bursage Desert Scrub* from *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas*

Defining the separation between these two matrix communities was the most complex mapping challenge presented in this study. While we found that satellite spectral characteristics and biophysical parameters could be used to approximate the two communities, the spectral/biophysical model we developed was not accurate enough to reliably map the two communities. Therefore, we relied on aerial photo interpretation and manual digitizing of the boundary between these two communities. But these two communities grade into each other through broad transition zones and it is difficult for photo-interpreters to draw the boundaries between the two communities in a consistent, repeatable fashion. Also, small patches of each community are contained within the other community, but it is difficult to map each inclusion through aerial photo interpretation and manual digitizing.

We have developed a new method to more reliably separate the two communities (along with the xeroriparian communities that overlay these matrix communities) through a combination of automated and manual interpretation of CIR DOQQs using an image processing approach created to extract this information from the DOQQs. We recommend applying this approach across the study area to more accurately distinguish *Creosotebush – Bursage Desert Scrub* from *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas.*

Repeat Sampling for Exotic Plants and Changes in Ecological Condition of Natural Communities

Since field sampling occurred after a period of severe long-term local and regional drought, the condition of vegetation throughout the study area was substantially influenced by this phenomenon. We recommend that field sampling be repeated using similar methods after this drought has abated to determine the response of the natural communities and exotic plants to more moisture. Repeated sampling may be necessary to adequately determine which stressors have the most influence on the condition of the natural communities. During our field season, it was obvious that a long-term moisture deficit has been a major stressor that may have masked other factors. Precipitation can vary considerably from year to year, and some exotic plants (e.g. *Bromus rubens*) may be much more abundant during wetter periods. Likewise, many native grasses and forbs may be much more abundant during wetter periods.

Analysis of Satellite Imagery on an Annual Basis to Assess Changes in Ecological Condition

During both phases of this project we examined and analyzed a sequence of Landsat satellite imagery that covers the study area. Our initial analysis indicates that there is significant variation in spectral response that is visible between images from different times of the year and from different years. A surge in photosynthetically active vegetation can sometimes occur in the late spring, after vegetation has a chance to respond to winter rains. Comparison of images from one year to the next can reveal significant changes in abundance of photosynthetically active vegetation between years. Satellite image analysis could be used to gauge the relative level of actively growing vegetation between years and between seasons. This information could be useful in assessing improvement in range condition due to changes in livestock management or changes in precipitation levels. Assessment of the level of photosynthetically active vegetation from Landsat or ASTER satellite imagery could aid in rapid determination of the appropriate livestock stocking levels for specific sites or allotments.

Formal Accuracy Assessment

A formal accuracy assessment of the natural community map and the ecological condition map would be a valuable endeavor. This would entail the establishment of randomly located accuracy assessment plots in each natural community using a stratified, random sampling approach. Similar data to that collected during Phase 2 fieldwork would be collected at each accuracy assessment plot. These data would be analyzed and the results compared to the mapped natural community and ecological condition at that location. This information could then be used to determine errors of omission and commission or user's and producer's accuracies (Story and Congalton, 1986). A carefully designed and executed accuracy assessment will help validate the results of this study. It would also help to determine areas where additional data collection, mapping, and model improvement may be beneficial.

Conclusion

Twelve natural communities exist in the SDNM and adjacent areas. There is considerable natural ecological variation between each of these communities. There is also considerable natural variation within the communities and many communities grade into one another. The ecological variation within and between communities can be explained by gradients of moisture, temperature and substrates. Temperature and moisture are largely controlled by topographic factors (elevation, aspect and slope) and by regional precipitation gradients. Substrate conditions are a result of geology and soil conditions.

There are several stressors that influence the ecological condition of natural communities in the area. Some of these stressors affect only localized areas while other stressors influence the entire study area. Localized stressors include hydrologic alteration, undocumented alien and drug traffic, military training (BMGR), recreational sites and historical mineral and/or gravel extraction. Regional stressors include invasion by exotic plant and animal species, climate change and inadvertent weather modification, and air pollution from urbanized and agricultural areas. The influence of livestock and the influence of vehicles (both on roads and off roads) affect some natural communities (e.g. *Creosotebush – Bursage Desert Scrub*) more than other communities (e.g. *Rock Outcrops*). These last two stressors may have fairly extensive influence on condition within the natural communities where they occur.

There are many ways that the mapping of natural communities and the assessment of ecological condition can be improved. There are also many additional products that can be produced from the data collected in this study. We list a series of recommendations for further work that would greatly expand the usefulness of this study.

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APPENDICES – VOLUME 2

APPENDICES

The Natural Communities and Ecological Condition of the Sonoran Desert National Monument and Adjacent Areas

Pacific Biodiversity Institute

Appendix A

Description of Natural Communities

Table of Contents

Creosotebush-Bursage Desert Scrub

Ecological Characteristics

Description and Composition

The *Creosotebush–Bursage Desert Scrub* community occupies the lowest elevations on the SDNM covering desert flats, valley bottoms and lower portions of bajadas that extend considerable distances from the desert mountain ranges of the Monument.

Larrea divaricata tridentata is the obvious dominant plant species in this community. It has the highest mean cover (7.92%) and the highest constancy (97.7%) of any native plant species occurring in our natural community plots that were located in this community. *Ambrosia deltoidea* is the second-most common shrub species in this community, occurring in 42.5% of the plots with a mean cover of 0.84% in our field plots. *Schismus arabicus* is the most common annual in this community, occurring in 93.1% of our plots with an average cover of 11.11%. At nearly all sites within this natural community, there is less than 3% cover of leguminous tree species (*Parkinsonia microphylla, Olneya tesota* and/or *Prosopis velutina*). This scarcity of leguminous trees plus the lower abundance of cacti species are the primary factors distinguishing the *Creosotebush–Bursage Desert Scrub* community from the adjacent *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community.

The *Creosotebush–Bursage Desert Scrub* community often has low species diversity compared to other natural communities on the SDNM, though the species diversity often increases substantially during the spring annual bloom. Annual plants and grasses can be an important component of this community, but because the blooming period for annuals is so short in the Sonoran Desert's lower elevations, perennial shrubs and herbs play a much more important temporal role in this community throughout the year. The mean overall vegetative cover of all the field plots in this community following the spring bloom was 50%.

Larrea divaricata tridentata is perhaps the most ubiquitous plant in the Sonoran Desert. It has wide ecological amplitude – covering the low elevation desert flats and occurring at the highest elevations in the mountains of the SDNM. It can be found in the driest areas of the monument and it is also found lining the intermittent stream channels as part of the xeroriparian scrub communities. In that light, it makes a poor indicator plant. *Ambrosia deltoidea* also has wide ecological amplitude, occurring in nearly all the natural communities in the SDNM. The clear dominance of these two species is a unique feature of the *Creosotebush–Bursage Desert Scrub* community. The near absence of many other species that characterize other natural communities in the Sonoran Desert is also apparent when examining sites in the *Creosotebush–Bursage Desert Scrub* community.

Other species that were found during initial field sampling in this community include (in order of constancy in our field plot data): *Lepidium lasiocarpum, Plantago ovata, Lesquerella gordonii, Amsinckia intermedia, Chorizanthe rigida, Chaenactis stevioides, Eriophyllum lanosum, Caulanthus lasiophyllus, Erodium cicutarium, Erodium texanum, Pectocarya spp., Chorizanthe brevicornu,* and *Prosopis velutina.*

Structure

This community is composed of a medium to sparse cover of medium-size to small shrubs (primarily *Larrea divaricata tridentata*). Sometimes there is an extremely sparse overstory of small trees (*Parkinsonia microphylla, Olneya tesota, Prosopis velutina*) and a few large cacti (*Carnegiea gigantea*) – particularly where this community is transitional to the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community. The total average tree cover in our field plots within this community was 2.47%. Under and between the small shrubs is a patchy cover of herbs and grasses – often dramatically increased during certain times of the year by annuals. The dominant ground cover in the community is gravel, sand and soil that form the surface of the lower bajadas and the desert flats. This matrix community covers extensive areas of the SDNM. The *Valley Xeroriparian Scrub* community, occurring along the numerous meandering large and small drainages, dissects this community.

Function and Disturbance Processes

Active geomorphic processes affect this community. These processes include debris flows, gully and surface erosion, and wind erosion. Some of these geomorphic processes are continually active and others are episodic. Episodic high intensity rainstorms and associated erosion processes have a persistent effect on these communities. Sheet wash during rainstorms carries fine soil particles from the soil surface and into small intermittent channels. Gully erosion during these events continually widens and deepens the channels – supporting the gradual extension and expansion of the *Valley Xeroriparian Scrub* community into the *Creosotebush–Bursage Desert Scrub* matrix community. Debris flows also may influence some areas within this community if an active bajada is present. On active bajadas, debris flows can deposit new alluvium to the surface of the bajada during peak flow events. Other areas of the bajada can be eroded during these events and the ephemeral streams and associated xeroriparian areas, which dissect the bajada, can change course during storm events. Many bajadas are not subject to active deposition at this time and the streams that once deposited alluvium on their surface are now deeply incised into the bajada. These older bajadas are still subject to gully and surface erosion during storms and to wind erosion. The composition of the *Creosotebush–Bursage Desert Scrub* community may vary with the age of the surface and the composition of the substrate.

Landscape Context

The *Creosotebush–Bursage Desert Scrub* natural community is the most prevalent community in the study area, occupying nearly 108,800 hectares. It forms the primary matrix community of the Sonoran Desert ecoregion (Figure 1). Areas that are distant from mountain ranges generally have the finest textured soils. These desert flats are often covered with a sparse cover of *Larrea divaricata tridentata* and few other species (Figures 2 and 3). Sites that are closer to the mountains generally have higher species diversity and become transitional to the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community (Figure 4). Some sites have little *Larrea* and are dominated by Bursage (*Ambrosia* spp.) (Figure 5).

Figure 1. Landscape view of a typical Creosotebush-Bursage community. Notice the linear Valley Xeroriparian Scrub community patches within the matrix Creosotebush-Bursage community.

Figure 2 Phase 1 Plot 122. Creosotebush flat near Mobile, AZ in the northeastern portion of the SDNM. This area is distant from the Maricopa Mountains and has low species diversity.

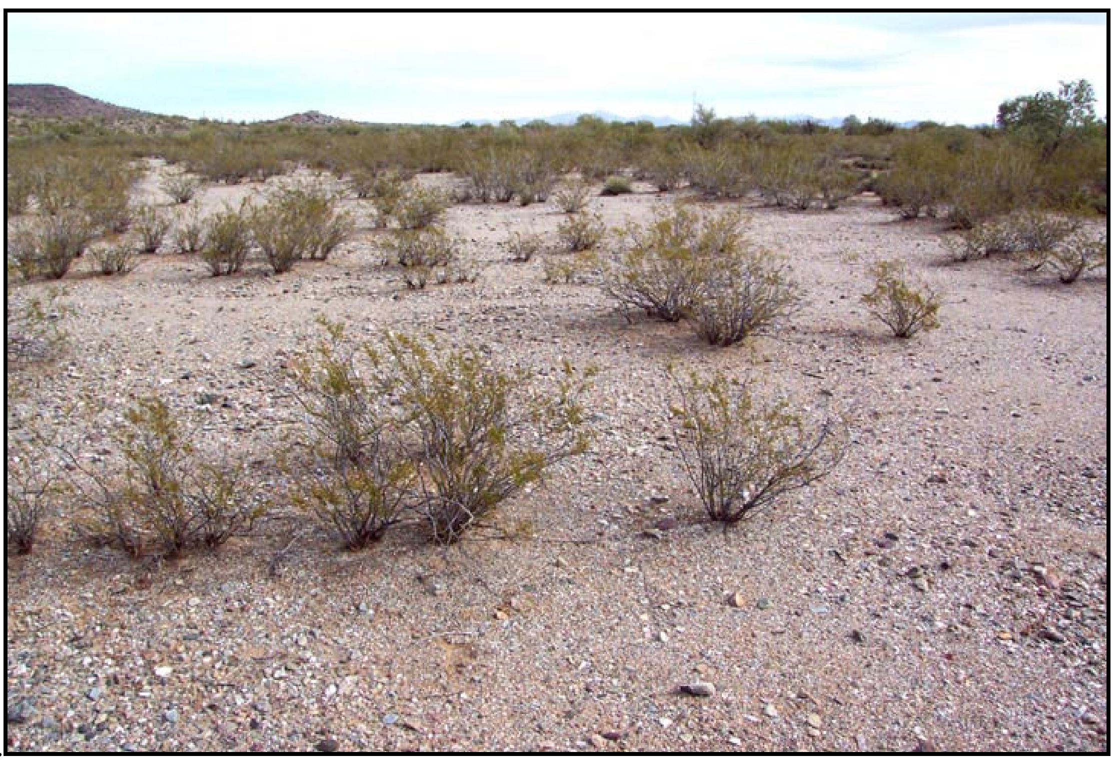


Figure 3. Phase 1 Plot 96. Creosotebush community and desert pavement south of the Freeman exit on Interstate 8. This plot is in the valley between the Maricopa Mountains and the Sand Tank Mountain. It also has low species diversity.

Examples of Baseline Conditions

There are many good examples of the *Creosotebush–Bursage Desert Scrub* community on the Monument. Some examples are illustrated below (Figures 4-5).

Figure 4. Phase 1 Plot 86. *Creosotebush–Bursage Desert Scrub* community north of Javelina Mountain in an area where it transitions to the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community. Most of the cacti and leguminous trees are located in small draws, while the interfluvial areas are covered with desert pavement, creosotebush, triangle-leaved bursage and other small shrubs and cacti.

Figure 5. Phase 1, Plot 121. Bursage dominated desert flat north east of Gila Bend. This plot is closer to the Maricopa Mountains and has higher species diversity than the community illustrated in Figure 1.

Mapping Methods, Biophysical Modeling Parameters and Discussion of Previous Mapping Efforts

The extent of the *Creosotebush–Bursage Desert Scrub* natural community in our map of natural communities of the SDNM is significantly different from its extent in the map provided to us by TNC at the beginning of the project. In that map, the extent of the *Creosotebush–Bursage Desert Scrub* community was based on the GAP Analysis statewide vegetation map. Our fieldwork along with interpretation of DOQQs and satellite imagery revealed that there are significant areas of *Creosotebush–Bursage Desert Scrub* in the Vekol Valley and other areas south of Interstate 8 that were mapped as the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community in the GAP vegetation map and subsequently in TNC's initial map. There are also significant areas delineated in those maps as *Paloverde - Mixed Cacti - Mixed Scrub* north of Interstate 8 but these are more appropriately mapped as *Creosotebush-Bursage Desert Scrub*.

In the northern part of the SDNM and in some other areas of the Monument, there are areas mapped as *Creosotebush-Bursage Desert Scrub* that have little resemblance to that community and are more appropriately mapped as a *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* or a *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* community. We incorporated all these revisions in our map of natural communities of the SDNM.

We developed a GIS model to predict the distribution of the *Creosotebush–Bursage Desert Scrub* community. This model is based on the spectral characteristics of a Landsat TM7 satellite image and digital elevation data. Several spectral classes from an unsupervised classification of the image corresponded to the *Creosotebush–Bursage Desert Scrub* community. Its distribution was further confined to areas below 685 meters elevation and to desert flats or bajadas with less than 3 degrees slope.

This model predicts the distribution of this community better than the GAP mapping, but its accuracy was still less than desired. The distribution of this community was further refined by careful interpretation of the DOQQs. We determined the community was *Creosotebush–Bursage Desert Scrub* if less than 5% cover of leguminous trees was visible in the DOQQ imagery. Fortunately, individuals and clumps of the larger leguminous trees can be seen in the digital aerial imagery. This is similar to the approach taken by Jim Malusa on the Cabeza Prieta NWR (personal communication). During this aerial photo interpretation process, we referred to our predictive model and the GAP distribution frequently to facilitate the delineation of the boundaries of this community. The most difficult separation between the *Creosotebush–Bursage Desert Scrub* community and other communities is where it grades into the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community.

Many of the revisions that we made in the GAP vegetation map and TNC's initial map are reflected in the boundary between the Lower Colorado Subdivision and Arizona Upland Subdivision of the Sonoran Desertscrub as mapped by Brown and Lowe (1980). Their rough boundaries correspond fairly well to our boundaries between the *Creosotebush–Bursage Desert Scrub* community and the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community – particularly where we made significant revisions in the Vekol Valley and in the area between Gila Bend and the South Maricopa Mountains. Brown and Lowe's map is generalized, but it does appear to support some of the modifications in vegetation boundaries that we have made.

Further refinement of the separation between the *Creosotebush–Bursage Desert Scrub* community and the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community is possible, but not within the time and budget constraints of this project. There is considerable variation in composition and structure within *Creosotebush–Bursage Desert Scrub* community and many variants exist. There are a few areas on some of the steep, rocky slopes that have a similar composition to the *Creosotebush–Bursage Desert Scrub* community but these were considered inclusions within the *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* community.

Relationship to Plant Community Classification Systems

This community falls within Brown and others' (1979) Creosotebush – Bursage series (154.11). It corresponds with the *Larrea tridentata* Shrubland alliance, Evergreen Shrubland formation of the National Vegetation Classification (TNC 1998).

Paloverde - Mixed Cacti - Mixed Scrub on Bajadas

Ecological Characteristics

Description and Composition

This community is included within the Arizona Upland series of Sonoran Desertscrub vegetation (Brown 1994, Brown and Lowe 1980). It occupies the upper bajadas that extend out from the desert mountains in the SDNM and is characterized by a diverse mixture of leguminous trees, large and small cacti, shrubs, herbs and grasses.

This community has some compositional similarities to the adjacent *Creosotebush–Bursage Desert Scrub* and the adjacent *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* communities, but it also has significant differences in species presence and abundance. This community is normally found sandwiched in between these two other communities. *Larrea divaricata tridentata* is the dominant plant and has a mean cover of 5.51% and a constancy of 100% in our field plots. *Ambrosia deltoidea* is found at nearly all sites with 97.1% constancy and 4.69% mean cover. *Parkinsonia microphylla* has the highest constancy for tree species at 71.4%, and has a mean cover of 3.05%. It is one of the most characteristic species of this community. Another distinct canopy feature of this community is the presence of *Carnegiea gigantea*, which occurs in 65.7% of our plots with a mean cover of 0.4%. Other species that occur in over half of our field plots include: *Lepidium lasiocarpum, Chorizanthe brevicornu, Cylindropuntia acanthocarpa, Plantago ovata, Caulanthus lasiophyllus, Cryptantha pterocarya, Cryptantha maritime, Lesquerella gordonii, Krameria grayi, Chorizanthe rigida, Fouquieria splendens,* and *Amsinckia intermedia.* At most sites within this natural community there is over 5% cover of leguminous tree species (*Parkinsonia microphylla, Olneya tesota* and/or *Prosopis velutina*) along with numerous other shrubs and cacti. *Phoradendron californicum* is a common epiphytic parasite associated with the overstory of leguminous trees, and is commonly found in the tree canopy of this community.

A major difference between this community and the similar community found on rocky slopes *(Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes)* is the infrequent occurrence of *Lycium* species and the low abundance of *Encelia farinosa farinosa,* which are both common on rocky slopes. On the bajadas, the mean cover and constancy of *Parkinsonia microphylla* and *Carnegiea gigantea* are considerably less than that found on the rocky slopes.

Structure

This community is composed of a sparse overstory of small trees (*Parkinsonia microphylla, Olneya tesota, Prosopis velutina*) and large cactus (*Carnegiea gigantea*), and a patchy understory of smaller shrubs, cacti, herbs and grasses. The total average tree cover in our field plots within this community was 5.62%, significantly more than in the *Creosotebush–Bursage Desert Scrub community*. The dominant ground cover in the community is gravel and boulders deposited during debris flows, along with sand and soil that form the surface of the bajada. Large patches of this community are found throughout the SDNM. The *Valley Xeroriparian Scrub* community extends though these large patches along the many sinuous, intermittent drainages.

Function and Disturbance Processes

Active geomorphic processes affect this community. These processes include debris flows, gully and surface erosion, and wind erosion. Some of these geomorphic processes are continually active and others are episodic. Debris flows are the most important geomorphic process that is responsible for forming the bajada. On active bajadas these flows can deposit new alluvium to the surface of the bajada during peak flow events. Other areas of the bajada can be eroded during these events and the ephemeral streams and associated xeroriparian areas, which dissect the bajada, can change course during storm events. Many bajadas are not subject to active deposition at this time and the streams that once deposited alluvium on their surface are now deeply incised into the bajada. These older bajadas may still be subject to gully and surface erosion during storms and to wind erosion. The plant communities that form on the bajada surface vary considerably depending on the age of the bajada, whether it is an active bajada, and the type of material that forms the surface layers of the bajada.

Landscape Context

The *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* natural community is the third most prevalent community in the study area, occupying over 61,400 hectares. It forms the "matrix" of the Arizona Uplands subdivision of the Sonoran Desert ecoregion (Hall et al 2001). This community characterizes the alluvial fans (bajadas) that surround the mountain ranges and larger desert hill complexes. There is usually an abrupt transition to the *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slope* community at the slope break between the bajada and the rocky slope (usually at 5-6 degrees). The lower transition to the *Creosotebush–Bursage Desert Scrub* community is often less obvious and these two communities often grade into each other. The *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community is usually found on slightly steeper slopes and at slightly higher elevations than the *Creosotebush–Bursage Desert Scrub community*. The soils of this community are generally coarse-textured and formed from rocky and gravelly alluvium. There is considerable caliche on or near the surface of the older bajadas.

Examples of Baseline Conditions

There are numerous excellent examples of the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community on the SDNM and near the Sand Tank Mountains. Figure 4 illustrates an area that is transitional between *Creosotebush–Bursage Desert Scrub* and *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* north of the Sand Tank Mountains. Figure 6 illustrates a more fully developed *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community in the same area. An area at the base of the South Maricopa Mountains where this community is more fully developed is illustrated in Figure 7. Figure 8 illustrates an extensive patch of this community occurring on older, dissected bajadas extending north from Javelina Mountain.

Figure 6. West of Phase 1 Plot 86. Excellent example of a fully developed *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* natural community.

Figure 7. Paloverde - Mixed Cacti - Mixed Scrub on Bajadas community north of Bighorn Peak.

Figure 8. Extensive old dissected bajada with *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community north of Javelina Mountain. Table Top Mountain in far distance.

Mapping Methods and Biophysical Modeling Parameters

The extent of the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* natural community in our map is significantly different from its extent in the map provided to us by TNC at the beginning of the project. As described in the section above, a significant portion of the area mapped in the GAP vegetation map and TNC's initial map is more accurately mapped as *Creosotebush–Bursage Desert Scrub*. We also found that there were some areas mapped as *Creosotebush–Bursage Desert Scrub* that have little resemblance to that community and are more appropriately mapped as a *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas.*

Our GIS model that predicts the distribution of the *Creosotebush–Bursage Desert Scrub* community also predicts the distribution of the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community with slight modifications. Several spectral classes from an unsupervised classification of the Landsat TM image corresponded to the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community. Its distribution was further confined to slopes less than 6 degrees but greater than or equal to 3 degrees and areas less than 1200 meters but over 250 meters in elevation.

This model predicts the distribution of this community better than the GAP mapping, but we further refined its distribution through careful interpretation of the DOQQs. The model may be useful for large scale landscape planning, but should not be used for projects that require high accuracy of vegetation type determination. During this photo interpretation process, we referred to our predictive model and the map provided by TNC frequently to facilitate the delineation of the boundaries of the community. Through photo interpretation, we determined if the community was *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* when it had at least 5% cover of leguminous trees visible in the DOQQ imagery. Fortunately, one can see individuals and clumps of the larger leguminous trees in the digital aerial imagery. This is similar to the approach taken by Jim Malusa on the Cabeza Prieta NWR (personal communication). As described in the section above, the most difficult separation between the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community and other communities on the SDNM is where it grades into the *Creosotebush–Bursage Desert Scrub* community.

Relationship to Plant Community Classification Systems

This community falls within Brown and others' (1979) Paloverde – mixed cacti series (154.12). It includes many alliances within the Evergreen Shrubland formation of the National Vegetation Classification, including *Ambrosia deltoidea* Shrubland alliance, *Carnegiea gigantean* Wooded Shrubland alliance, *Parkinsonia florida* Shrubland alliance, and *Opuntia bigelovii* Shrubland alliance (TNC 1998).

Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes

Ecological Characteristics

Description and Composition

This community has some compositional similarities to *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* but it has significant differences in species presence and abundance. *Parkinsonia microphylla* dominates this community with the highest mean cover (6.02%) and the highest constancy (92.2%) of any plant. *Ambrosia deltoidea* dominates the understory in many areas and has a mean cover of 3.32% and constancy of 67.2% in our field plots. Perhaps the best indicator species for this community is *Encelia farinosa farinosa*, which occurs in relatively high abundance in most areas (mean cover = 2.72%, constancy = 73.4%). This species rarely occurs on the bajadas as a significant component of the plant community and is not common in the other natural communities on the SDNM. Other species that are common in this community include (in order of constancy in our field plot data): *Lepidium lasiocarpum, Schismus arabicus, Fouquieria splendens, Cylindropuntia acanthocarpa, Carnegiea gigantea, Cryptantha pterocarya, Larrea divaricata tridentata, Chorizanthe brevicornu, Lycium spp., Vulpia octoflora, Krameria grayi,* and *Caulanthus lasiophyllus.*

This community has considerable variation that is dependent on aspect, slope, elevation and geologic parent material. One of the most significant variants occurs on northerly facing slopes, primarily in granitic mountains. On these rocky slopes *Selaginella arizonica* is often the dominant plant, covering 20% to 60% of the ground surface (Figure 9). While *Parkinsonia microphylla* is usually present on these north facing rocky slopes, it is often less abundant than elsewhere and *Carnegiea gigantea* is often nearly absent.

Figure 9. Phase 1 Plot 90. Selaginella–paloverde dominated community on rocky slope north of Javelina Mountain.

Structure

This community is composed of a sparse overstory of small trees (*Parkinsonia microphylla* and *Olneya tesota*) and large cactus (*Carnegiea gigantea*) and a patchy understory of smaller shrubs, cacti, herbs and grasses. The total average tree cover in our field plots within this community was 6.54%. The dominant ground cover in this community is the rock (bedrock and colluvium) that forms the rocky slope. Large patches of this community are found throughout the SDNM in all the mountainous regions. The *Mountain Xeroriparian Scrub* community extends through these large patches in the steep and narrow mountain drainages.

Function and Disturbance Processes

Active geomorphic processes affect this community. These processes include rock cracking and spalling, downhill soil and rock creep, gully and surface erosion, wind erosion and possibly occasional landslides during peak storm events. Some of these geomorphic processes are continually active and others are episodic. Water is stored in the cracks between rocks and in the shallow soil. Many of the plants that thrive in this community are adapted to utilize the moisture stored in the cracks in the fractured bedrock and colluvium.

Landscape Context

This community forms the core of the study area and is the second most extensive natural community, covering over 81,600 hectares. Figure 10 is a landscape view of this community. It is surrounded by the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* and *Creosotebush–*

Bursage Desert Scrub communities, which cover the lower elevations of the Sonoran Desert. This community occupies nearly all the mountain slope terrain above the bajada / mountain slope transition, which usually occurs abruptly at about 5 to 6 degrees slope. Only at the highest elevations in the Monument does this community give way to the *Mountain Upland* community.

Examples of Baseline Conditions

There are numerous excellent examples of this community in the study area. Figure 11 illustrates one example in the Sand Tank Mountains where vegetation cover is relatively high. A more typical example of this community where vegetation cover is significantly lower is illustrated in Figure 12 in the North Maricopa Mountains.

Figure 10. Landscape view of the *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* community in the SDNM. Notice the even distribution of leguminous trees (mainly *Parkinsonia microphylla*) throughout the community.

Figure 11. Excellent example of densely vegetated *Paloverde - Mixed Cacti - Mixed Scrub* community on northeast facing rocky slopes south of Johnson Well in the Sand Tank Mountains.

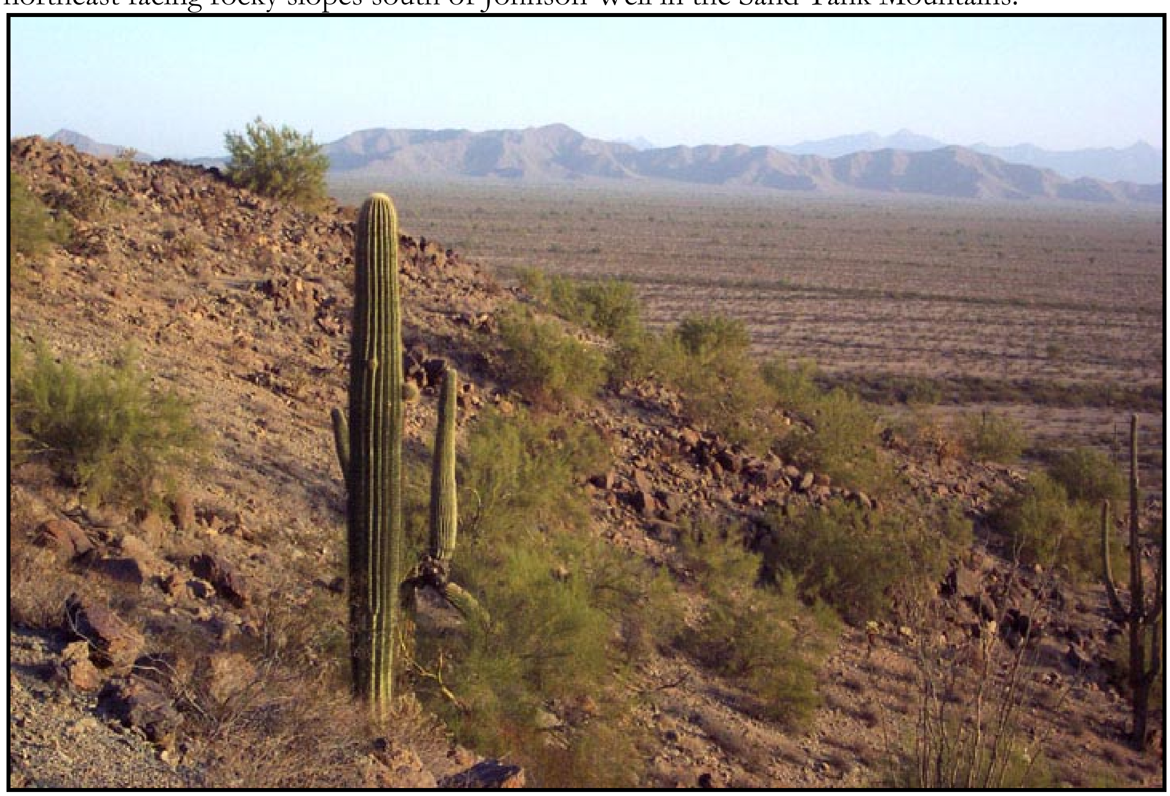


Figure 12. Phase 1 Plot 1, west of Mobile in North Maricopa Mountains. More sparsely vegetated *Paloverde - Mixed Cacti - Mixed Scrub* community on east facing slope, granite bedrock.

Mapping Methods and Biophysical Modeling Parameters

The *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community was initially mapped by TNC on slopes that were greater than 25 degrees. Our analysis of the DOQQs and all our fieldwork indicate that this community extends down to about 5 or 6 degrees and that there is nearly always an abrupt slope break at this point where the bajadas start. The NRCS soil mapping also clearly indicates where this natural community is separated from the *Paloverde - Mixed Cacti – Mixed Scrub on Bajadas* community. For most of the SDNM, we used polygons from the NRCS soil GIS layer to delineate the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community with minor adjustments and improvements based on field data and interpretation of the DOQQs. In the Area-A part of the SDNM and in the adjacent Sand Tank Mountains no soil data exists and we delineated this community based on the slope break discussed above and more extensive interpretation of the DOQQs and field data.

It should be noted that small areas with slopes less than 6 degrees are present in the mountains (on summits, plateaus or other relatively flat areas) and were not separated from the rocky slope matrix community. These areas are nearly all rocky and have similar composition to the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community with few exceptions.

During our fieldwork, we noted significant differences in the species composition of this community on north and south-facing aspects. The more typical community composition occurs on south, east and west aspects. But on more northerly aspects the species composition shifts significantly. As discussed above, *Selaginella arizonica* becomes one of the dominant plants (often with over 20% ground cover). *Carnegiea gigantea* often drops out of the community on north slopes and grass is often much more abundant. Because of these compositional differences, this forms a distinct variant of the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community. Other variants within the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community are discussed in the Results section of this report (see Variation within the Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes community).

Relationship to Plant Community Classification Systems

This community falls within Brown and others' (1979) Paloverde – mixed cacti series (154.12). It includes many alliances within the Evergreen Shrubland formation of the National Vegetation Classification, including *Parkinsonia microphylla* Shrubland alliance, *Ambrosia deltoidea* Shrubland alliance, *Carnegiea gigantean* Wooded Shrubland alliance, *Simmondsia chinensis* Shrubland alliance, *Encelia farinosa* Shrubland alliance, and *Opuntia bigelovii* Shrubland alliance (TNC 1998).

Mountain Uplands

Ecological Characteristics

Description and Composition

The *Mountain Uplands* are characterized by the presence of several species that are only found in the cooler and moister habitats of the highest mountains and their north facing slopes. *Canotia holacantha* is probably the best indicator plant of this upland community. It occurred in 69.4% of our upland field natural community plots and had an average cover of 3.84%, but was absent from all the other communities described in this study. *Ephedra aspera*, *Yucca baccata*, and *Agave deserti simplex* are other common plants that are largely confined to the upland plant community. *Juniperus coahuilensis* and *Berberis harrisonia* have been reported in the Sand Tank Mountains (Felger et al 1997, Hall et al 2001), but were not observed during our field reconnaissance. However *Vauquelinia californica ssp. sonorensis* and *Quercus turbinella* were observed in limited areas within the Sand Tank Mountains. These four species appear to be confined to a limited number of sites within the *Mountain Uplands*.

The *Mountain Uplands* are characterized by their extensive cover of perennial grasses. On the average, around 10% of the ground surface of our field plots had perennial grass cover. The primary species that were commonly found in the upland communities include *Muhlenbergia porteri, Pleuraphis mutica,* and *Tridens muticus* (Turner et al 2000).

The *Mountain Uplands* are also characterized by a relatively high cover (3.15%) and constancy (61.11%) of *Opuntia* spp. *Fouquieria splendens splendens* was also found in 75% of our field plots and had an average cover of 1.66%.

Other species that are common in this community include: *Larrea divaricata tridentata*, *Parkinsonia microphylla*, *Echinocereus* spp., *Rhynchosia texana*, *Yucca elata*, *Carnegiea gigantea*, *Selaginella arizonica*, *Acacia constricta*, *Ferocactus* spp., *Mammillaria grahamii*, *Lycium* spp., and *Calliandra eriophylla*.

Structure

A unique feature of the *Mountain Uplands* is the high overall vegetative cover of perennial plants (59.8% mean cover in our field plots). These include small trees, large and small shrubs, cacti, perennial herbs and grasses. Tree cover (1.1%) is considerably less than that on the lower rocky slopes, and tree stature is also considerably less. Annuals are present but were not included in the above cover estimate because of the timing of our fieldwork.

Function and Disturbance Processes

Like the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community, active geomorphic processes affect the *Mountain Uplands*. These processes include rock cracking and spalling, downhill soil and rock creep, gully and surface erosion, wind erosion and infrequent landslides during peak storm events. Some of these geomorphic processes are continually active and others are episodic. Water is stored in the cracks between rocks and in the shallow soil. Many of the plants that thrive in this community are adapted to utilize the moisture stored in the cracks in the fractured bedrock and colluvium.

The *Mountain Uplands* are one of the few natural communities on the SDNM that experience regular freezing temperatures in the winter. Infrequent snow also occurs. This community is also subjected to desiccation by regular high winds. Cold temperatures limit plant growth during the late fall, winter and early spring months. Persistent and regular cloud cover appears to affect this community (Figure 13) and may help maintain higher plant moisture levels than in other communities on the SDNM. While this community is not a cloud forest, it appears that some of the same factors that influence the formation of cloud forests may operate in this community as well – at least during the cooler part of the year.

Figure 13. Persistent cloud over Table Top Mountain. Lower elevation limit of cloud is near that of the lower limit of the *Mountain Upland* community. Regular cloud formations at this level may be one factor that influences the development of the mountain upland natural community. The *Mountain Upland* community is enveloped by the cloud. Below the cloud level is the *Paloverde - Mixed Cacti - Mixed Scrub* community on rocky slopes and below that (in the foreground) the *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* community.

Wildfire may be an infrequent event in the *Mountain Upland* community, but little is known about the fire return interval. This community is unlike all other non-riparian communities in the SDNM. It has a high level of vegetative cover (nearly 60%), resulting in sufficient fuel to carry and sustain a wildfire. Another factor that may affect the fire return interval is the tendency for mountaintops to attract lightning. This community may have both the necessary fuel and the ignition source to support more frequent fire than other communities in the SDNM.

Landscape Context
The *Mountain Upland* community occupies a small portion of the study area (2,302 ha). Examples of this community can be found at the higher elevations in the Sand Tank Mountains, on Table Top Mountain and at a few locations on slightly lower mountains to the north of Table Top.

The *Mountain Upland* community is surrounded by the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community and grades into this community at its lower boundary. There are many similarities between these two communities and they share many species. In some areas there is a broad ecotone between these two mountain communities.

Examples of Baseline Conditions

Excellent examples of this community are illustrated in the photographs below (Figures 14-19). The best examples of this community are found on the upper north side of Table Top Mountain, the upper north side of Javelina Mountain/Maricopa Peak and at the highest elevations in the Sand Tank Mountains near Bender Spring.

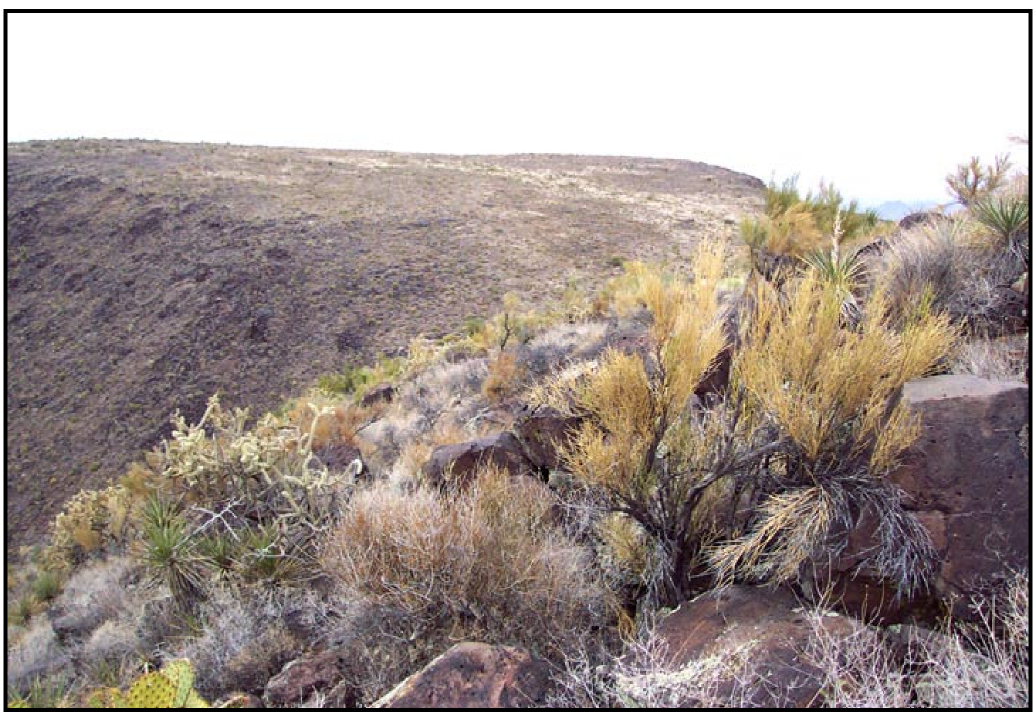


Figure 14. Phase 1 Plot 7. *Mountain Upland* community near summit of Table Top. *Canotia holacantha* on right side, foreground.

Figure 15. Phase 1 Plot 81 north of Bender Springs Canyon in the Sand Tank Mountains. *Mountain Upland* community with abundant *Canotia holacantha* (the tall yellow-green shrubs occupying the middle portion of the photo).

Figure 16. *Mountain Upland* community on east side of Maricopa Peak, Javelina Mountain. Note the abundant *Canotia holacantha* on north facing slope in contrast to south slope dominated by vegetation typical of *Paloverde - Mixed Cacti - Mixed Scrub* communities on rocky slopes.

Figure 17. Closer look at *Mountain Upland* community on east side of Maricopa Peak.

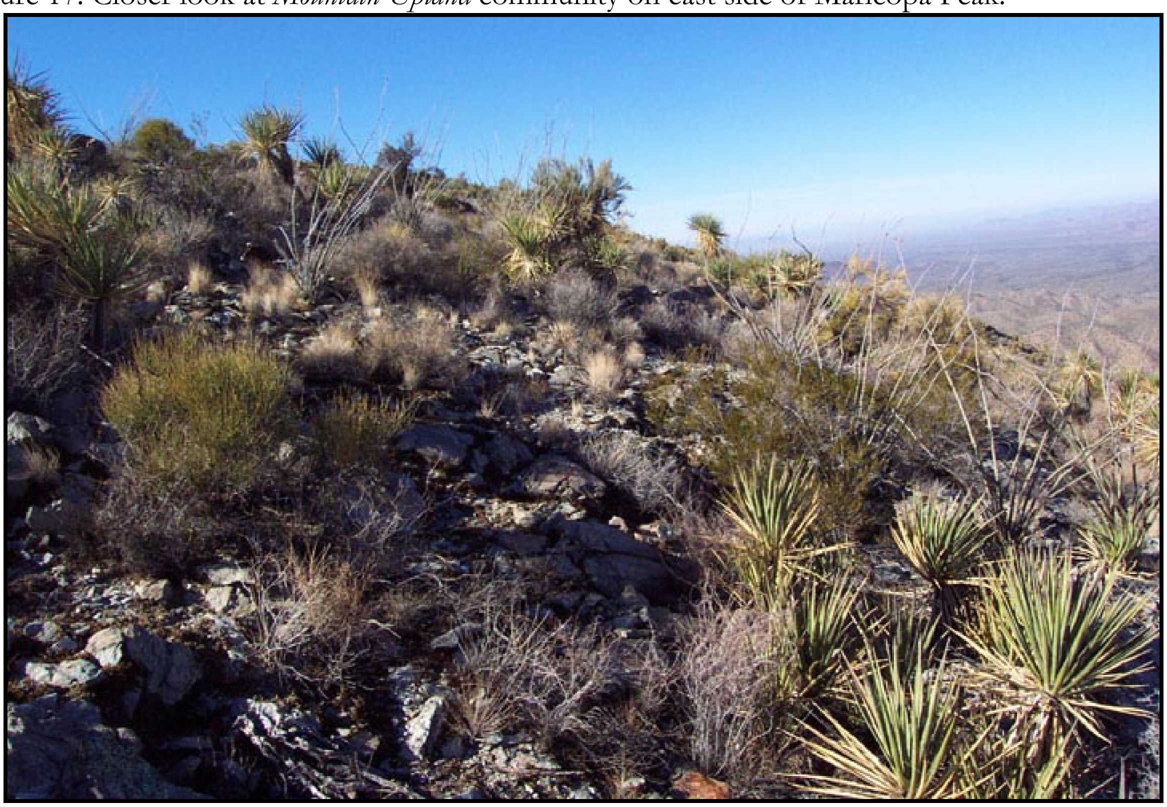


Figure 18. Details of *Mountain Upland* community on east side of Maricopa Peak. Indicator species include *Canotia holacantha, Yucca baccata, Ephedra aspera and Agave deserti simplex*.


Figure 19. South slope near top of Maricopa Peak. Note the slight presence of species indicative of *Mountain Upland* community and the abundance of species typical of the *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* community. This area is considered transitional to the *Mountain Upland* community.

Mapping Methods and Biophysical Modeling Parameters

We revised the extent of the *Mountain Upland* communities initially mapped by TNC in the Sand Tank Mountains (Hall et al 2001) and Table Top areas based in part on the lower elevation limit of *Canotia holacantha* and *Vauquelinia californica sonorensis* that was documented by Turner and others (1995). In TNC's mapping, the *Mountain Upland* community extended down to 792 meters in elevation, without regard to aspect.

While occasional occurrences of the indicator species may possibly occur at a few sites down to 792 meters in elevation, this is not a viable elevation limit for the *Mountain Upland* community in the SDNM and Sand Tank Mountains. All of our fieldwork indicates that this elevation limit is too low, particularly on south-facing slopes. We did find one *Canotia holacantha* stand at 848 meters in elevation on a steep, north-facing slope (Plot 66), but our reconnaissance field surveys indicate that the *Mountain Upland* communities are considerably more restricted than initially mapped by TNC.

The most significant biophysical modeling parameters that can be used to predict the occurrence of this community are the combination of aspect and elevation. Neither parameter suffices alone. The *Mountain Upland* community is largely constrained to north-facing slopes above 1000 meters. The community extends lower in elevation on the most northerly aspects, which are shaded, cooler and retain soil moisture for much longer periods than more southerly aspects. Freezing temperatures are also more common on these north aspect slopes. Based on our field observations, we developed a biophysical model implemented to predict the extent of the Mountain Upland community. Slightly different elevation breaks were used on Table Top Mountain than in the Sand Tank Mountains. The following conditions predict this community's extent with a reasonable degree of accuracy. All these conditions are designed to be implemented simultaneously, with the effect that the upland community wraps around the mountain at lower elevations on more northerly aspects.

Table Top Upland Conditions:

1. If elevation in feet is > 3900 then upland community exists on all aspects
2. If aspect is less than 130 or greater than 210 degrees then upland community extends down to 3800 feet
3. If aspect is less than 110 or greater than 260 degrees then upland community extends down to 3700 feet
4. If aspect is less than 80 or greater than 290 degrees then upland community extends down to 3400 feet
5. If aspect is less than 55 or greater than 330 degrees then upland community extends down to 3200 feet

Sand Tank Upland Conditions:

1. If elevation in feet is > 3800 then upland community exists on all aspects
2. If aspect is less than 130 or greater than 210 degrees then upland community extends down to 3700 feet
3. If aspect is less than 110 or greater than 260 degrees then upland community extends down to 3300 feet
4. If aspect is less than 80 or greater than 290 degrees then upland community extends down to 3000 feet
5. If aspect is less than 55 or greater than 330 degrees then upland community extends down to 2900 feet

The occurrence of the Mountain Upland community in the Sand Tank Mountains at lower elevations than at Table Top is probably due to greater precipitation in the Sand Tanks. This may be related to the large mountain mass that is present. The larger mountain mass may also result in slightly cooler temperatures.

On Table Top Mountain, the *Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes* community extends nearly to the summit of Table Top Mountain on the south-facing slopes. The same situation was observed on Javelina Mountain and Maricopa Peak in the Sand Tank Mountains. On north-facing slopes, the upland community is more extensive and extends down to about 1000 meters based on the distribution of *Canotia holacantha.* This elevation limit was observed during our fieldwork on Table Top Mountain and areas north of Table Top, on Maricopa Peak and Javelina Mountain, and in the Sand Tank Mountains near Bender Spring.

Some components of the upland community extend lower on the mountain slopes than *Canotia holacantha*. *Yucca baccata*, *Agave deserti simplex*, and *Ephedra aspera* (which are often dominant plant species in the uplands) may occur at significantly lower elevations, but are never a major component of the lower elevation communities. The extent of the *Mountain Upland* community should include areas where these species form a major component of the plant community, even if *Canotia holacantha* and *Vauquelinia californica sonorensis* are absent.

In the southern part of the SDNM and adjacent Sand Tank Mountains, *Simmondsia chinensis* (jojoba) was observed on all aspects in the Bender Spring Canyon. This species was not found in other places on the SDNM during our fieldwork and may be a special component of the upland community in parts of the Sand Tanks. In xeroriparian areas it was found down as low as 835 meters in elevation.

Relationship to Plant Community Classification Systems

This community is within the Paloverde – mixed cacti series (154.12) of Brown and others (1979). It is not well described by any associations within that classification, or in the classification work of Warren and others (1981). Within the National Vegetation Classification System (NVCS), it broadly falls under the Evergreen Shrubland formation. It includes a number of alliances, based on dominant plant cover, which have not yet been named or added to the NVCS (TNC 1998).

Desert Grasslands

Nomenclature

Variations of the community this report refers to as *Desert Grasslands* have been described by a variety of authorities using a variety of descriptive titles: desert grasslands, desert shrub grassland, scrub-grassland, desert-grassland transition, or semi-desert grasslands (Brown, 1994). The title that best fits the description of the study area’s particular grassland community is *Desert Grassland* (Turner, 2000). The principal justification for using this term is that this community occurs in a low precipitation zone within the Sonoran Desert. The environment within which these particular grasslands occur would be difficult to describe as a "semi-desert”, and is more accurately referred to as a desert community. The semi-desert grasslands that Brown (1994) refers to primarily occur in eastern Arizona and New Mexico at much higher elevations (where precipitation is also higher). The grasslands in the study area exist in an arid environment with much less precipitation than the semi-grasslands described by Brown. They inhabit poorly drained desert valley bottom areas with significant hydrologic flow accumulation from surrounding uplands.

Ecological Characteristics

Description and Composition

Desert Grasslands are confined to the southeastern corner of the SDNM and adjacent lands in the TON. The grasslands occupy only 781 hectares in the study area. One species of grass, *Pleuraphis mutica* dominates this community to the exclusion of most other species (100% constancy and 15.23% mean cover). *Prosopis velutina* appears to be invading the grasslands from adjacent *Mesquite Woodland* communities and is quite common in some areas (Figure 21). The mesquite in the grasslands is often quite young, indicating recent invasion and establishment. Another bunch grass observed in this community was *Pleuraphis rigida*, with

7.7% constancy and .02% mean cover. Other plant species observed during the field survey of the grasslands included, *Lesquerella gordonii, Amsinckia sp., Erodium cicutarium, Monolepis nuttalliana, Koeberlinia spinosa, Larrea divaricata tridentata, Ferocactus sp*. and *Opuntia spp*

Brown (1994) describes the composition of desert (or semi-desert) grasslands throughout the Southwest in considerable detail. Additional fieldwork is needed in the grasslands of the study area to adequately describe their composition and condition.

Structure

The grasslands have a relatively simple structure, with one canopy layer of grasses where they have not been invaded by *Prosopis velutina.* Intensive grazing appears to have broken up this structure, leaving large and small bare areas scattered throughout the community. There are marked differences in structure in the TON as compared to the SDNM (Figures 20-22). Plots done on the SDNM part of the Desert Grasslands showed an average of 50% bare ground exposure.

Function and Disturbance Processes

Livestock grazing, periodic flooding and hydrologic alteration caused by spreader dikes constructed in this area all have a potential influence on the composition and structure of parts of this natural community. More investigation of these disturbance processes is necessary to determine their degree of influence.

Landscape Context

The *Desert Grassland* community occupies about 780 hectares in the study area. It lies in the upper part of the Vekol Valley in a flat valley bottom that receives considerable drainage and moisture from the surrounding mountains. The grasslands are now ringed and sometimes penetrated by mesquite stands, but are primarily a small patch community within the *Creosotebush–Bursage Desert Scrub* matrix community. Small areas of a rocky grassland type exist near the summit of Table Top Mountain and a few places in the Sand Tank Mountains – but these areas are considered inclusions within the *Mountain Upland* or *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* communities. Additional field investigation of some of these upland grass-dominated areas might lead to a conclusion they should be mapped as a type of grassland community.

Examples of Baseline Conditions

The best example of the Desert Grassland community in the SDNM is at the head of the Vekol Valley, extending southward into the TON (Figures 20-22). The grasslands are fairly disturbed sites, but the TON side of the grasslands is closer to representing baseline conditions.

Figure 20. *Desert Grassland* community and fence line separating the SDNM (left) from the TON (right). Two different grazing regimes are evident on the two jurisdictions.

Figure 21. Phase 1 Plot 12. *Desert Grassland* on SDNM. Note, the invasion of young *Prosopis velutina* (green shrubs in the middle and far distance).

Figure 22. Phase 1 Plot 13. *Desert Grassland* on TON (photo taken from the border fence). Note the strip of young *Prosopis velutina* (green shrubs in the middle distance).

Mapping Methods and Biophysical Modeling Parameters

The grasslands were mapped based on field work conducted in November 2002 and April 2003 and interpretation of color infrared DOQQs. There is one prominent grassland polygon (a large meadow-like feature) that covers the central portion of the upper Vekol Valley near the boundary between the SDNM and the TON. This prominent grassland polygon extends into the TON for over a mile.

Examination of the DOQQs revealed that there appears to be an area to the west of this primary polygon in the center of the valley, which extends west and south on flat to gentle slopes, and has a somewhat similar appearance to the grassland areas. This area appeared to have enough similarity in appearance that we initially mapped it as grassland. But further field examination of this area in April lead to the conclusion that this is a Creosotebush – Bursage Desert Scrub community with extensive desert pavement and only scattered patches of grass. Our mapping of the grasslands was corrected in this area as a result of our later fieldwork.

As mentioned earlier, there are small grassland areas that are inclusions in the *Mountain Upland* or *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* communities. These areas are below our minimum mapping unit and vary considerably in composition from the Vekol Valley grasslands. The grassy patches in the mountains were not mapped as *Desert Grassland* community, but were included in one of the mountain communities.

The *Desert Grassland* community is difficult to model with a set of biophysical parameters. The presence of a fine textured, heavy clay soil is one biophysical characteristic of the site. Further investigation of this community may lead to a better understanding of other factors.

Relationship to Plant Community Classification Systems

This community relates to the 143.12 Series (Tobosa-Grass Scrub) of Brown and others (1979). Within the National Vegetation Classification System, the Desert Grassland community relates broadly to the Perennial Graminoid Vegetation formation, but does not appear to fit well into any specific alliance (the most closely related class listed is the *Hilaria mutica* Shrub Herbaceous alliance) (TNC 1998).

Mesquite Woodlands

Ecological Characteristics

Of all the Sonoran Desert natural communities, the *Mesquite Woodland* community is one of the most unique. Typically limited in its range in Southwestern Arizona, *Mesquite Woodland* has functioned as an important contributor to historic socio/economic development as a food and fuel source for Southwest communities (Olson 1940), and as an ecological apex, providing valuable habitat to species like the cactus ferruginous pygmy owl (*Glaucidium brasilianum cactorum*) (Gerst 1997) and food to Sonoran Desert wildlife (Gavin 1973). *Mesquite Woodland* communities are deserving of special attention due to their limited distributional range, susceptibility to human disturbance, and their importance as wildlife habitat.

It should be noted that historically, attention to *Mesquite Woodland* communities typically focused on a particular sub-class of the *Mesquite Woodland* community, the *Prosopis velutina* true bosque association (Lacey et al. 1975), or the "*Mesquite Bosque*". We focused on a greater spectrum of the *Mesquite Woodland* community than just the true bosque association. *Mesquite Woodland* communities we considered to be areas of land containing a substantial tree density in which the overstory of these areas consists mostly of *Prosopis spp*. with less than 25% of the overstory tree layer composed of other species (Stromberg 2002, Minckley and Clark 1981, 1984; Szaro 1989).

The *Mesquite Woodland* community was stratified into three sub-community types: 1) Mesquite dominated woodlands established before the late 1960s, 2) mesquite stands found on or near spreader dikes or water tanks, and 3) pure mesquite stands invading other natural communities after 1968. Figures 23 through 27 illustrate some of the distinguishing coarse scale characteristics that were used to separate these patches into the three sub-community types.

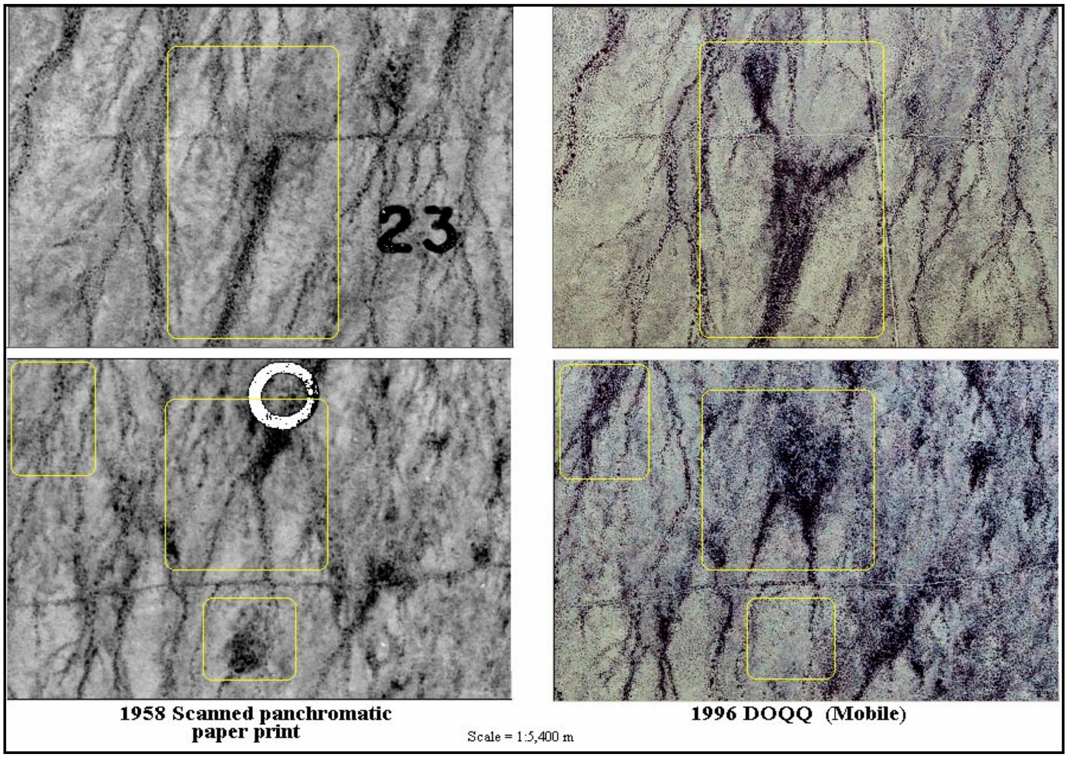


Figure 23. North Tank area Mesquite Woodland patches in 1958 and 1996. Though there are significant changes that appear between 1958 and 1996, these stands did exist before 1958 and are therefore being regarded as community sub-class 1.

Figure 24. Mesquite Woodland community sub-class 1 in the North Tank area near Mobile.

Figure 25. Examples of Mesquite Woodland community sub-class 2.

Figure 26. Examples of Mesquite Woodland community sub-class 3.

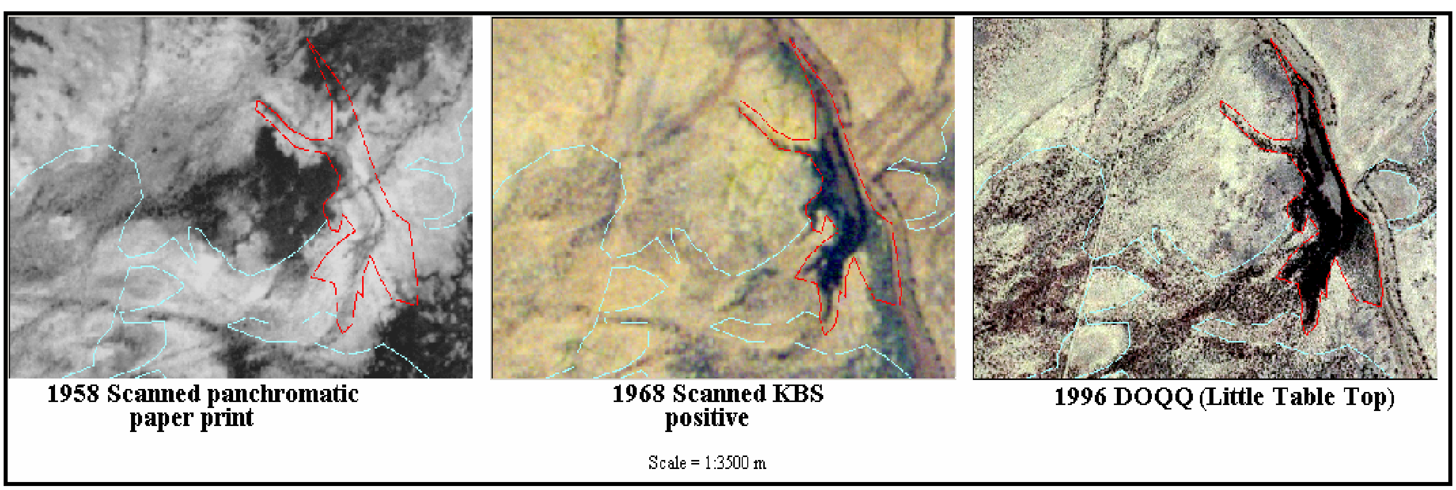


Figure 27. These are aerial photographs of an area in the upper Vekol Valley. The area outlined in red is a network of spreader dikes and berms, and the mesquite patch there is considered to be in community sub-class 2. The area outlined in blue shows mesquite invading after 1968, and therefore is considered to be in community sub-class 3

Composition and Structure
The main compositional and structural element uniting these variable *Mesquite Woodlands* is the dominating presence of *P. velutina.* The mean percent cover of *P. velutina* in the natural community plots was 50%, with 100% constancy. *Larrea divaricata tridentata* occurred in 85% of the natural community plots and had a mean percent cover of 17.38%, while constantly being noted as standing 2 meters tall or higher. Other plants that had a high frequency of occurrence in the natural community plots were, *Schismus arabicus, Erodium cicutarium, Lepidium lasiocarpum, Amsinckia intermedia, Sisymbrium irio, Lesquerella gordonii, Filago arizonica, Ambrosia deltoidea, Sphaeralcea coulteri,* and *Plantago ovata*.

Mesquite Woodlands on the whole had high total percent covers per plot because of multiple canopy layering. The mean percent cover of native species for the natural community plots was 104.4%, with exotic species percent cover averaging 40.2%. Most plots consisted of a tree overstory, shrub mid-canopy, tall herbaceous canopy, and then a low herbaceous canopy. The following tables illustrate the mean percent cover of plants by growth form for the different *Mesquite Woodland* sub-community types.

Table 1. Tree and *Larrea divaricata tridentata* cover derived from the Mesquite Condition and Extent Plot and Natural Community Plot data.

Mesquite Observations (for 69 observation points)	Mean Cover of Mesquite	Standard Deviation in Mesquite Cover	Mean Cover of Other Tree Species	SD in Other Tree Species Cover	Mean LARDIV Cover	SD in LARDIV Cover
Naturally Occurring/Persistent Stand	33.12	25.63	1.6	3.8	18.95	18.37
Stand in Tank/Disturbed Area	60.84	26.79	0.51	1.45	6.24	14.86
Young Stand in Area Previously Not Dominated by Mesquite (Invading Mesquite)	29.62	30.49	0	0	15.38	23.85

Table 2. Mean cover of non-tree growth-forms derived from the Natural Community Plot data.

Mesquite Observations (for 13 plots)	Mean shrub cover	Mean Cacti Cover	Mean grass cover	Mean Exotic Species Cover	Mean Herb cover
Naturally Occurring/Persistent Stand	30.9	0.06	29.3	44.78	51.37
Stand in Tank/Disturbed Area	0.88	0	13.63	17	6.88
Young Stand in Area Previously Not Dominated by Mesquite (invading mesquite)	1.75	0	40.25	40.25	10.5

Function and Disturbance Processes

Mesquite Woodlands are strongly associated with riparian areas or areas where the water table has been altered or extensive grazing has occurred. The mesquite stands that we identified were either closely associated with water impoundments, *Braided Channel Floodplain*s, *Valley Xeroriparian Scrub* communities, areas that had experienced substantial grazing, or areas that experienced periodic flooding.

A unique disturbance observed in this community was woodcutting. Many of the *Mesquite Woodland* patches visited during our fieldwork exhibited signs of cutting, both historic and recent. Typically, the cutting was done on the larger limbs of old mesquite trees, usually in patches considered as community sub-class 1 (where most of the older trees occur).

Landscape Context

The *Mesquite Woodland* community is a small or linear patch community that is associated with riparian areas and floodplains, or with hydrologic disturbances and intensive grazing. About 1700 hectares of *Mesquite Woodland* patches were identified in the study area. These patches occur largely within the *Creosotebush–Bursage Desert Scrub* matrix community.

Examples of Baseline Conditions

Most of the mesquite stands in the study area are highly disturbed communities (Figure 28). The most extensive less disturbed mesquite stands in the study are located in the Vekol Valley. Most of these stands are in community sub-classes 2 and 3, being either fairly young or associated with water impoundments in the upper valley. But there are some more natural, and somewhat older stands associated with the *Braided Channel Floodplain* community that we have mapped in the lower Vekol Valley. In the North Tank area near Mobile, an extensive grouping of community sub-class 1 patches exists (Figure 29), though there is no noticeable *Braided Channel Floodplain* uniting them. Field surveys suggest that this area experiences periodic sheet flooding, a factor that may be influencing the development of *Mesquite Woodlands* here.

Figure 28. A highly disturbed Mesquite Woodland near Interstate 8 in area developed as water tank and pasture. *Prosopis velutina* forms an open overstory canopy and *Cynodon dactylon* covers much of the soil surface at this site.

Figure 29. A thick Mesquite Woodland patch near North Tank. This mesquite patch had a closed upper canopy consisting purely of *P. velutina*. There were mesquite trees here ranging from 1 cm dbh saplings around 1 to 2 meters tall, to over 30 cm dbh canopy dominants.

Mapping Methods and Biophysical Modeling Parameters

Mesquite Woodlands are somewhat difficult to map from DOQQs or to predict based on biophysical parameters. They are typically confined to valley bottom locations, and can be mixed in with the *Valley Xeroriparian* or *Braided Channel Floodplain* communities. We mapped mesquite patches by first identifying the most extensive woody areas within valley bottoms using the DOQQs and historical aerial imagery. Ground reconnaissance was then used to further refine the initial mapping, specifically looking to eliminate areas that were mapped as *Mesquite Woodlands* but did not meet the compositional standards we stated as our guiding prerequisite in identifying *Mesquite Woodlands.*

Relationship to Plant Community Classification Systems

This community relates to the Mesquite series (124.71) of Brown and others (1979) and the *Prosopis Velutina* Shrubland alliance, Deciduous Shrubland formation of the National Vegetation Classification System (TNC 1998).

Rock Outcrops

Ecological Characteristics

Description and Composition

Rock cliffs, extensive talus slopes or other rock outcrop areas that are of sufficient size to map characterize the *Rock Outcrop* community. Any other rocky areas that have significant vegetative cover are included in the *Mountain Upland* or *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* communities – only those that are largely devoid of significant vegetation are mapped as rock outcrops. The *Rock Outcrop* community is a small patch community that normally occurs within the *Mountain Upland* or *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* communities. A few rock outcrops border the *Creosotebush–Bursage Desert Scrub* community. There are many small rock outcrops scattered throughout the *Mountain Upland* and *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* communities that are too small to map. Both of these communities have considerable surface rock and provide habitat for many of the species that rely on habitat provided by the *Rock Outcrop* community.

The vegetation composition of the *Rock Outcrop* community can be similar to the surrounding *Mountain Upland* or *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* communities – but with significantly less vegetative cover. Based on our field sampling, average total tree cover in this community was less than 1%. *Encelia farinosa farinosa, Larrea divaricata tridentata, and Eriogonum wrightii* were the only plant species on Rock Outcrops that had mean percent covers of over 1%. Some of the species that had relatively high constancy in this community include: *Lycium spp., Parkinsonia microphylla, Carnegiea gigantea, Sphaeralcea ambigua, and Phacelia spp.*

Structure

The structure of this community is defined by the rock substrate. Some areas are steep cliff faces, some areas are small rocky buttes, some areas are large jumbles of rocks and some areas are extensive talus slopes with a combination of medium and large boulders and talus blocks.

The vegetation in all situations is sparse, with occasional small trees, shrubs and some perennial herbs and grasses. Annual vegetation is extremely sparse in most circumstances.

Function and Disturbance Processes

The rock outcrop community is exposed to wind erosion and subject to cracking, spalling, rock fall and rock slides. Quarrying, mining, target practice and/or graffiti have impacted a few areas that are close to human access points.

Landscape Context

The *Rock Outcrop* community occupies about 1627 hectares, mostly in the Sand Tank Mountains. This small patch community occurs on steep slopes and rocky summits within the *Mountain Upland* or *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* communities. Many smaller rock outcrops (not possible to map at the resolution chosen for this project) occur throughout the mountain matrix communities.

Examples of Baseline Conditions

The best examples of the *Rock Outcrop* community occur in the Sand Tank Mountains (Figures 30-32). But numerous examples occur in the Table Top Mountain area and in the Maricopa Mountains in the central and northern part of the Monument.

Figure 30. Rock outcrops above saguaros rise above Bender Spring Canyon, Sand Tank Mountains.

Figure 31. Phase 1 Plot 67. Top of a small rock outcrop, in the Sand Tank Mountains west of Johnson Well. This rock outcrop was below our minimum map unit and is an inclusion in the *Mountain Upland* community.

Figure 32. Dragon's Tooth in the East TAC area of the BMGR is an extensive Rock Outcrop community with some impressive geological features such as this natural rock arch.

Mapping Methods and Biophysical Modeling Parameters

We extensively revised the mapping of rock outcrops provided to us by TNC at the beginning of this project. The initial GIS layer of rock outcrops was based on National Land Cover Data (NLCD) mapping (Vogelmann et al 2001). Close examination of this data layer revealed that it was highly inaccurate. It was based on a classification of Landsat TM satellite imagery. Since most of the land surface of the SDNM is sparsely vegetated, it is not possible to determine rock outcrops using Landsat satellite imagery. Many areas that have no rock were mapped as rock outcrops in the NLCD data but are really bajadas, desert washes or flats. The NLCD data greatly over-predicts the *Rock Outcrop* community in the basalt hills and mountains. The basalt bedrock dominates the spectral response from the land surface in these areas, masking the fact that considerable vegetation exists. After examining the NLCD rock outcrop GIS layer carefully, we rejected this layer and mapped the significant rock outcrops using the much higher resolution DOQQs. We also developed a steep slope GIS layer (slopes greater than 25 degrees), and a 5-meter interval contour layer to help guide our interpretation of the DOQQs. Using this approach, we were able to map the *Rock Outcrop* community in a much more reliable fashion than was presented in the NLCD data.

Nearly all the rock outcrops exist on or near slopes that exceed 25 degrees. Some of the most significant rock outcrops are vertical, and therefore have no real aerial extent and are difficult to map as a significant rock outcrop polygon. In these cases we often digitized a slightly larger polygon around a vertical cliff rock outcrop to signify its presence. The nature of the rock outcrop community does not lend itself to modeling using biophysical parameters and/or mapping with Landsat satellite imagery. Our minimum mapping unit for patches in this community was 450 sq. meters.

Relationship to Plant Community Classification Systems

As this community is based on physical features, its vegetation is not well-captured by most vegetation classifications. Broadly, it corresponds with the Paloverde – mixed cacti series (154.12) of Brown and others (1979), with much sparser vegetation. There are no relevant alliances within the National Vegetation Classification System (TNC 1998).

Valley Xeroriparian Scrub

Ecological Characteristics

Description and Composition

The *Valley Xeroriparian Scrub* community is found along nearly all, low gradient, intermittent streams that flow across the bajadas and desert flats. As we have defined this community, *Valley Xeroriparian Scrub* occurs along the intermittent drainages that cross unconsolidated, alluvial deposits composed of gravels and sands. These drainages are not confined by bedrock outcrops and can change course due to bank cutting, channel migration, channel blockage and reformation during debris flows. It is contrasted with the *Mountain Xeroriparian Scrub* community (discussed later in this paper), which occurs adjacent to steeper gradient streams flowing across rocky slopes and upland communities. The streams of the *Mountain Xeroriparian Scrub* community flow across bedrock and rocky substrates and are largely confined by bedrock where channel migration only occurs on a geologic time scale.

This community occurs as a narrow, linear patch community within the *Creosotebush–Bursage Desert Scrub* and *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* communities. The vegetation composition is highly variable and depends on the matrix community, the relative size of the drainage system and the dynamic hydrologic and geomorphic processes that control this community. The community is normally characterized by the overstory dominance of xeromorphic, deciduous trees including *Olneya tesota, Parkinsonia florida, and Prosopis velutina* (Hall et al 2001). *Parkinsonia microphylla* is also common in the overstory, but not as abundant and common as *Parkinsonia florida*. *Phoradendron californicum* is a common epiphytic parasite associated with the leguminous trees in the overstory. The presence of herbaceous and woody perennial vines are also common in this community (Hall, 2001)

In our field plots, *Parkinsonia florida* was the dominant plant (8.37% mean cover) but *Larrea divaricata tridentata* had the highest constancy, occurring in 92% of the plots. *Larrea divaricata tridentata* is not, however, an indicator species for this community, having a mean percent cover of only 2.77%. Rather, it is a common component of the surrounding matrix communities. *Ambrosia deltoidea,* another common member of the matrix community, also occurs in most of the plots (68% constancy) but in lower abundance. Other shrubs with either high constancy or cover include: *Acacia greggii, Acacia constricta, and Ambrosia ambrosioides.*

The shrubs listed above contribute to a dense understory that is also composed of sub-shrubs, vines, cacti and herbs. Also included in this understory, according to data from our field plots are: *Schismus arabicus, Lycium* spp*., Celtis pallida pallida, Krameria grayi,* several native grass species*, Cryptantha spp., Lesquerella gordonii, Camissonia spp., Justicia californica, Hyptis emoryi, Hymenoclea salsola, Erodium cicutarium, Bebbia juncea aspera, Sphaeralcea ambigua, Lyrocarpa coulteri,* and *Janusia gracile*. This is one of the most diverse natural communities in this region of the Sonoran Desert.

Larger floodplain systems that have multiple braided channels and overland flow between channels are described later in this paper as the *Braided Channel Floodplain* community. Some of the species occurring in that community also occur in the larger washes that lie within the *Valley Xeroriparian Scrub* community.

Structure
The average vegetative cover in the *Valley Xeroriparian Scrub* community measured in our field plots was 76.5%, which is nearly equal to the average vegetative cover in the other xeroriparian communities and much higher than all the upland communities except for the *Mountain Uplands*. This community typically has three strata: an open overstory of small trees, a dense to sometimes sparse medium to small shrub layer, and a mix of smaller shrubs, grasses and herbs in the understory. Spring annuals often cover some of the bare sand, gravel and soil that is exposed in the wash bottom, but at other times of year the wash itself is devoid of vegetation.

Function and Disturbance Processes
Episodic stream flow along the channels within the *Valley Xeroriparian Scrub* community is the dominant ecological and geomorphic process that controls the composition and structure of this

community. Debris flows also occur along the channels during infrequent, high amplitude storms. During the high amplitude flood and debris flow events, some channels can abruptly change course or become more deeply scoured. The frequency, volume and duration of flow events along the channels in this community are a function of catchment area and regional rainfall regime (Warren and Anderson 1985, Hall et al 2001). Geologic substrate, distance from mountain range and stream gradient are also important factors that influence frequency, volume and duration of flow events.

Landscape Context
This community forms long, narrow, sinuous patches within the low gradient bajadas and gentle valley bottoms within the *Creosotebush-Bursage Desert Scrub* and *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas* matrix communities. The stream gradients in this community are nearly always less than 9% (5 degrees) and the community is normally found below 600 meters in elevation. Some valleys and gentle bajadas in which this community is embedded extend over 800 meters in elevation within the Sand Tank Mountains.

Examples of Baseline Conditions

There are excellent examples of this community throughout the SDNM and Sand Tank Mountains. Figures 33, 34 and 35 illustrate some of the variation within this community that is present in the area.

Figure 33. Phase 1 Plot 63. *Valley Xeroriparian Scrub* community north of Maricopa Mountains near the northern boundary of the SDNM.

Figure 34. Phase 1 Plot 35. *Valley Xeroriparian Scrub* community in lower Vekol Valley.

Figure 35. Phase 1, Plot 118. Desert wash with sparse *Valley Xeroriparian Scrub* community northeast of Gila Bend near the western border of the SDNM. This is one of the driest areas of the Monument and the xeroriparian scrub community is poorly developed despite the fact that the wash has cut down at least 6 meters below the level of the surrounding bajada. This site is over 13-km west of the western edge of the Maricopa Mountains.

Mapping Methods and Biophysical Modeling Parameters

In the initial mapping provided by TNC, the xeroriparian communities were mapped as linear features along all of the streams delineated on the 1:100,000-scale hydrography data. Unfortunately, the 1:100,000-scale hydrography data is not an adequate depiction of the hydrography of the SDNM and surrounding area. Most drainages that exist in this area are not shown in this hydrography data. Sometimes even the major channels are not shown, or minor channels were depicted instead. The initial mapping underestimates the extent of the xeroriparian communities on the SDNM by a factor of at least three. Higher resolution hydrography data (at least 1:24,000-scale) is necessary to adequately map these communities based on the approach taken in the initial mapping. However, hydrologic data at this scale has not yet been produced by the USGS for this part of Arizona. Because of this fact, we also had to rely on the 1:100,000-scale hydrography data for our mapping. We mapped areas where 1:100,000-scale streams flowed across the valley bottom areas (bajadas and desert flats) as *Valley Xeroriparian Scrub*. We did not add any channels to this GIS layer beyond what was contained in the 1:100,000-scale stream layer. We made the assumption that a buffer of 10-meters around the stream arcs represented the location of this community. This is the best we could do with existing data and the constraints of this project.

The *Valley Xeroriparian Scrub* community could be accurately mapped by photo interpretation of the DOQQs, but this would require over a year of work and is well beyond what was possible within the timeframe and budget for this project.

Relationship to Plant Community Classification Systems

This community has a wide range of vegetation types and is not well captured by most vegetation classification systems. Components of the community are included in both the Creosotebush-Bursage series (154.11) and Paloverde-mixed cacti series (154.1215R) of Brown and others (1979). This community encompasses several alliances in the National Vegetation Classification System (TNC 1998), including the *Parkinsonia florida*, *Prosopis velutina*, and *Olneya tesota* alliances. It also shares some characteristics of the *Cercidium floridum-Prosopis glandulosa-Ambrosia ambrosioides* association (154.1215R) of Warren and others (1981).

Mountain Xeroriparian Scrub

Ecological Characteristics

Description and Composition

The *Mountain Xeroriparian Scrub* community is similar to the *Valley Xeroriparian Scrub* community. It occurs adjacent to the higher gradient streams flowing through the *Mountain Upland* and *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* communities. The intermittent streams that form the basis for the *Mountain Xeroriparian Scrub* community flow across bedrock and rocky substrates and are largely confined by bedrock where channel migration only occurs on a geologic time scale. This community usually occurs where stream gradients equal or exceed 9% (5 degrees slope). Usually, it occurs at elevations above 600 meters.

Like the *Valley Xeroriparian Scrub* community, the *Mountain Xeroriparian Scrub* community has a highly variable composition that is dependent on drainage size and composition of the surrounding matrix community. Aspect and elevation have a pronounced influence on the composition of this community.

The community is normally characterized by the overstory dominance of leguminous, deciduous trees. *Parkinsonia microphylla* is a dominant compositional species that occurred in 75% of our plots and had the highest average species percent cover (5%). The lesser importance of *Parkinsonia florida* in this community is one factor that distinguishes it from the *Valley Xeroriparian Scrub* community. *P. florida* had a constancy of 18.8% and a mean percent cover of 2.88%. *Phoradendron californicum* is a common epiphytic parasite associated with the overstory of leguminous trees.

There is usually a moderately dense to dense understory of shrubs, cacti, herbs and grasses in this community. The most common species encountered in our field plots were (in order of constancy): *Lepidium lasiocarpum, Schismus arabicus, Cryptantha pterocarya, Poa bigelovii, Lycium spp., Vulpia octoflora, Descurainia pinnata, Ephedra aspera, Amsinckia intermedia, Eucrypta micrantha, Eriogonum fasciculatum, Linanthus jonesii, Encelia farinosa farinosa, Fouquieria splendens, Trixis californica, and Cylindropuntia acanthocarpa.*

Structure
The average vegetative cover in the *Mountain Xeroriparian Scrub* community measured in our field reconnaissance plots was around 80% - nearly identical to the average cover in the *Valley Xeroriparian Scrub* community. This community typically has three strata: an open overstory of small trees, a dense to sometimes sparse medium to small shrub layer and a mix of smaller shrubs, grasses and herbs in the understory. The rocky substrate of the intermittent stream bottoms is often rough. In some places, steep-walled rocky banks are present. In the rockiest areas, the channel and its immediate banks support little vegetation and fewer annuals are present than in the gentle gradient streams that characterize the *Valley Xeroriparian Scrub* community.

Function and Disturbance Processes
Episodic stream flow along the channels within the *Mountain Xeroriparian Scrub* community is the dominant ecological and geomorphic process that controls the composition and structure of this community. Debris flows may also occur along some of these channels during infrequent storm events. Unlike the *Valley Xeroriparian Scrub* community, the channels in this community are more stable and do not change location due to the fact that they are usually carved into bedrock.

Landscape Context
The *Mountain Xeroriparian Scrub* community is a narrow, linear patch community, but the channels and associated scrub communities are often much straighter than the sinuous channels in the *Valley Xeroriparian Scrub* community. These fairly straight channels drain the mountain slopes of the Maricopa Mountains, the Table Top Mountains and the Sand Tank Mountains. The *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* community or the *Mountain Upland* community surround this riparian scrub community. The stream gradients are usually equal to or greater than 9% (5 degrees) and the community is normally found above 600 meters in elevation.

Some stream channels and associated *Mountain Xeroriparian Scrub* community can extend to over 1100 meters in elevation.

Examples of Baseline Conditions

There are excellent examples of the *Mountain Xeroriparian Scrub* community throughout the SDNM and Sand Tank Mountains. Figures 36 and 37 illustrate some of the variation within this community that is present in the area.

Figure 36. Phase 1 Plot 83. *Mountain Xeroriparian Scrub* in Bender Spring Canyon, Sand Tank Mountains.

Figure 37. Phase 1 Plot 91. *Mountain Xeroriparian Scrub* community on small intermittent stream draining the north slopes of Javelina Mountain.

Mapping Methods and Biophysical Modeling Parameters

As discussed with the *Valley Xeroriparian Scrub* community, there is a need for higher resolution hydrography data to adequately map all of the xeroriparian communities. This is somewhat less of a problem for the *Mountain Xeroriparian Scrub* community as more of the mountain stream channels are captured in the 1:100,000 scale hydrography data, but it still is an issue. Higher resolution hydrologic data is not yet available for this part of Arizona. Because of this fact, we also had to rely on the 1:100,000-scale hydrography data for our mapping. We mapped areas where 1:100,000-scale streams flowed across the rocky slope and mountain upland areas as *Mountain Xeroriparian Scrub*. We made the assumption that a buffer of 10-meters around the stream arcs represented the location of this community. This is the best we could do with existing data and the constraints of this project.

The *Mountain Xeroriparian Scrub* community could be mapped through photo interpretation of the DOQQs, but this would require many hours of work and is beyond what is possible within the timeframe and budget for this project.

Relationship to Plant Community Classification Systems

This community has a wide range of vegetation types and is not well captured by most vegetation classification systems. Components of the community are included in both the Creosotebush-Bursage series (154.11) and Paloverde-mixed cacti series (154.1215R) of Brown and others (1979). This community encompasses several alliances in the National Vegetation Classification System (TNC 1998), including the *Parkinsonia microphylla*, *Prosopis velutina*, and *Olneya tesota* alliances. It also shares some characteristics of the *Ambrosia ambrosioides-Olneya tesota-Acacia* spp. association (154.1214R) of Warren and others (1981).

Braided Channel Floodplains

Ecological Characteristics

Description and Composition

The *Braided Channel Floodplain* community has many similarities to the *Valley Xeroriparian Scrub* community but differs in regard to width, dominant geomorphic/hydrologic processes and vegetation composition. This community occupies relatively broad floodplain areas within the mountain valleys and along major washes on the bajadas. Multiple, cross-braiding channels characterize the *Braided Channel Floodplain* community. Significant island areas and adjacent floodplain zones often exist that are inundated by floodwaters during high flow events. These areas are much wider than the typical xeroriparian communities and often bear some resemblance to river floodplains along major perennial rivers throughout the world.
A cross-section of the *Braided Channel Floodplain* community often consists of many different surfaces with varying vegetation and disturbance frequency (Figures 38-40).

Vegetation composition of the *Braided Channel Floodplain* community is similar to the *Valley Xeroriparian Scrub* community. Nearly all species that are found in the *Valley Xeroriparian Scrub* community are also found in the floodplain community. But the floodplain community differs considerably from the xeroriparian community in the abundance of some species. *Hymenoclea salsola* is one of the most abundant perennial species in the *Braided Channel Floodplain* community with an average cover of 2.68% in our field plots. It also occurred in 42.9% of our plots within this community. In contrast to this, *Hymenoclea salsola* had a mean cover of 0.96% and a constancy of 20% in our plots within the *Valley Xeroriparian Scrub* community. Other species that were largely or solely found within the *Braided Channel Floodplain* community include: *Bebbia juncea aspera, Hyptis emoryi, Sebastiania bilocularis, Chilopsis linearis arcuata* and *Baccharis sarothroides.*

Parkinsonia florida is the dominant tree in the *Braided Channel Floodplain* community (as it is within the Valley Xeroriparian Scrub community). *Parkinsonia microphylla*, *Olneya tesota* and *Prosopis velutina* also contribute to the overstory tree canopy. *Phoradendron californicum* is a common epiphytic parasite associated with the leguminous trees in the overstory. Overall tree cover is less in this community (12.82%) than it is in the *Valley Xeroriparian Scrub* community (24.26%). This may be due to the more active flooding and scouring within the floodplain which tends to favor shrubs like *Hymenoclea salsola*, *Bebbia juncea aspera*, *Hyptis emoryi*, *Sebastiania bilocularis*, *Chilopsis linearis arcuata* and *Baccharis sarothroides* over tree species that require more stable substrates to become established and survive. All of the above-mentioned shrub species have adaptations such as small flexible, multiple stems and deep roots, which contribute to survival in the floodplain environment.

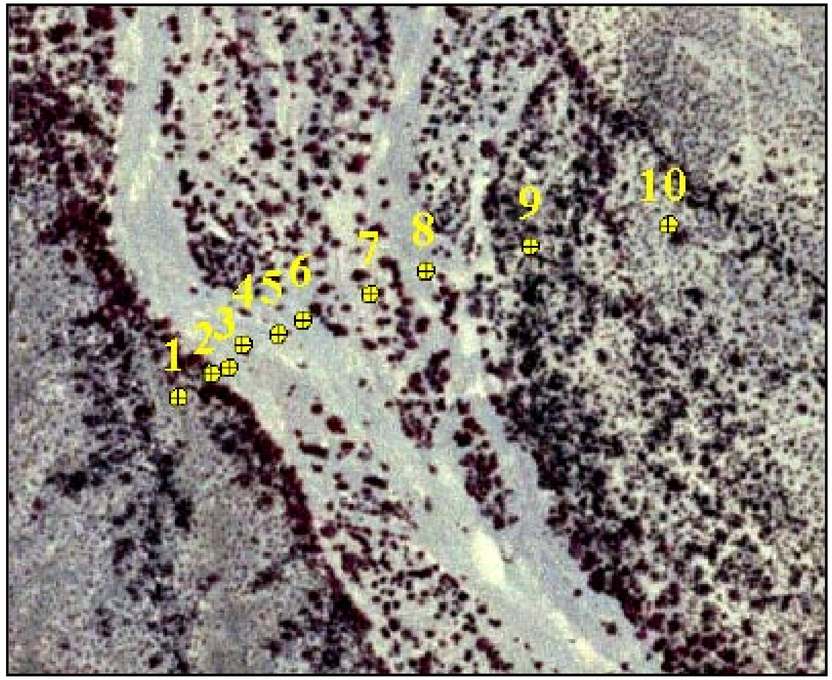


Figure 38. Layout of transect across floodplain in the middle Vekol Valley, with natural community plot locations in yellow.

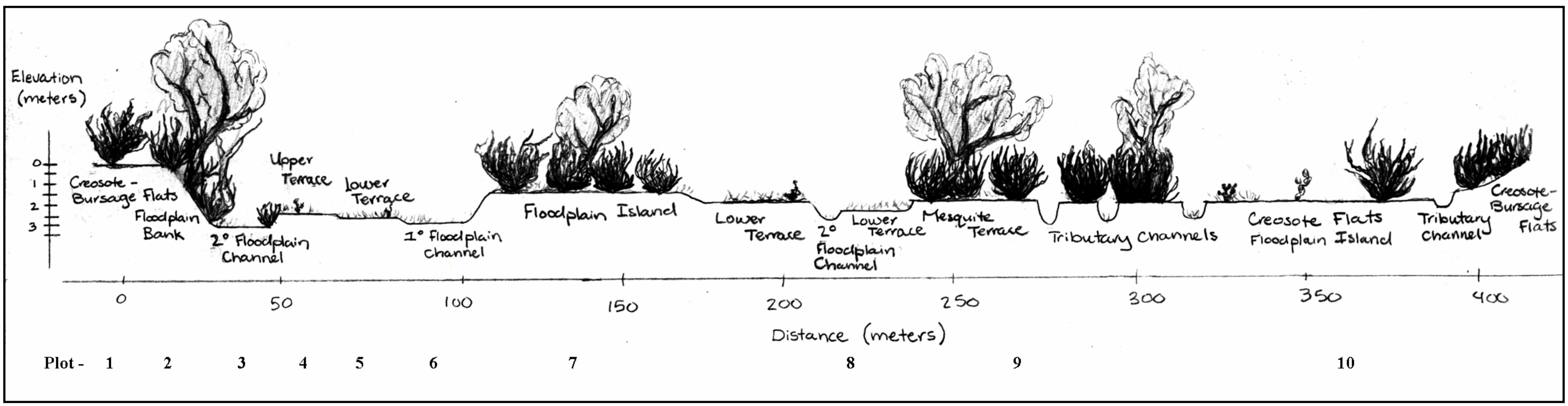


Figure 39. Illustration of the floodplain transect shown in Figure 38 as a cross-section with various flood and channel surfaces and various sub-communities on each surface

Plot 2 – floodplain bank

Plot 3 – active wash channel

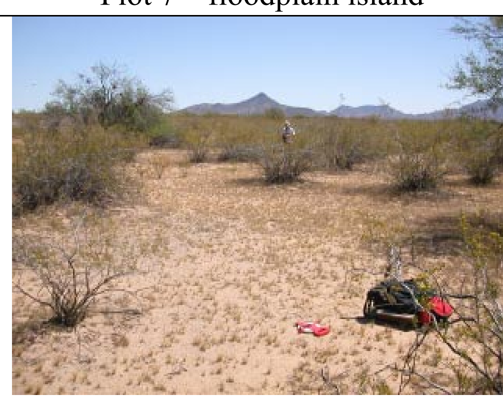
Plot 4 – flood terrace

Plot 5 – lower terrace

Plot 6 – primary active wash

Plot 7 – floodplain island

Plot 9 – mesquite terrace



Plot 10 – floodplain island

Figure 40. Photos of plots along the floodplain transect.

It is worth noting that some of the community sub-class 1 examples of the *Mesquite Woodland* community we have mapped on the SDNM occur as inclusions within the *Braided Channel Floodplain* community and are controlled by the same geomorphic/hydrologic processes that function in this community.

Other species found in our field plots in this community include: *Acacia greggii*, *Ambrosia ambrosioides*, *Justicia californica*, *Lycium* spp., *Larrea divaricata tridentata*, *Eriogonum fasciculatum*, *Carnegiea gigantea*, *Ambrosia deltoidea, Acacia constricta, Amsinckia intermedia, Lepidium lasiocarpum, Cryptantha* spp., and *Pectocarya* spp.

Structure
The structure of this community is unique among the xeroriparian communities in the SDNM. The community is composed of four major elements:

1. Major and minor wash channels that braid through the community
2. Islands that are regularly inundated with floodwaters and have regular deposition and/or erosion
3. Adjacent off channel floodplain areas that are occasionally inundated with floodwaters and subject to deposition and/or erosion
4. Xeroriparian scrub vegetation that lines the banks of many of the wash channels and is above the zone that is subject to regular inundation

Overall vegetation cover is slightly less than the other xeroriparian communities (around 66%) and tree cover is lower than in those communities. Significant areas of the most frequently inundated areas of the floodplain are covered with small to medium sized shrubs.

Function and Disturbance Processes
The *Braided Channel Floodplain* community is influenced by episodic stream flow along the main channels and less frequent flood events that inundate islands and off channel areas. The episodic flow volumes in the floodplain areas are generally higher than experienced in channels within the *Valley Xeroriparian Scrub* community. The intermittent stream flows and floods are the dominant ecological and geomorphic processes that control the composition and structure of this community. During high amplitude flood events, many of the wash channels that braid through the floodplain may change course or become more deeply scoured. Due to these factors, this community is probably the most dynamic community in the SDNM.

Landscape Context
The *Braided Channel Floodplain* community occurs along major wash systems that flow out of mountain ranges within the SDNM. Floodplain areas may be adjacent to *Creosotebush-Bursage Desert Scrub*, *Paloverde - Mixed Cacti - Mixed Scrub on Bajadas,* or *Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes* communities. Some of the floodplains occur at the base of mountain slopes on relatively flat canyon bottoms (Figure 41 and 42) while others have formed at the bottom of broad valleys (Figures 43-45). The *Braided Channel Floodplain* community is connected to *Valley Xeroriparian Scrub* and *Mountain Xeroriparian Scrub* communities through the intermittent stream network that feeds the channels that flow through the floodplain.

Examples of Baseline Conditions

Some of the best examples of the *Braided Channel Floodplain* community in the SDNM exist in the Sand Tank Mountains along Sand Tank Wash (Figures 41 – 42) and in the Vekol Valley along Vekol Wash (Figures 43 - 45). Other good examples occur in the Maricopa Mountains in the northern part of the SDNM and northeast of Table Top Mountain.

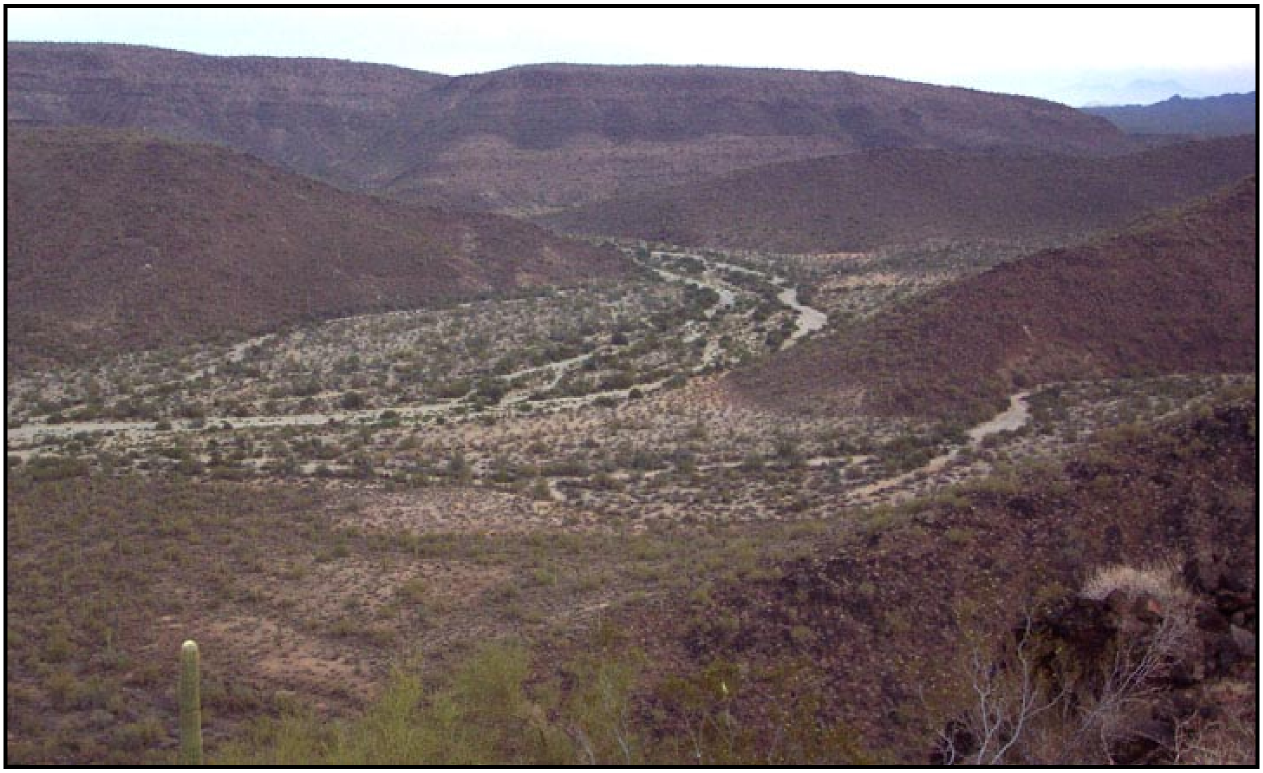


Figure 41. Upper portion of Sand Tank Wash Braided Channel Floodplain community. Note multiple braided channels. During large floods, water flows across most of the valley bottom, including area between major washes.

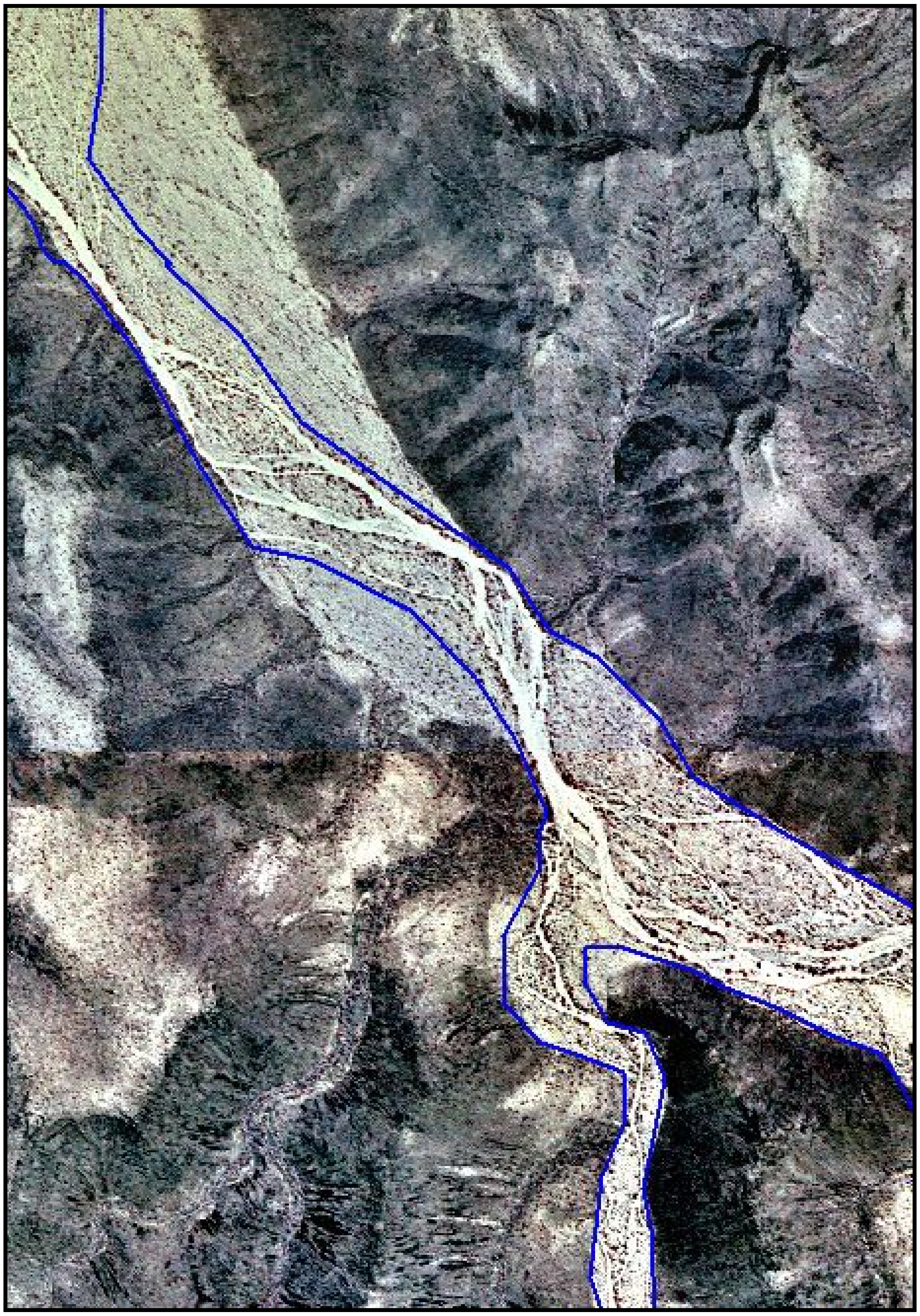


Figure 42. Braided Channel Floodplain community (outlined in blue) in Sand Tank Wash, background image is a 1996 color infrared digital orthophoto.

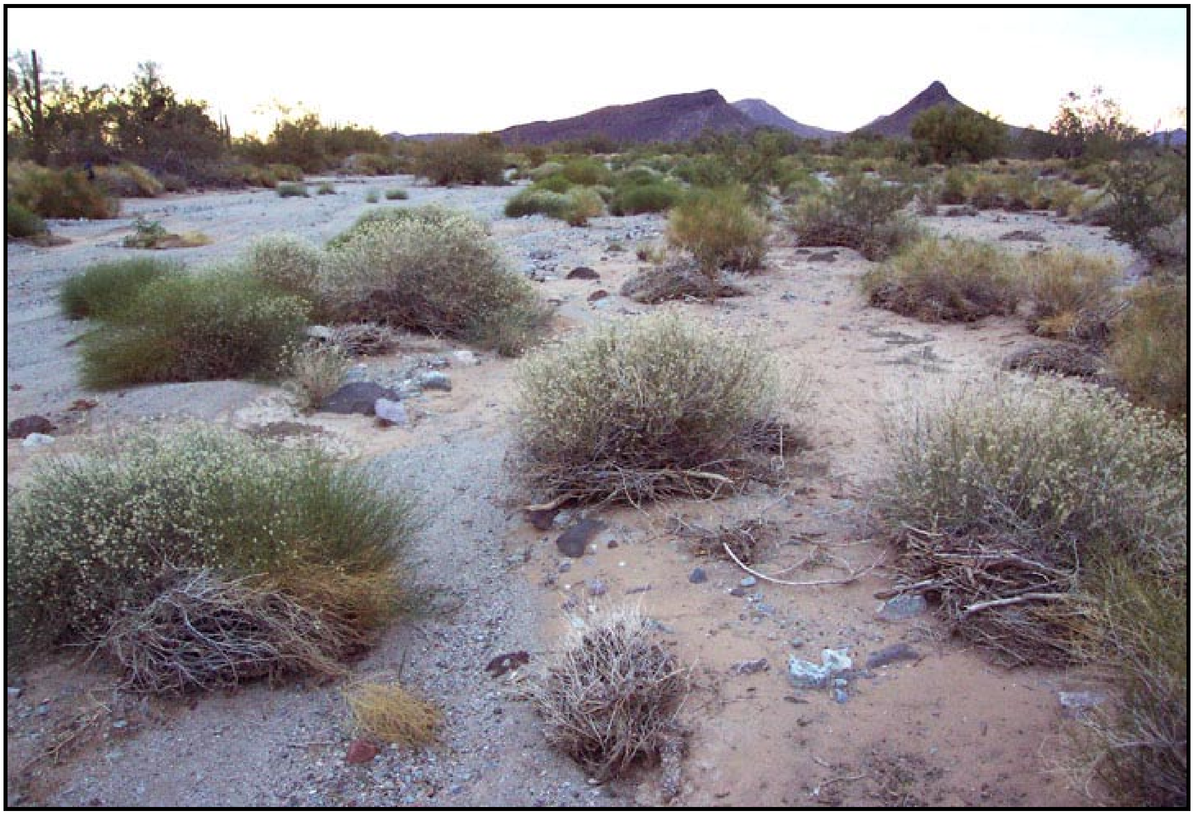


Figure 43(above) and Figure 44 (below): Lower portion of Sand Tank Wash Braided Channel Floodplain community. Note evidence of recent flooding and flood debris extending throughout area between most active wash channels.

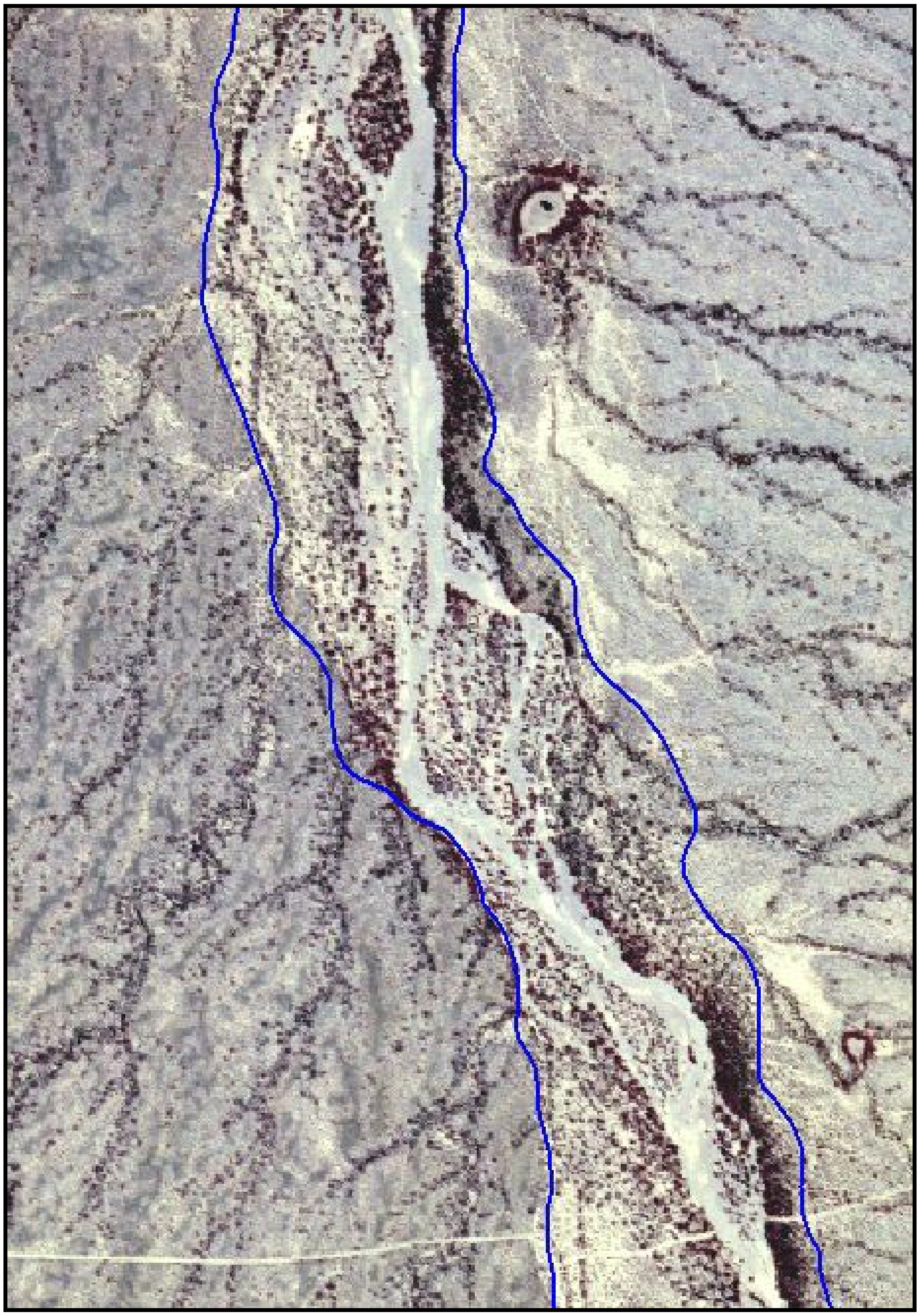


Figure 45. Braided Channel Floodplain community in Vekol Valley, background image is a 1996 color infrared digital orthophoto.

Mapping Methods and Biophysical Modeling Parameters

These floodplain communities are distinguished from other xeroriparian communities by their overall width, presence of multiple, braided channels and presence of off channel areas inundated by floods. The xeroriparian communities were mapped as linear features while these floodplain communities were mapped as polygon features. We restricted the floodplain communities that we mapped on the SDNM to areas that generally maintain a width of over 100 meters. They are also only associated with relatively low gradient channels.

The *Braided Channel Floodplain* community that we mapped should not be confused with the *Valley Bottom Floodplain Complex* community that was mapped in the BMGR (Hall et al 2001). The latter community has a less active channel system, is considerably wider and is largely dominated by infrequent overland flow.

Relationship to Plant Community Classification Systems

This community has a wide range of vegetation that is not well captured by most vegetation classification systems. Components of the community are included in both the Creosotebush-Bursage series (154.11) and Paloverde-mixed cacti series (154.1215R) of Brown and others (1979). Within the National Vegetation Classification System (TNC 1998), vegetation falls into the Deciduous Shrubland and Evergreen Shrubland formations. The Deciduous Shrubland formation includes a *Hymenoclea monogyra* Shrubland alliance, but not a *Hymenoclea salsola* alliance, which would better describe much of the vegetation in this community.

Desert Springs

There are two springs in the study area, Burro Spring and Bender Spring. Both are in the Sand Tank Mountains southwest of the SDNM within the BMGR.

Ecological Characteristics

Description and Composition

The *Desert Spring* community is a unique small patch community extremely limited to two remote locations in the study area. *Desert Springs* are important ecological areas because they are one of the few places in the desert where surface water occurs naturally, thus providing a water source for a variety of desert plants and wildlife. Unfortunately, human development of natural springs in the study area seems to be the status quo. All the natural springs have been altered through the construction of concrete or brick walls with metal piping.

The overall composition of *Desert Springs* tends to be greatly influenced by the surrounding matrix community, though some plant species that are found next to a spring may not occur in the adjacent communities. Springs sampled had similar plant species diversities to the *Mountain Xeroriparian* occurring in the same areas, though there was typically a higher total vegetation cover adjacent to springs than to a typical *Mountain Xeroriparian* area. As with the *Mountain Xeroriparian* community, the number of plant species occurring next to a spring was always impressively higher than what was found in the surrounding matrix community. All the springs we sampled were located within the Sand Tank Mountains, in areas that were dominated by either a *Paloverde - Mixed-Cactus on Rocky Slope* or *Mountain Upland* community. As stated before, all of these spring areas had experienced some degree of recent development, which has probably impacted the plant species composition of these areas. It seems reasonable to assume that the species compositions were also impacted to an unknown degree by historic human use.

Perennial species that occurred (100% constancy) in all of our *Desert Spring* sampling include: *Prosopis velutina, Acacia greggii, Coursetia glandulosa, Ephedra aspera, Acacia constricta,* and *Brickellia coulteri. Simmondsia chinensis* was also found in most of our plots (66.7% constancy, 1.42% mean percent cover). This species seemed to occur only in areas where there was obvious historic aboriginal use.

Exotic grasses like *Bromus rubens* and *Schismus arabicus* had some of the highest average percent covers of all the plant species documented in our field surveys (6% and 4.67% respectively). Other annuals with a high constancy and average percent cover were: *Amsinckia intermedia, Lepidium lasiocarpum, Phacelia coerulea, Cryptantha pterocarya, Caulanthus lasiophyllus, Silene antirrhina,* and *Daucus pusillus.*

Structure

The *Desert Spring* community's structure is highly variable, being largely defined by vegetative composition, which is greatly influenced by the surrounding matrix community, and the quality of a given community's substrate. In our field sampling in the areas adjacent to springs, there was typically a sparse to moderate canopy of overstory leguminous trees and/or large cacti, a thick secondary canopy of large shrubs, vines, cacti, and other perennials (if there was an adequate substrate in which to grow roots), and then a thick understory canopy of small shrubs, herbs, cacti, and other annuals. The cover and spatial distribution of plants tended to be influenced by the quality of a given spring's substrate. If there was a high degree of surface bedrock, plant cover tended to be restricted to areas where there were sufficient soil or gravel pockets for establishing roots. Where sufficient rooting substrate was not a limiting factor, plant cover tended to be high, well over 100% due to canopy layering.

Function and Disturbance Processes

Typical disturbance processes affecting the other natural communities don't appear to have a substantial impact upon the *Desert Spring* community. One observed trend that might be considered to be a natural disturbance is drought. During field sampling, Burro Spring was dry and Bender Spring only contained a small amount of water at the bottom of a small well-like hole (of possible aboriginal excavation). It is not known whether this is a historic seasonal trend of the Sand Tank Mountain springs, or whether the continuing drought in southern Arizona is drying out these natural springs.

Landscape Context

The study area's *Desert Spring* community is a small patch community that is extremely limited in its geographic range. This community's importance in terms of species biodiversity and providing water to wildlife is disproportionate to its geographic breadth.

Examples of the Desert Spring Community

Burro Spring in the East Tactical Range of the BMGR was dry when we visited. It also has been developed (Figure 46). Bender Spring is also developed, therefore we have no good examples of baseline conditions for this natural community.

Figure 46. Burro Spring in the East Tactical Range on the BMGR.

Mapping Methods and Biophysical Modeling Parameters

No biophysical modeling parameters are known to work for mapping the *Desert Spring* community. The *Desert Spring* locations were determined by field surveillance prior to our involvement in this project.

Tinajas

Ecological Characteristics

Description and Composition

Tinajas are small aquatic ecosystems formed through water accumulation in bedrock depressions (Hall, 2001). Due to the restrictive nature of bedrock exposures, vegetation is typically absent or sparsely present in a *Tinaja*. *Tinajas* can be important water sources for desert wildlife.

Structure

Tinajas form in canyons, caves, and other places where bedrock depressions are protected from direct sun exposure throughout much of the year. The bedrock topography is the defining structural element of a *Tinaja*, as there is typically no vegetative canopy.

Function and Disturbance Processes

Tinajas are important landscape components due to their function as a potential water source in the arid desert environment. As with the Desert Spring community, *Tinajas* are sensitive to regional and local climate change. Drought is a natural process that can severely impact *Tinajas*.

Landscape Context

Most of the *Tinajas* in the study area have been developed to create more extensive water catchments for wildlife or livestock use. There were six *Tinajas* in the study area according to a GIS data layer provided by TNC, and they all occur in the Sand Tank Mountains on both the SDNM and BMGR. Three of these *Tinajas* appear to have been replaced by developed reservoirs (tanks). Phase 2 fieldwork revealed another undeveloped *tinaja* in the study area that was not accounted for in the GIS layer.

Examples of Tinajas

The best example of an undeveloped *Tinaja* was found near Bender Spring, in Bender Canyon (Figure 47). This *tinaja* has not been developed, though there is a road near by and considerable evidence of historical human presence in the area.

Figure 47. Tinaja in Bender Canyon.

Mapping Methods and Biophysical Modeling Parameters

No biophysical modeling parameters are known to work for mapping *Tinajas*. *Tinaja* locations were determined by field surveillance prior to our involvement in this project.

APPENDIX B
LIST OF PLANTS FOUND IN STUDY AREA

Exotic	Scientific Name	Code	Family	Authority	Growth Form	Common Name
	Abutilon incanum	ABUINC	Malvaceae	(Link) Sweet	shrub	
	Acacia constricta	ACACON	Fabaceae	Benth.	shrub	whitethorn acacia
	Acacia greggii	ACAGRE	Fabaceae	Gray	shrub	catclaw acacia
	Acleisanthes longiflora	ACLLON	Nyctaginaceae	Gray	herb	
	Acourtia nana	ACONAN	Asteraceae	(Gray) Reveal & King	herb	desert-holly
	Acourtia wrightii	ACOWRI	Asteraceae	(Gray) Reveal & King	herb	
	Adenophyllum porophylloides	ADEPOR	Asteraceae	(Gray) Strother	shrub	
	Agave deserti simplex	AGADES	Agavaceae	Engelm.	shrub	desert agave
	Allionia incarnata	ALLINC	Nyctaginaceae	L.	herb	
	Allium macropetalum	ALLMAC	Liliaceae	Rydb.	herb	
	Aloysia wrightii	ALOWRI	Verbeneaceae	Heller ex Abrams	shrub	little oregano
	Amaranthus albus	AMAALB	Amaranthaceae	L.	herb	
	Amaranthus crassipes	AMACRA	Amaranthaceae	Schlecht.	herb	
	Ambrosia ambrosioides	AMBAMB	Asteraceae	(Cav.) Payne	herb	canyon ragweed
	Ambrosia confertiflora	AMBCON	Asteraceae	DC.	herb	
	Ambrosia deltoidea	AMBDEL	Asteraceae	(Torr.) Payne	shrub	triangle-leaved bursage
	Ambrosia dumosa	AMBDUM	Asteraceae	(Gray) Payne	shrub	white bursage
	Amsinckia intermedia	AMSINT	Boraginaceae	Fisch. & C.A. Mey.	herb	fiddleneck
	Amsinckia tessellata	AMSTES	Boraginaceae	Gray	herb	
	Androsace occidentalis	ANDOCC	Primulaceae	Pursh	herb	
	Anisacanthus thurberi	ANITHU	Acanthaceae	(Torr.) Gray	shrub	
	Antirrhinum cyathiferum	ANTCYA	Scrophulariaceae	Benth.	herb	
	Antirrhinum filipes	ANTFIL	Scrophulariaceae	Gray	vine	
	Arabis perennans	ARAPER	Brassicaceae	S. Wats.	herb	
	Argemone pleiacantha	ARGPLE	Papaveraceae	Greene	herb	southwest prickly poppy
	Aristida adscensionis	ARIADS	Poaceae	L.	grass	
	Aristida parishii	ARIPAR	Poaceae	A.S. Hitchc.	grass	
	Aristida purpurea	ARIPUR	Poaceae	Nutt.	grass	
	Aristida ternipes var. ternipes	ARITER	Poaceae	Cav.	grass	
	Aristolochia watsonii	ARIWAT	Aristolochiaceae	Woot. & Standl.	herb	
	Artemisia ludoviciana	ARTLUD	Asteraceae	Nutt.	shrub	
	Asclepias subulata	ASCSUB	Asclepidaceae	Dcne.	vine	
	Astragalus arizonicus	ASTARI	Fabaceae	Gray	herb	
	Astragalus nuttallianus	ATRNUT	Fabaceae	DC.	herb	
	Astrolepis cochisensis	ASTCOC	Pteridaceae	(Goodding) Benham & Windham	fern	scaly star fern
	Astrolepis sinuata sinuata	ASTSIN	Pteridaceae	(Lag. ex Sw.) Benham & Windham	fern	wavy star fern
	Atriplex canescens	ATRCAN	Chenopodiaceae	(Pursh) Nutt.	shrub	four-wing saltbush
	Atriplex elegans	ATRELE	Cheonopodiaceae	(Moq.) D. Dietr.	herb	
@	*Avena fatua*	AVEFAT	Poaceae	L.	grass	wild oat
	Ayenia filiformis	AYEFIL	Sterculiaceae	S. Wats.	shrub	

	Ayenia microphylla	AYEMIC	Sterculiaceae	Gray	shrub	
	Baccharis salicifolia	BACSAL	Asteraceae	(Ruiz & Pavón) Pers.	shrub	
	Baccharis sarothroides	BACSAR	Asteraceae	Gray	shrub	desertbroom
	Bebbia juncea aspera	BEBJUN	Asteraceae	(Benth.) Greene	shrub	sweetbush
	Bernardia incana	BERINC	Euphorbiaceae	Morton	shrub	
	Boerhavia coccinea	BOECOC	Nyctaginaceae	P. Mill.	herb	
	Boerhavia wrightii	BOEWRI	Nyctaginaceae	Gray	shrub	
	Bouteloua aristidoides	BOUARI	Poaceae	(Kunth) Griseb.	grass	
	Bouteloua curtipendula	BOUCUR	Poaceae	(Michx.) Torr.	grass	
	Bouteloua repens	BOUREP	Poaceae	(Kunth) Scribn. & Merr.	grass	
	Bowlesia incana	BOWINC	Apiaceae	Ruiz & Pavón	herb	
@	*Brassica tournefortii*	BRATOU	Brassicaceae	Gouan	herb	Sahara mustard
	Brickellia atractyloides	BRIATR	Asteraceae	Gray	shrub	
	Brickellia coulteri	BRICOU	Asteraceae	Gray	shrub	Coulter's brickellbush
	Brickellia frutescens	BRIFRU	Asteraceae	Gray	shrub	
@	*Bromus carinatus*	BROCAR	Poaceae	Hook. & Arn.	grass	California brome
@	*Bromus rubens*	BRORUB	Poaceae	L.	grass	red brome
	Calandrinia ciliata	CALCIL	Portulacaceae	(Ruiz & Pavón) DC.	herb	
	Calliandra eriophylla	CALERI	Fabaceae	Benth.	shrub	fairyduster
	Calochortus kennedyi	CALKEN	Liliaceae	Porter	herb	mariposa lily
	Calycoseris parryi	CALPAR	Asteraceae	Gray	herb	
	Calycoseris wrightii	CALWRI	Asteraceae	Gray	herb	tack stem
	Camissonia boothii ssp condensata	CAMBOO	Onograceae	(Dougl. ex Lehm.) Raven	herb	
	Camissonia californica	CAMCAL	Onograceae	(Nutt. ex Torr. & Gray) Raven	herb	
	Camissonia chamaenerioides	CAMCHA	Onograceae	(Gray) Raven	herb	
	Camissonia claviformis	CAMCLA	Onograceae	(Torr. & Frém.) Raven	herb	
	Canotia holacantha	CANHOL	Celastraceae	Torr.	shrub	canotia crucifixion thorn
	Carlowrightia arizonica	CARARI	Acanthaceae	Gray	shrub	
	Carnegiea gigantea	CARGIG	Cactaceae	(Engelm.) Britton & Rose	cactus	saguaro
	Castela emoryi	CASEMO	Simaroubaceae	(Gray) Moran & Felger	shrub	castela crucifixion thorn
	Castilleja exserta ssp. Exserta	CASEXS	Scrophulariaceae	(Heller) Chuang & Heckard	herb	
	Castilleja lanata	CASLAN	Scrophulariaceae	Gray	herb	
	Caulanthus lasiophyllus	CAULAS	Brassicaceae	(Hook. & Arn.) Payson	herb	
	Celtis pallida	CELPAL	Ulmaceae	Torr.	shrub	spiny hackberry
	Chaenactis carphoclinia	CHACAR	Asteraceae	Gray	herb	
	Chaenactis stevioides	CHASTE	Asteraceae	Hook. & Arn.	herb	
	Cheilanthes parryi	CHEPAR	Pteridaceae	(D.C. Eat.) Domin	fern	
	Cheilanthes villosa	CHEVIL	Pteridaceae	Davenport ex Maxon	fern	
	Cheilanthes yavapensis	CHEYAV	Pteridaceae	Reeves ex Windham	fern	
@	*Chenopodium murale*	CHEMUR	Cheonopodiaceae	L.	herb	nettleleaf goosefoot
	Chenopodium neomexicanum	CHENEO	Cheonopodiaceae	Standl.	herb	
	Chenopodium pratericola	CHEPRA	Chenopodiaceae	Rydb.	herb	
	Chilopsis linearis arcuata	CHILIN	Bignoniaceae	(Cav.) Sweet	shrub	desert willow
	Chorizanthe brevicornu	CHOBRE	Polygonaceae	Torr.	herb	brittle spine flower
	Chorizanthe rigida	CHORIG	Polygonaceae	(Torr.) Torr. & Gray	herb	rigid spine-flower
	Cirsium neomexicanum	CIRNEO	Asteraceae	Gray	herb	

	Clematis drummondii	CLEDRU	Ranunculaceae	Torr. & Gray	vine	clematis
	Commicarpus scandens	COMSCA	Nyctaginaceae	(L.) Standl.	vine	
	Condalia warnockii	CONWAR	Rhamnaceae	M.C. Johnston	shrub	
@	*Conyza canadensis*	CONCAN	Asteraceae	(L.) Cronq.	herb	Canadian horseweed
	Conyza coulteri	CONCOU	Asteraceae	Gray	herb	
	Coursetia glandulosa	COUGLA	Fabaceae	Gray	shrub	
	Crassula connata	CRACON	Crassulaceae	(Ruiz & Pavón) Berger	herb	
	Crossosoma bigelovii	CROBIG	Crossosmataceae	S. Wats.	shrub	
	Cryptantha angustifolia	CRYANG	Boraginaceae	(Torr.) Greene	herb	
	Cryptantha barbigera	CRYBAR	Boraginaceae	(Gray) Greene	herb	
	Cryptantha maritima	CRYMAR	Boraginaceae	(Greene) Greene	herb	
	Cryptantha micrantha	CRYMIC	Boraginaceae	(Torr.) I.M. Johnston	herb	
	Cryptantha pterocarya	CRYPTE	Boraginaceae	(Torr.) Greene	herb	
	Cucurbita digitata	CUCDIG	Cucurbidaceae	Gray	vine	
	Cylindropuntia acanthocarpa	CYLACA	Cactaceae	(Engelm. & Bigelow) Knuth	cactus	buckhorn cholla
	Cylindropuntia bigelovii	CYLBIG	Cactaceae	(Engelm.) Knuth	cactus	teddybear cholla
	Cylindropuntia fulgida	CYLFUL	Cactaceae	(Engelm.) Knuth	cactus	chainfruit cholla
	Cylindropuntia spinosior	CYLSPI	Cactaceae	(Engelm.) Knuth	cactus	cane cholla
	Cylindropuntiaa leptocaulis	CYLLEP	Cactaceae	(DC) Knuth	cactus	Christmas cholla
@	*Cynodon dactylon*	CYNDAC	Poaceae	(L.) Pers.	grass	Bermuda grass
	Dalea mollissima	DALMOL	Fabaceae	(Rydb.) Munz	herb	
	Datura discolor	DATDIS	Solanaceae	Bernh.	herb	
	Daucus pusillus	DAUPUS	Apiaceae	Michx.	herb	indian carrot
	Delphinium scaposum	DELSCA	Scrophulariaceae	Greene	herb	
	Descurainia pinnata	DESPIN	Brassicaceae	(Walt.) Britt.	herb	
	Dichelostemma capitatum ssp. Pauciflorum	DICCAP	Linaceae	(Benth.) Wood	herb	
	Digitaria californica	DIGCAL	Poaceae	(Benth.) Henr.	grass	
	Ditaxis adenophora	DITADE	Euphorbiaceae	auct. non (Gray) Pax & K. Hoffman	herb	
	Ditaxis lanceolata	DIXLAN	Euphorbiaceae	(Benth.) Pax & K. Hoffmann	shrub	
	Ditaxis neomexicana	DIXNEO	Euphorbiaceae	(Muell.-Arg.) Heller	herb	
	Draba cuneifolia	DRACUN	Brassicaceae	Nutt. ex Torr. & Gray	herb	
	Dudleya arizonica	DUDARI	Crassulaceae	Rose	herb	
	Echinocereus engelmannii	ECHENG	Cactaceae	(Parry ex Engelm.) Lem.	cactus	Engelmann's hedgehog
	Elymus elymoides	ELYELY	Poaceae	(Raf.) Swezey	grass	
	Encelia farinosa farinosa	ENCFAR	Asteraceae	Gray ex Torr.	shrub	brittlebush
	Ephedra aspera	EPHASP	Ephedraceae	Engelm. ex S. Wats.	shrub	boundary ephedra
@	*Eragrostis lehmanniana*	ERALEH	Poaceae	Nees	grass	Lehmann lovegrass
	Eriastrum diffusum	ERIDIF	Polemoniaceae	(Gray) Mason	herb	
	Ericameria laricifolia	ERILAR	Asteraceae	(Gray) Shinners	shrub	
	Erigeron divergens	ERIDIV	Asteraceae	Torr. & Gray	herb	fleabane
	Eriogonum abertianum	ERIABE	Polygonaceae	Torr.	herb	
	Eriogonum deflexum	ERIDEF	Polygonaceae	Torr.	herb	
	Eriogonum fasciculatum	EPIFAS	Polygonaceae	Benth.	shrub	
	Eriogonum inflatum	ERIINF	Polygonaceae	Torr. & Frém.	herb	
	Eriogonum maculatum	ERIMAC	Polygonaceae	Heller	herb	

	Eriogonum thomasii	ERITHO	Polygonaceae	Torr.	herb	
	Eriogonum trichopes	ERITRI	Polygonaceae	Torr.	herb	
	Eriogonum wrightii	ERIWRI	Polygonaceae	Torr. ex Benth.	shrub	
	Erioneuron pulchellum	ERIPUL	Poaceae	(Kunth) Tateoka	grass	fluff-grass
	Eriophyllum lanosum	ERILAN	Polygonaceae	(Gray) Gray	herb	
@	*Erodium cicutarium*	EROCIC	Geraniaceae	(L.) L'Hér. ex Ait.	herb	filaree
	Erodium texanum	EROTEX	Geraniaceae	Gray	herb	false filaree
	Eschscholzia mexicana	ESCMEX	Papaveraceae	Greene	herb	Mexican gold poppy
	Eucrypta chrysanthemifolia	EUCCHR	Hydrophyllaceae	(Benth.) Greene	herb	
	Eucrypta micrantha	EUCMIC	Hydrophyllaceae	(Torr.) Heller	herb	
	Euphorbia albomarginata	CHAALB	Euphorbiaceae	Torr. & Gray	herb	
	Euphorbia arizonica	EUPARI	Euphorbiaceae	Engelm.	herb	
	Euphorbia capitellata	EUPCAP	Euphorbiaceae	Engelm.	herb	
	Euphorbia eriantha	EUPERI	Euphorbiaceae	Benth.	herb	
	Euphorbia melanadenia	EUPMEL	Euphorbiaceae	Torr.	herb	
	Euphorbia pediculifera	CHAPED	Euphorbiaceae	Engelm.	herb	
	Euphorbia polycarpa	CHAPOL	Euphorbiaceae	Benth.	herb	
	Euphorbia setiloba	CHASET	Euphorbiaceae	Engelm. ex Torr.	herb	
	Evax multicaulis	EVAMUT	Asteraceae	DC.	herb	
	Evax verna	EVAVER	Asteraceae	Raf.	herb	
	Fagonia californica ssp longipes	FAGLAE	Zygophyllaceae	Benth.	shrub	California fagonbush
	Ferocactus cylindraceus	FERCYL	Cactaceae	(Engelm.) Orcutt	cactus	mountain barrel cactus
	Ferocactus emoryi	FEREMO	Cactaceae	(Engelm.) Orcutt	cactus	barrel cactus
	Ferocactus wislizeni	FERWIS	Cactaceae	(Engelm.) Britt. & Rose	cactus	fishhook barrelcactus
	Filago arizonica	FILARI	Asteraceae	Gray	herb	
	Filago californica	FILCAL	Asteraceae	Nutt.	herb	
	Filago depressa	FILDEP	Asteraceae	Gray	herb	
	Filago verna	FILVER	Asteraceae	(Raf.) Shinners	herb	
	Forestiera phillyreoides	FORPHI	Oleaceae	(Benth.) Torr.	shrub	desert olive
	Fouquieria splendens	FOUSPL	Fouquieraceae	Engelm.	shrub	ocotillo
	Gaillardia arizonica	GAIARI	Asteraceae	Gray	herb	
	Galactia wrightii	GALWRI	Fabaceae	Gray	vine	
	Galium aparine	GALAPA	Rubiaceae	L.	vine	
	Galium stellatum	GALSTE	Rubiaceae	Kellogg	shrub	
	Gilia flavocincta	GILFLA	Polemoniaceae	A. Nels.	herb	
	Gilia stellata	GILSTE	Polemoniaceae	Heller	herb	
	Grusonia parishii	GROPAR	Cactaceae	(Orcutt) Pinkava	cactus	
	Gutierrezia arizonica	GUTARI	Asteraceae	(Gray) M.A. Lane	herb	
	Gutierrezia sarothrae	GUTSAR	Asteraceae	(Pursh) Britt. & Rusby	shrub	broom snakeweed
	Gymnosperma glutinosum	GYMGLU	Asteraceae	(Spreng.) Less.	shrub	
	Hedeoma nana ssp. macrocalyx	HEDNAN	Lamiaceae	(Torr.) Briq.	herb	
	Herissantia crispa	HERCRI	Malvaceae	(L.) Briz.	herb	
	Herniaria cinerea	HERCIN	Caryophyllaceae	DC.	herb	
	Heteropogon contortus	HETCON	Poaceae	(L.) Beauv. ex Roemer & J.A. Schultes	grass	

	Hibiscus coulteri	HIBCOU	Malvaceae	Harvey ex Gray	shrub	
	Hibiscus denudatus	HIBDEN	Malvaceae	Benth.	shrub	
@	*Hordeum murinum*	HORMUR	Poaceae	L.	grass	mouse barley
@	*Hordeum pusillum*	HORPUS	Poaceae	Nutt.	grass	little barley
	Horsfordia newberryi	HORNEW	Malvaceae	(S. Wats.) Gray	shrub	
	Hybanthus verticillatus var. verticillatus	HYBVER	Violaceae	(Ortega) Baill.	herb	
	Hymenoclea salsola	HYMSAL	Asteraceae	Torr. & Gray ex Gray	shrub	cheesebush
	Hyptis emoryi	HYPEMO	Lamiaceae	Torr.	shrub	desert lavender
	Isocoma acradenia	ISOACR	Asteraceae	(Greene) Greene	shrub	alkali jimmyweed
	Janusia gracilis	JANGRA	Malpighiaceae	Gray	vine	Janusia
	Jatropha cardiophylla	JATCAR	Euphorbiaceae	(Torr.) Muell.-Arg.	shrub	limberbush
	Justicia longii	JUSLON	Acanthaceae	Hillsenbeck	shrub	
	Keckiella antirrhinoides	KECANT	Scrophulariaceae	(Benth.) Straw	shrub	
	Koeberlinia spinosa	KOESPI	Koeberliniaceae	Zucc.	shrub	allthorn
	Krameria erecta	KRAERE	Krameriaceae	Willd. ex J.A. Schultes	shrub	range ratany
	Krameria grayi	KRAGRA	Krameriaceae	Rose & Painter	shrub	white ratany
	Lactuca serriola	LACSER	Asteraceae	L.	herb	prickly lettuce
	Langloisia setosissima ssp. Setosissima	LANSET	Polemoniaceae	(Torr. & Gray ex Torr.) Greene	herb	
	Lappula occidentalis	LAPOCC	Boraginaceae	(S. Wats.) Greene	herb	
	Lappula texana	LAPTEX	Boraginaceae	(Scheele) Britt.	herb	
	Larrea divaricata tridentata	LARDIV	Zygophyllaceae	(DC.) Felger & Lowe	shrub	creosotebush
	Lepidium lasiocarpum	LEPLAS	Brassicaeae	Nutt.	herb	pepper grass
	Leptochloa panicea ssp. brachiata	HEPPAN	Poaceae	(Retzius) Ohwi (Steudel) N. Snow	grass	
	Lesquerella gordonii	LESGOR	Brassicaeae	(Gray) S. Wats.	herb	bladderpod
	Lesquerella tenella	LESTEN	Brassicaeae	A. Nels.	herb	
	Linanthus bigelovii	LINBIG	Polemoniaceae	(Gray) Greene	herb	
	Linanthus jonesii	LINJON	Polemoniaceae	(Gray) Greene	herb	
	Linum perenne ssp lewisii	LINPER	Linaceae	L.	herb	Flax
	Loeflingia squarrosa ssp. Cactorum	LOESQU	Caryophyllaceae	Nutt.	herb	
	Lotus rigidus	LOTRIG	Fabaceae	(Benth.) Greene	herb	
	Lotus salsuginosus	LOTSAL	Fabaceae	Greene	herb	
	Lotus strigosus v. tomentellus	LOTSTR	Fabaceae	(Nutt.) Greene	herb	
	Lupinus Arizonicus	LUPARI	Fabaceae	(S. Wats.) S. Wats.	herb	
	Lupinus concinnus	LUPCON	Fabaceae	J.G. Agardh	herb	
	Lupinus sparsiflorus	LUPSPA	Fabaceae	Benth.	herb	
	Lycium andersonii	LYCAND	Solanaceae	Gray	shrub	desert wolfberry
	Lycium berlandieri	LYCBER	Solanaceae	Dunal	shrub	Berlandier's wolfberry
	Lycium exsertum	LYCEXS	Solanaceae	Gray	shrub	Arizona desertthorn
	Lycium fremontii	LYCFRE	Solanaceae	Gray	shrub	
	Lycium macrodon	LYCMAC	Solanaceae	Gray	shrub	
	Lycium parishii	LYCPAR	Solanaceae	Gray	shrub	Parish's desertthorn
	Lyrocarpa coulteri	LYRCOU	Brassicaceae	Hook. & Harvey ex Harvey	vine	banana scent vine
	Machaeranthera pinnatifida gooddingii	MACPIN	Asteraceae	(Hook.) Shinners	shrub	
	Machaeranthera tagetina	MACTAG	Asteraceae	Greene	herb	

	Malacothrix coulteri	MALCOU	Asteraceae	Harvey & Gray	herb	
	Malacothrix fendleri	MALFEN	Asteraceae	Gray	herb	desert dandelion
	Malacothrix sonorae	MALSON	Asteraceae	W.S. Davis & Raven	herb	
	Malacothrix stebbinsii	MALSTE	Asteraceae	W.S. Davis & Raven	herb	
@	*Malva parviflora*	MALPAR	Malvaceae	L.	herb	cheeseweed
	Malvastrum bicuspidatum	MALBIC	Malvaceae	(S. Wats.) Rose	herb	
	Malvella sagittifolia	MAVSAG	Malvaceae	(Gray) Fryxell	herb	
	Mammillaria grahamii	MAMGRA	Cactaceae	Engelm.	cactus	pincushion cactus
	Mammillaria tetrancistra	MAMTET	Cactaceae	Engelm.	cactus	
	Marina parryi	MARPAR	Fabaceae	(Torr. & Gray) Barneby	herb	
	Matelea parvifolia	MATPAR	Asclepiadaceae	(Torr.) Woods.	vine	
	Matricaria discoidea	MATDIS	Asteraceae	DC.	herb	pineapple weed
	Maurandya antirrhiniflora	MAUANT	Scrophulariaceae	Humb. & Bonpl. ex Willd.	vine	
	Menodora scabra	MENSCA	Oleaceae	Gray	shrub	
	Mentzelia affinis	MENAFF	Loasaceae	Greene	herb	
	Mentzelia involucrata	MENINV	Loasaceae	S. Wats.	herb	
	Mentzelia puberula	MENPUB	Loasaceae	J. Darl.	herb	
	Metastelma arizonicum	METARI	Asclepiadaceae	Gray	vine	
	Mirabilis laevis var. villosa	MIRBIG	Nyctaginaceae	R. Spellenberg & S.R. Rodriguez	shrub	
	Monolepis nuttalliana	MONNUT	Chenopodiaceae	(J.A. Schultes) Greene	herb	
	Monoptilon bellioides	MONBEL	Asteraceae	(Gray) Hall	herb	
	Muhlenbergia microsperma	MUHMIC	Poaceae	(DC.) Trin.	grass	
	Muhlenbergia porteri	MUHPOR	Poaceae	Scribn. ex Beal	grass	
	Myosurus cupulatus	MYOCUP	Ranunculaceae	S. Wats.	herb	
	Nama hispidum	NAMHIS	Hydrophyllaceae	Gray	herb	
	Nemacladus glanduliferus var. orientalis	NEMGLA	Campanulaceae	Jepson	herb	
	Nicotiana obtusifolia	NICOBT	Solanaceae	Mertens & Galeotti	herb	coyote tobacco
	Nissolia schottii	NISSCH	Fabaceae	(Torr.) Gray	vine	
	Nolina microcarpa	NOLMIC	Agavaceae	S. Wats.	shrub	
	Notholaena standleyi	NOTSTA	Pteridaceae	Maxon	fern	star cloak-fern
	Oenothera primiveris	OENPRI	Onagraceae	Gray	herb	evening primrose
	Oligomeris linifolia	OLILIN	Resedaceae	(Vahl) J.F. Macbr.	herb	
	Olneya tesota	OLNTES	Fabaceae	Gray	tree	desert ironwood
	Opuntia chlorotica	OPUCHL	Cactaceae	Engelm. & Bigelow	cactus	pancake prickly-pear
	Opuntia engelmannii	OPUENG	Cactaceae	Salm-Dyck	cactus	Engelmann's prickly pear
	Opuntia phaeacantha	OPUPHA	Cactaceae	Engelm.	cactus	brown-spine prickly pear
	Orobanche cooperi	OROCOO	Orobanchaceae	(Gray) Heller	herb	
	Orthocarpus purpurascens	ORTPUR	Scrophulariaceae	Benth.	herb	
	Parietaria floridana	PARFLO2	Urticaceae	Nutt.	herb	
	Parkinsonia florida	PARFLO	Fabaceae	(Benth. ex Gray) S. Wats.	tree	blue paloverde
	Parkinsonia microphylla	PARMIC	Fabaceae	Torr.	tree	foothill paloverde
	Pectocarya platycarpa	PECPLA	Boraginaceae	(Munz & Johnston) Munz & Johnston	herb	
	Pectocarya recurvata	PECREC	Boraginaceae	I.M. Johnston	herb	
	Pellaea truncata	PELTRU	Pteridaceae	Goodding	fern	

	Peniocereus greggii	PENGRE	Cactaceae	(Engelm.) Britt. & Rose	cactus	night blooming cereus
@	*Pennisetum ciliare*	PENCIL	Poaceae	(L.) Link	grass	buffelgrass
	Penstemon parryi	PENPAR	Scrophulariaceae	(Gray) Gray	herb	
	Penstemon pseudospectabilis	PENPSE	Scrophulariaceae	M.E. Jones	herb	
	Perityle emoryi	PEREMO	Asteraceae	Torr.	herb	Emory's rock daisy
	Petalonyx thurberi	PETTHU	Losaceae	Gray	shrub	
	Phacelia ambigua	PHAAMB	Hydrophyllaceae	M.E. Jones	herb	
	Phacelia coerulea	PHACOE	Hydrophyllaceae	Greene [orthographic variant]	herb	
	Phacelia distans	PHADIS	Hydrophyllaceae	Benth.	herb	
@	*Phalaris minor*	PHAMIN	Poaceae	Retz.	grass	canary grass
	Phaseolus filiformis	PHAFIL	Fabaceae	Benth.	vine	
	Pholistoma auritum var arizonicum	PHOAUR	Hydrophyllaceae	(Lindl.) Lilja	herb	
	Phoradendron californicum	PHOCAL	Viscaceae	Nutt.	tree	mistletoe
	Physalis crassifolia	PHYCRA	Solanaceae	Benth.	shrub	
	Physalis lobata	PHYLOB	Solanaceae	Torr.	herb	ground cherry
	Plagiobothrys arizonicus	PLAARI	Boraginaceae	(Gray) Greene ex Gray	herb	
	Plagiobothrys jonesii	PLAJON	Boraginaceae	Gray	herb	
	Plantago ovata	PLAOVA	Plantaginaceae	Forsk.	herb	
	Plantago patagonica	PLAPAT	Plantaginaceae	Jacq.	herb	
	Plantago rhodosperma	PLAROD	Plantaginaceae	Dcne.	herb	
	Pleuraphis mutica	PLEMUT	Poaceae	Buckl.	grass	tobosa grass
	Pleuraphis rigida	PELRIG	Poaceae	Thurb.	grass	big galleta
	Poa bigelovii	POABIG	Poaceae	Vasey & Scribn.	grass	
	Polygala macradenia	POLMAC	Polygalaceae	Gray	shrub	
	Porophyllum gracile	PORGRA	Asteraceae	Benth.	shrub	odora
	Prosopis velutina	PROVEL	Fabaceae	Woot.	tree	velvet mesquite
	Psilostrophe cooperi	PSICOO	Asteraceae	(Gray) Greene	shrub	
	Psorothamnus spinosus	PSOSPI	Fabaceae	(Gray) Barneby	tree	smoke tree
	Quercus turbinella	QUETUR	Fagaceae	Greene	tree	Oak
	Rafinesquia californica	RAFCAL	Asteraceae	Nutt.	herb	
	Rafinesquia neomexicana	RAFNEO	Asteraceae	Gray	herb	desert chicory
	Rhynchosia senna var. texana	RHYSEN	Fabaceae	Gillies ex Hook.	vine	
	Rhynchosia texana	RHYTEX	Fabaceae	Torr. & Gray	vine	rosary bean
@	*Salsola tragus*	SALTRA	Chenopodiaceae	L.	herb	russian thistle
	Salvia columbariae	SALCOL	Lamiaceae	Benth.	herb	Chia
	Salvia pinguifolia	SALPIN	Lamiaceae	(Fern.) Woot. & Standl.	herb	
	Sarcostemma cynanchoides	SARSYN	Asclepidaceae	Dcne.	vine	
@	*Schismus arabicus*	SCHARA	Poaceae	Nees	grass	mediterranean grass
@	*Schismus barbatus*	SCHBAR	Poaceae	(Loefl. ex L.) Thellung	grass	mediterranean grass
	Sebastiania bilocularis	SEBBIL	Pteridaceae	S. Wats.	shrub	Mexican jumping bean
	Selaginella arizonica	SELARI	Pteridaceae	Maxon	club moss	arizona spike-moss
	Senecio lemmonii	SENLEM	Asteraceae	Gray	herb	
	Senna covesii	SENCOV	Fabaceae	(Gray) Irwin & Barneby	shrub	
	Silene antirrhina	SILANT	Caryophyllaceae	L.	herb	

	Simmondsia chinensis	SIMCHI	Simmadonsiaceae	(Link) Schneid.	shrub	jojoba
@	*Sisymbrium irio*	SISIRI	Brassicaeae	L.	herb	London rocket
@	*Sonchus oleraceus*	SONOLE	Asteraceae	L.	herb	cow thistle
	Spermolepis echinata	SPEECH	Apiaceae	(Nutt. ex DC.) Heller	herb	
	Sphaeralcea ambigua	SPHAMB	Malvaceae	Gray	herb	desert globemallow
	Sphaeralcea coulteri	SPHCOU	Malvaceae	(S. Wats.) Gray	herb	
	Sphaeralcea laxa	SPHLAX	Malvaceae	Woot. & Standl.	herb	
	Stephanomeria pauciflora	SPHPAU	Asteraceae	(Torr.) A. Nels.	herb	desert straw
	Streptanthus carinatus	STRCAR	Brassicaeae	C. Wright ex Gray	herb	
	Stylocline micropoides	STYMIC	Asteraceae	Gray	herb	
	Talinum auantiacum	TALAUA	Portulacaceae	Engelm.	shrub	
@	*Tamarix ramosissima*	TAMRAM	Tamaricaceae	Ledeb.	shrub	salt cedar, tamarisk
	Taraxacum	TARXXX	Asteraceae	G.H. Weber ex Wiggers	herb	dandelion
	Teucrium cubense ssp depressum	TEUCUB	Lamiaceae	Jacq.	herb	
	Teucrium glandulosum	TEUGLA	Lamiaceae	Kellogg	herb	
	Thymophylla pentachaeta	THYPEN	Asteraceae	(DC.) Small	shrub	
	Thysanocarpus curvipes	THYCUR	Brassicaeae	Hook.	herb	
	Tidestromia lanuginosa	TIDLAN	Amaranthaceae	(Nutt.) Standl.	shrub	
	Tiquilia canescens	TIQCAN	Boraginaceae	(DC.) A. Richards.	shrub	
	Tragia nepetifolia var dissecta	TRANEP	Euphorbiaceae	Cav.	shrub	
	Tridens muticus	TRIMUT	Poaceae	(Torr.) Nash	grass	
	Trifolium wormskioldii	TRIWOR	Fabaceae	Lehm.	herb	
	Trisetum interruptum	TRIINT	Poaceae	Buckl.	grass	
@	*Triticum aestivum*	TRIAES	Poaceae	L.	grass	common wheat
	Trixis californica	TRICAL	Asteraceae	Kellogg	shrub	California trixis
	Typha domingensis	TYPDOM	Typhaceae	Pers.	herb	southern cattail
	Uropappus lindleyi	UROLIN	Asteraceae	(DC.) Nutt.	herb	syn. Microseris lindleyi
	Vauquelinia californica ssp. Sonorensis	VAUCAL	Rosaceae	(Torr.) Sarg.	tree	Arizona rosewood
	Verbena bracteata	VERBRA	Verbenaceae	Lag. & Rodr.	herb	
	Verbena neomexicana	VERNEO	Verbenaceae	(Gray) Small	herb	
	Veronica peregrina ssp. xalapensis	VERPER	Verbenaceae	L.	herb	
	Vicia ludoviciana var. ludoviciana	VICLUD	Fabaceae	Nutt.	vine	
	Viguiera parishii	VIGPAR	Asteraceae	Greene	shrub	(V. deltoidea v parishii)
	Vulpia octoflora	VULOCT	Poaceae	(Walt.) Rydb.	grass	
	Yabea microcarpa	YABMIC	Apiaceae	(Hook. & Arn.) K.-Pol.	herb	
	Yucca baccata	YUCBAC	Liliaceae	Torr.	shrub	banana yucca
	Zinnia acerosa	ZINACE	Asteraceae	(DC.) Gray	shrub	
	Ziziphus obtusifolia canescens	ZIZOBT	Rhamnaceae	(Hook. ex Torr. & Gray) Gray	shrub	graythorn

Discrepancies in Spelling

In Database As:	Authority's Spelling:
Allium macropetalon	Allium macropetalum
Ambrosia confertifolia	Ambrosia confertiflora
Anisacathus thurberi	Anisacanthus thurberi
Aristida adsensionis	Aristida adscensionis
Brickellia atrostyloides	Brickellia atractyloides
Brickellia fructescens	Brickellia frutescens
Calocortus kennedeyi	Calochortus kennedyi
Carlowrightii arizonica	Carlowrightia arizonica
Celtis pallida pallida	Celtis pallida
Chenopodium neomexicana	Chenopodium neomexicanum
Chorizanthe brevicornus	Chorizanthe brevicornu
Cirsium neomexicana	Cirsium neomexicanum
Commicarpas scandens	Commicarpus scandens
Crossosma bigelovii	Crossosoma bigelovii
Descurania pinnata	Descurainia pinnata
Eriogonum fasiculatum	Eriogonum fasciculatum
Forestiera phillyreiodes	Forestiera phillyreoides
Gailardia arizonica	Gaillardia arizonica
Hedeona nanum var marocalyx	Hedeoma nana ssp. macrocalyx
Heptochloa panicea ssp. Brachiata	Leptochloa panicea ssp. brachiata
Janusia gracile	Janusia gracilis
Lactuca serrulata	Lactuca serriola
Lotus strigosa var tomentellum	Lotus strigosus v. tomentellus
Malocothrix coulteri	Malacothrix coulteri
Malocothrix fendleri	Malacothrix fendleri
Malocothrix sonoraae	Malacothrix sonorae
Malocothrix stebbinsi	Malacothrix stebbinsii
Maurandya antirrhinifolia	Maurandya antirrhiniflora
Mavella sagittiloba	Malvella sagittiloba
Nemacladus glanduliferous var. orienta	Nemacladus glanduliferus var. orientalis
Oenothera primaveris	Oenothera primiveris
Perityle emoryii	Perityle emoryi
Plantago rodosperma	Plantago rhodosperma
Poa bigeloviii	Poa bigelovii
Polygala macrodemia	Polygala macradenia
Talinum auantiacum Englemann	Talinum auantiacum
Thysanocarpis curvipes	Thysanocarpus curvipes
Veronica peregrina ssp xalapsis	Veronica peregrina ssp. xalapensis

APPENDIX C

Natural Community Composition and Structure

Sorted by Average % Cover

Creosotebush - Bursage Desert Scrub

(Summary Data Based on 87 Plots)

Scientific Name	Avg. % Cover	% Constancy
Structural Growth Form 1. Trees		
Prosopis velutina	1.46	28.7
Parkinsonia florida	0.61	9.2
Olneya tesota	0.28	9.2
Parkinsonia microphylla	0.07	8.0
Phoradendron californicum	0.04	4.6
Sum for Structure Class:	2.47	
Structural Growth Form 2. Shrubs		
Larrea divaricata tridentata	7.92	97.7
Ambrosia deltoidea	0.84	42.5
Krameria grayi	0.13	12.6
Fouquieria splendens	0.10	6.9
Ambrosia dumosa	0.09	12.6
Acacia constricta	0.05	8.0
Encelia farinosa farinosa	0.04	4.6
Baccharis sarothroides	0.03	1.1
Lycium	0.03	4.6
Acacia greggii	0.02	4.6
Ditaxis lanceolata	0.02	3.4
Lycium andersonii	0.01	4.6
Tamarix ramosissima	0.01	1.1
Krameria erecta	0.01	1.1
Senna covesii	0.01	3.4
Fagonia californica ssp longipes	0.01	2.3
Celtis pallida pallida	0.01	2.3
Yucca baccata	0.00	1.1
Hymenoclea salsola	0.00	1.1
Ziziphus obtusifolia canescens	0.00	1.1

Scientific Name	Avg. % Cover	% Constancy
Abutilon incanum	0.00	1.1
Physalis crassifolia	0.00	1.1
Boerhavia wrightii	0.00	1.1
Sum for Structure Class:	9.34	
Structural Growth Form 3. Cactus		
Cylindropuntia fulgida	0.16	5.7
Cylindropuntia acanthocarpa	0.11	19.5
Cylindropuntia bigelovii	0.05	3.4
Carnegiea gigantea	0.04	17.2
Cylindropuntia leptocaulis	0.02	3.4
Ferocactus	0.01	3.4
Ferocactus wislizeni	0.01	3.4
Mammillaria grahamii	0.01	2.3
Ferocactus emoryi	0.00	1.1
Echinocereus engelmannii	0.00	1.1
Grusonia parishii	0.00	1.1
Mammillaria	0.00	1.1
Echinocereus	0.00	1.1
Opuntia	0.00	1.1
Ferocactus cylindraceus	0.00	1.1
Sum for Structure Class:	0.43	
Structural Growth Form 4. Herbs		
Lepidium lasiocarpum	7.16	92.0
Plantago ovata	5.55	77.0
Erodium cicutarium	2.37	37.9
Pectocarya	1.78	34.5
Pectocarya platycarpa	1.35	21.8
Lesquerella gordonii	1.32	71.3
Pectocarya recurvata	1.07	11.5
Sisymbrium irio	0.94	16.1
Amsinckia intermedia	0.51	54.0
Erodium texanum	0.44	31.0
Caulanthus lasiophyllus	0.41	39.1

Scientific Name	Avg. % Cover	% Constancy
Cryptantha maritima	0.29	28.7
Chaenactis stevioides	0.26	39.1
Eriogonum thomasii	0.26	2.3
Eriophyllum lanosum	0.22	34.5
Chorizanthe brevicornus	0.22	34.5
Ambrosia ambrosioides	0.20	3.4
Chorizanthe rigida	0.19	39.1
Sphaeralcea coulteri	0.18	6.9
Cryptantha pterocarya	0.16	16.1
Amsinkia	0.14	17.2
Monoptilon bellioides	0.09	3.4
Brassica tournefortii	0.09	11.5
Cryptantha barbigera	0.09	6.9
Eriogonum deflexum	0.08	8.0
Phacelia	0.08	11.5
Nicotiana obtusifolia	0.07	4.6
Euphorbia polycarpa	0.07	3.4
Sphaeralcea	0.06	1.1
Verbena bracteata	0.05	2.3
Chaenactis carphoclinia	0.05	2.3
Astragalus nuttallianus	0.04	5.7
Euphorbia	0.04	4.6
Chenopodium murale	0.04	4.6
Phacelia ambigua	0.04	2.3
Teucrium cubense ssp depressum	0.04	2.3
Filago	0.03	5.7
Cryptantha	0.03	8.0
Descurania pinnata	0.03	8.0
Malva parviflora	0.03	4.6
Lupinus sparsiflorus	0.03	10.3
Camissonia chamaenerioides	0.03	6.9
Ditaxis neomexicana	0.03	3.4
Sonchus	0.03	3.4
Loeflingia squarrosa ssp.	0.03	2.3

Scientific Name	Avg. % Cover	% Constancy
Plagiobothrys	0.03	2.3
Monolepis nuttalliana	0.02	1.1
Draba cuneifolia	0.02	8.0
Sphaeralcea ambigua	0.02	4.6
Eriastrum diffusum	0.02	4.6
Cryptantha micrantha	0.02	4.6
Camissonia	0.02	6.9
Daucus pusillus	0.02	6.9
Astragalus	0.02	3.4
Amsinckia tessellata	0.02	3.4
Linanthus jonesii	0.01	5.7
Eucrypta micrantha	0.01	2.3
Eriogonum	0.01	2.3
Veronica peregrina ssp xalapsis	0.01	2.3
Gilia	0.01	4.6
Filago arizonica	0.01	4.6
Oligomeris linifolia	0.01	4.6
Datura discolor	0.01	1.1
Conyza canadensis	0.01	1.1
unknown herb 1	0.01	3.4
Lappula occidentalis	0.01	3.4
Rafinesquia neomexicana	0.01	2.3
Nama hispidum	0.01	2.3
Lotus salsuginosus	0.01	2.3
Lupinus	0.01	2.3
Herniaria cinerea	0.01	2.3
Chenopodium pratericola	0.01	2.3
Chenopodium neomexicana	0.01	2.3
Chenopodium	0.01	2.3
Stylocline micropoides	0.00	1.1
Plantago patagonica	0.00	1.1
Cirsium neomexicana	0.00	1.1
Salvia columbariae	0.00	1.1
Silene antirrhina	0.00	1.1

Scientific Name	Avg. % Cover	% Constancy
Sonchus oleraceus	0.00	1.1
Spermolepis echinata	0.00	1.1
Chaenactis	0.00	1.1
Conyza coulteri	0.00	1.1
Sphaeralcea laxa	0.00	1.1
Salsola tragus	0.00	1.1
Camissonia californica	0.00	1.1
Calycoseris wrightii	0.00	1.1
unknown herb 2	0.00	1.1
Uropappus lindleyi	0.00	1.1
Bowlesia incana	0.00	1.1
Ambrosia confertifolia	0.00	1.1
Gilia stellata	0.00	1.1
Castilleja exserta ssp. Exserta	0.00	1.1
Oenothera	0.00	1.1
Machaeranthera tagetina	0.00	1.1
Malocothrix	0.00	1.1
Linanthus bigelovii	0.00	1.1
Mentzelia affinis	0.00	1.1
Amaranthus albus	0.00	1.1
Silene	0.00	1.1
Filago depressa	0.00	1.1
Plantago	0.00	1.1
Oenothera primaveris	0.00	1.1
Evax multicaulis	0.00	1.1
Orthocarpus purpurascens	0.00	1.1
Phacelia coerulea	0.00	1.1
Eucrypta chrysanthemifolia	0.00	1.1
Eschscholzia mexicana	0.00	1.1
Penstemon parryi	0.00	1.1
Perityle emoryii	0.00	1.1
Eriogonum trichopes	0.00	1.1
Dalea mollissima	0.00	1.1
Nemacladus glanduliferous var.	0.00	1.1

Scientific Name	Avg. % Cover	% Constancy
Eriogonum abertianum	0.00	1.1
Euphorbia albomarginata	0.00	1.1
Sum for Structure Class:	26.70	
Structural Growth Form 5. Grasses		
Schismus arabicus	11.11	93.1
Pleuraphis mutica	0.34	4.6
Phalaris minor	0.09	1.1
Vulpia octoflora	0.07	12.6
Cynodon dactylon	0.05	2.3
Poa bigelovii	0.04	9.2
Erioneuron pulchellum	0.04	2.3
Muhlenbergia porteri	0.03	3.4
Eragrostis lehmanniana	0.01	1.1
Pleuraphis rigida	0.00	1.1
Aristida	0.00	1.1
Bromus rubens	0.00	1.1
Bromus	0.00	1.1
Heteropogon contortus	0.00	1.1
Bromus carinatus	0.00	1.1
Sum for Structure Class:	11.80	
Structural Growth Form 6. Vines		
Janusia gracile	0.00	1.1
Sum for Structure Class:	0.00	

Scientific Name	Avg. % Cover	% Constancy

Desert Grassland
(Summary Data Based on 13 Plots)

Structural Growth Form 1. Trees

Scientific Name	Avg. % Cover	% Constancy
Prosopis velutina	3.15	100.0
Sum for Structure Class:	3.15	

Structural Growth Form 2. Shrubs

Scientific Name	Avg. % Cover	% Constancy
Koeberlinia spinosa	0.08	7.7
Larrea divaricata tridentata	0.02	7.7
Lycium	0.02	7.7
Acacia constricta	0.02	7.7
Sum for Structure Class:	0.13	

Structural Growth Form 3. Cactus

Scientific Name	Avg. % Cover	% Constancy
Cylindropuntia	0.08	7.7
Grusonia parishii	0.06	23.1
Cylindropuntia spinosior	0.04	15.4
Cylindropuntia fulgida	0.02	7.7
Ferocactus	0.02	7.7
Sum for Structure Class:	0.21	

Structural Growth Form 4. Herbs

Scientific Name	Avg. % Cover	% Constancy
Lesquerella gordonii	9.69	100.0
Erodium cicutarium	6.54	100.0
Monolepis nuttalliana	2.12	84.6
Amsinkia	1.33	53.8
Plantago rodosperma	1.12	38.5
Plantago	1.00	38.5
Astragalus nuttallianus	0.62	46.2
Amsinckia tessellata	0.58	46.2
Plantago patagonica	0.56	38.5
Sphaeralcea coulteri	0.21	61.5
Chaenactis stevioides	0.19	53.8
Eriophyllum lanosum	0.17	46.2
Bowlesia incana	0.17	23.1

Scientific Name	Avg. % Cover	% Constancy
Calycoseris wrightii	0.13	30.8
Plantago ovata	0.13	30.8
Sisymbrium irio	0.12	23.1
Taraxacum	0.12	23.1
Erigeron divergens	0.10	15.4
Pectocarya platycarpa	0.08	7.7
Phacelia ambigua	0.06	23.1
Mavella sagittiloba	0.06	23.1
Malocothrix	0.06	23.1
Uropappus lindleyi	0.06	23.1
Cryptantha maritima	0.06	23.1
Atriplex elegans	0.04	15.4
Erodium texanum	0.04	15.4
Monoptilon bellioides	0.04	15.4
Mentzelia affinis	0.02	7.7
Astragalus	0.02	7.7
Camissonia chamaenerioides	0.02	7.7
Sonchus	0.02	7.7
Chenopodium	0.02	7.7
Chorizanthe brevicornus	0.02	7.7
Cryptantha angustifolia	0.02	7.7
Draba cuneifolia	0.02	7.7
Phacelia	0.02	7.7
Eriogonum deflexum	0.02	7.7
Linanthus jonesii	0.02	7.7
Lappula occidentalis	0.02	7.7
Descurania pinnata	0.02	7.7
Evax verna	0.02	7.7
Pectocarya	0.02	7.7
Euphorbia albomarginata	0.02	7.7
Malocothrix coulteri	0.02	7.7
Matricaria discoidea	0.02	7.7
Oligomeris linifolia	0.02	7.7
Argemone pleiacantha	0.02	7.7

Scientific Name	Avg. % Cover	% Constancy
Lepidium lasiocarpum	0.02	7.7
Lactuca	0.02	7.7
Malocothrix fendleri	0.02	7.7
Sum for Structure Class:	25.81	
Structural Growth Form 5. Grasses		
Pleuraphis mutica	15.23	100.0
Schismus arabicus	1.77	84.6
Pleuraphis rigida	0.02	7.7
Sum for Structure Class:	17.02	

Scientific Name	Avg. % Cover	% Constancy

Mesquite Woodland
(Summary Data Based on 13 Plots)

Scientific Name	Avg. % Cover	% Constancy
Structural Growth Form 1. Trees		
Prosopis velutina	49.92	100.0
Parkinsonia florida	1.10	30.8
Phoradendron californicum	0.31	15.4
Olneya tesota	0.02	7.7
Sum for Structure Class:	51.35	
Structural Growth Form 2. Shrubs		
Larrea divaricata tridentata	17.38	84.6
Ambrosia deltoidea	3.19	69.2
Lycium	1.67	46.2
Ambrosia dumosa	1.38	38.5
Lycium andersonii	0.37	30.8
Castela emoryi	0.04	15.4
Celtis pallida pallida	0.02	7.7
Sum for Structure Class:	24.06	
Structural Growth Form 3. Cactus		
Cylindropuntia leptocaulis	0.02	7.7
Ferocactus	0.02	7.7
Sum for Structure Class:	0.04	
Structural Growth Form 4. Herbs		
Erodium cicutarium	15.29	84.6
Sisymbrium irio	7.63	69.2
Filago arizonica	2.85	61.5
Amsinckia intermedia	2.52	76.9
Pectocarya platycarpa	2.25	30.8
Lesquerella gordonii	1.77	76.9
Bowlesia incana	1.35	46.2
Lepidium lasiocarpum	1.13	84.6
Herniaria cinerea	1.08	38.5
Sphaeralcea coulteri	0.87	61.5

Scientific Name	Avg. % Cover	% Constancy
Plantago ovata	0.85	61.5
Pectocarya	0.73	30.8
Allionia incarnata	0.54	15.4
Evax multicaulis	0.38	30.8
Daucus pusillus	0.37	38.5
Descurania pinnata	0.35	30.8
Plagiobothrys	0.19	30.8
Matricaria discoidea	0.15	15.4
Camissonia chamaenerioides	0.13	30.8
Erodium texanum	0.12	23.1
Cryptantha	0.12	23.1
unknown herb 1	0.10	15.4
Astragalus	0.10	15.4
Ambrosia confertifolia	0.10	15.4
Draba cuneifolia	0.08	30.8
Parietaria floridana	0.08	7.7
Eriophyllum lanosum	0.06	23.1
Sonchus oleraceus	0.04	15.4
Ambrosia ambrosioides	0.04	15.4
Crassula connata	0.04	15.4
Oenothera	0.04	15.4
Mentzelia	0.02	7.7
Lappula occidentalis	0.02	7.7
Brassica tournefortii	0.02	7.7
Uropappus lindleyi	0.02	7.7
Sum for Structure Class:	41.38	

Structural Growth Form 5. Grasses

Scientific Name	Avg. % Cover	% Constancy
Schismus arabicus	17.08	92.3
Muhlenbergia microsperma	10.33	46.2
Vulpia octoflora	0.19	23.1
Cynodon dactylon	0.10	15.4
Bromus	0.02	7.7
Poa bigelovii	0.02	7.7
Sum for Structure Class:	27.73	

Scientific Name	Avg. % Cover	% Constancy

Mountain Upland
(Summary Data Based on 36 Plots)

Structural Growth Form 1. Trees

Scientific Name	Avg. % Cover	% Constancy
Parkinsonia microphylla	0.94	38.9
Prosopis velutina	0.29	19.4
Vauquelinia californica ssp.	0.03	2.8
Quercus turbinella	0.01	2.8
Phoradendron californicum	0.01	2.8
Sum for Structure Class:	1.28	

Structural Growth Form 2. Shrubs

Scientific Name	Avg. % Cover	% Constancy
Canotia holacantha	3.85	69.4
Yucca baccata	3.05	63.9
Ephedra aspera	2.56	86.1
Viguiera parishii	1.69	66.7
Fouquieria splendens	1.66	75.0
Aloysia wrightii	1.35	47.2
Larrea divaricata tridentata	1.26	44.4
Lycium	1.25	61.1
Zinnia acerosa	1.05	38.9
Acacia constricta	0.94	36.1
Eriogonum fasiculatum	0.92	41.7
Tiquilia canescens	0.88	27.8
Acacia greggii	0.71	27.8
Gallium stellatum	0.54	33.3
Encelia farinosa farinosa	0.51	19.4
Celtis pallida pallida	0.51	16.7
Krameria grayi	0.47	33.3
Menodora scabra	0.45	44.4
Calliandra eriophylla	0.37	22.2
Eriogonum wrightii	0.31	13.9
Condalia warnockii	0.26	19.4
Krameria erecta	0.25	22.2
Artemisia ludoviciana	0.25	22.2

Scientific Name	Avg. % Cover	% Constancy
Agave deserti simplex	0.24	55.6
unknown shrub 1	0.24	16.7
Gutierrezia sarothrae	0.20	13.9
Bernardia incana	0.20	13.9
Ambrosia deltoidea	0.19	2.8
Psilostrophe cooperi	0.16	22.2
Gymnosperma glutinosum	0.11	8.3
Coursetia glandulosa	0.11	2.8
Trixis californica	0.10	22.2
Lycium berlandieri	0.09	5.6
Lycium exsertum	0.08	2.8
Koeberlinia spinosa	0.06	8.3
Ziziphus obtusifolia canescens	0.06	5.6
Carlowrightii arizonica	0.06	5.6
Ericameria laricifolia	0.06	5.6
Crossosma bigelovii	0.06	5.6
Ayenia microphylla	0.05	11.1
Brickellia coulteri	0.04	8.3
Jatropha cardiophylla	0.04	8.3
Porophyllum gracile	0.04	8.3
Atriplex canescens	0.03	5.6
Ditaxis lanceolata	0.03	5.6
Hibiscus coulteri	0.03	11.1
Hyptis emoryi	0.03	2.8
Bebbia juncea aspera	0.03	2.8
Keckiella antirrhinoides	0.03	2.8
Machaeranthera pinnatifida	0.01	5.6
Abutilon	0.01	2.8
Anisacathus thurberi	0.01	2.8
Mirabilis laevis v villosa	0.01	2.8
Forestiera phillyreiodes	0.01	2.8
Thymophylla pentachaeta	0.01	2.8
Abutilon incanum	0.01	2.8
Tragia nepetifolia var dissecta	0.01	2.8

Scientific Name	Avg. % Cover	% Constancy
Talinum auantiacum Englemann	0.01	2.8
Tidestromia lanuginosa	0.01	2.8
Sum for Structure Class:	27.53	
Structural Growth Form 3. Cactus		
Opuntia	1.79	36.1
Opuntia engelmannii	0.90	11.1
Opuntia chlorotica	0.44	11.1
Cylindropuntia acanthocarpa	0.36	52.8
Echinocereus engelmannii	0.27	36.1
Echinocereus	0.21	16.7
Carnegiea gigantea	0.10	22.2
Cylindropuntia leptocaulis	0.08	11.1
Ferocactus emoryi	0.05	19.4
Mammillaria grahamii	0.04	8.3
Opuntia phaeacantha	0.03	2.8
Mammillaria	0.01	2.8
Ferocactus cylindraceus	0.01	2.8
Sum for Structure Class:	4.27	
Structural Growth Form 4. Herbs		
Lepidium lasiocarpum	4.47	61.1
Phacelia coerulea	2.62	47.2
Cryptantha pterocarya	2.42	75.0
Phacelia distans	1.63	16.7
Lesquerella gordonii	1.54	36.1
Eschscholzia mexicana	1.51	11.1
Descurania pinnata	1.21	61.1
Plantago patagonica	0.94	38.9
Eucrypta micrantha	0.91	38.9
Amsinckia intermedia	0.88	38.9
Caulanthus lasiophyllus	0.60	30.6
Thysanocarpis curvipes	0.52	47.2
Pholistoma auritum var	0.47	22.2
Androsace occidentalis	0.45	27.8

Scientific Name	Avg. % Cover	% Constancy
Lappula texana	0.36	11.1
Erodium cicutarium	0.35	27.8
Sphaeralcea ambigua	0.31	44.4
Plantago ovata	0.30	19.4
Eriastrum diffusum	0.25	30.6
Lappula occidentalis	0.24	16.7
Chorizanthe brevicornus	0.21	8.3
Cryptantha maritima	0.20	5.6
Daucus pusillus	0.19	41.7
Phacelia	0.19	11.1
Draba cuneifolia	0.19	33.3
Eriogonum abertianum	0.17	25.0
Uropappus lindleyi	0.17	50.0
Rafinesquia neomexicana	0.15	33.3
Parietaria floridana	0.15	22.2
Plantago	0.14	5.6
Gutierrezia arizonica	0.14	5.6
Streptanthus carinatus	0.13	22.2
Acleisanthes longiflora	0.10	16.7
Acourtia nana	0.10	22.2
Calycoseris wrightii	0.08	16.7
Stephanomeria pauciflora	0.08	16.7
Phacelia ambigua	0.08	13.9
Pectocarya recurvata	0.08	13.9
Acourtia wrightii	0.08	13.9
Dichelostemma capitatum ssp.	0.07	27.8
Senecio lemmonii	0.07	19.4
Gilia	0.07	19.4
Stylocline micropoides	0.07	19.4
Delphinium scaposum	0.06	16.7
Eucrypta chrysanthemifolia	0.06	5.6
Amsinckia tessellata	0.06	2.8
Gilia flavocincta	0.06	2.8
Gilia stellata	0.05	19.4

Scientific Name	Avg. % Cover	% Constancy
Chaenactis stevioides	0.05	11.1
Chenopodium neomexicana	0.05	11.1
Sphaeralcea coulteri	0.04	8.3
Linanthus jonesii	0.03	13.9
Hedeona nanum var marocalyx	0.03	13.9
Teucrium glandulosum	0.03	5.6
Sisymbrium irio	0.03	5.6
Mentzelia	0.03	5.6
Myosurus cupulatus	0.03	5.6
Allium macropetalon	0.03	11.1
Eriophyllum lanosum	0.03	11.1
unknown herb 1	0.03	11.1
Yabea microcarpa	0.03	11.1
Silene antirrhina	0.03	11.1
Cryptantha barbigera	0.03	11.1
Rafinesquia californica	0.03	11.1
Verbena	0.03	2.8
Sphaeralcea laxa	0.03	2.8
Chenopodium murale	0.03	2.8
Castilleja lanata	0.02	8.3
Cirsium neomexicana	0.01	5.6
Astragalus nuttallianus	0.01	5.6
Erodium texanum	0.01	5.6
Euphorbia	0.01	5.6
Pectocarya	0.01	5.6
Pectocarya platycarpa	0.01	5.6
Lupinus	0.01	5.6
Euphorbia eriantha	0.01	5.6
Cryptantha	0.01	5.6
Filago	0.01	5.6
Filago arizonica	0.01	5.6
Sphaeralcea	0.01	2.8
Arabis perennans	0.01	2.8
Chaenactis	0.01	2.8

Scientific Name	Avg. % Cover	% Constancy
Camissonia californica	0.01	2.8
Camissonia	0.01	2.8
Calocortus kennedeyi	0.01	2.8
Bowlesia incana	0.01	2.8
Atriplex elegans	0.01	2.8
Mentzelia affinis	0.01	2.8
Camissonia chamaenerioides	0.01	2.8
Penstemon	0.01	2.8
Monoptilon bellioides	0.01	2.8
Chenopodium	0.01	2.8
Eriogonum maculatum	0.01	2.8
Lupinus sparsiflorus	0.01	2.8
Malocothrix sonoraae	0.01	2.8
Penstemon pseudospectabilis	0.01	2.8
Lotus	0.01	2.8
Linum perenne ssp lewisii	0.01	2.8
Lactuca serrulata	0.01	2.8
Hybanthus verticillatus var.	0.01	2.8
Euphorbia polycarpa	0.01	2.8
Rafinesquia	0.01	2.8
Oenothera primaveris	0.01	2.8
Sum for Structure Class:	26.13	

Structural Growth Form 5. Grasses

Scientific Name	Avg. % Cover	% Constancy
Muhlenbergia porteri	6.45	80.6
Pleuraphis mutica	3.94	30.6
Poa bigelovii	1.32	63.9
unknown grass 1	0.78	25.0
Vulpia octoflora	0.71	66.7
Schismus arabicus	0.67	47.2
Pleuraphis rigida	0.62	11.1
Bromus rubens	0.53	33.3
Elymus elymoides	0.50	8.3
Bouteloua	0.17	2.8

Scientific Name	Avg. % Cover	% Constancy
Tridens muticus	0.07	11.1
Aristida purpurea	0.07	8.3
Muhlenbergia microsperma	0.03	2.8
Bouteloua repens	0.03	2.8
unknown grass 2	0.01	2.8
Heptochloa panicea ssp.	0.01	2.8
Bromus carinatus	0.01	2.8
Digitaria californica	0.01	2.8
Heteropogon contortus	0.01	2.8
Sum for Structure Class:	15.90	

Structural Growth Form 6. Vines

Scientific Name	Avg. % Cover	% Constancy
Janusia gracile	1.12	66.7
Matelea parvifolia	0.04	8.3
Sarcostemma cynanchoides	0.03	13.9
Galium aparine	0.01	5.6
Nissolia schottii	0.01	2.8
Metastelma arizonicum	0.01	2.8
Maurandya antirrhinifolia	0.01	2.8
Phaseolus filiformis	0.01	2.8
Sum for Structure Class:	1.24	

Structural Growth Form 7. Ferns

Scientific Name	Avg. % Cover	% Constancy
Selaginella arizonica	4.53	27.8
Astrolepis cochisensis	0.17	33.3
Pellaea truncata	0.10	25.0
Notholaena standleyi	0.05	11.1
unknown fern 1	0.03	5.6
Cheilanthes yavapensis	0.03	2.8
Astrolepis sinuata sinuata	0.02	8.3
Sum for Structure Class:	4.93	

Scientific Name	Avg. % Cover	% Constancy

Mountain Xeroriparian Scrub
(Summary Data Based on 16 Plots)

Structural Growth Form 1. Trees

Parkinsonia microphylla	5.00	75.0
Parkinsonia florida	2.88	18.8
Prosopis velutina	1.44	37.5
Olneya tesota	0.97	43.8
Phoradendron californicum	0.19	37.5
Quercus turbinella	0.13	6.3
Vauquelinia californica ssp.	0.02	6.3
Sum for Structure Class:	10.61	

Structural Growth Form 2. Shrubs

Acacia constricta	4.70	68.8
Celtis pallida pallida	3.63	37.5
Acacia greggii	2.70	62.5
Ephedra aspera	2.47	68.8
Calliandra eriophylla	1.58	50.0
Lycium	1.39	75.0
Lycium berlandieri	1.19	18.8
Encelia farinosa farinosa	1.17	62.5
Ambrosia deltoidea	1.16	43.8
Eriogonum fasiculatum	1.08	68.8
Larrea divaricata tridentata	1.08	56.3
Brickellia coulteri	1.08	37.5
Coursetia glandulosa	0.69	12.5
Fouquieria splendens	0.67	62.5
Simmondsia chinensis	0.63	6.3
Trixis californica	0.56	62.5
Krameria grayi	0.56	50.0
Condalia warnockii	0.52	12.5
Viguiera parishii	0.41	31.3
Jatropha cardiophylla	0.39	31.3
Ditaxis lanceolata	0.38	56.3

Scientific Name	Avg. % Cover	% Constancy
Anisacathus thurberi	0.38	12.5
Eriogonum wrightii	0.34	31.3
Hyptis emoryi	0.31	12.5
Bernardia incana	0.31	12.5
Brickellia fructescens	0.31	6.3
Lycium exsertum	0.31	6.3
Lycium andersonii	0.31	6.3
Sebastiania bilocularis	0.25	6.3
Fagonia californica ssp longipes	0.19	12.5
Crossosma bigelovii	0.19	6.3
Menodora scabra	0.14	18.8
Forestiera phillyreiodes	0.13	6.3
Ambrosia dumosa	0.13	6.3
Gallium stellatum	0.11	25.0
Mirabilis laevis v villosa	0.09	18.8
Carlowrightii arizonica	0.08	12.5
Aloysia wrightii	0.08	12.5
Ziziphus obtusifolia canescens	0.08	12.5
Tragia nepetifolia var dissecta	0.06	25.0
Baccharis sarothroides	0.06	6.3
Artemisia ludoviciana	0.05	18.8
unknown shrub 1	0.05	18.8
Abutilon incanum	0.05	18.8
Senna covesii	0.03	12.5
Hibiscus coulteri	0.03	12.5
Psilostrophe cooperi	0.03	12.5
Gymnosperma glutinosum	0.03	12.5
Ayenia microphylla	0.03	12.5
Adenophyllum porophylloides	0.02	6.3
Zinnia acerosa	0.02	6.3
Ericameria laricifolia	0.02	6.3
Tiquilia canescens	0.02	6.3
Agave deserti simplex	0.02	6.3
Machaeranthera pinnatifida	0.02	6.3

Scientific Name	Avg. % Cover	% Constancy
Atriplex canescens	0.02	6.3
Ayenia filiformis	0.02	6.3
Bebbia juncea aspera	0.02	6.3
Justicia longii	0.02	6.3
Brickellia atrostyloides	0.02	6.3
Canotia holacantha	0.02	6.3
Hibiscus denudatus	0.02	6.3
Sum for Structure Class:	32.38	

Structural Growth Form 3. Cactus

Scientific Name	Avg. % Cover	% Constancy
Cylindropuntia acanthocarpa	0.45	62.5
Cylindropuntia leptocaulis	0.28	18.8
Opuntia	0.27	25.0
Carnegiea gigantea	0.22	50.0
Echinocereus engelmannii	0.06	25.0
Ferocactus emoryi	0.03	12.5
Mammillaria grahamii	0.02	6.3
Opuntia engelmannii	0.02	6.3
Cylindropuntia	0.02	6.3
Sum for Structure Class:	1.36	

Structural Growth Form 4. Herbs

Scientific Name	Avg. % Cover	% Constancy
Lepidium lasiocarpum	2.45	87.5
Phacelia coerulea	2.20	50.0
Cryptantha pterocarya	2.19	81.3
Amsinckia intermedia	1.30	68.8
Eucrypta micrantha	1.28	68.8
Erodium cicutarium	1.02	43.8
Descurania pinnata	0.89	75.0
Lesquerella gordonii	0.78	43.8
Gilia stellata	0.61	56.3
Ambrosia ambrosioides	0.59	37.5
Phacelia ambigua	0.53	50.0
Pholistoma auritum var	0.53	37.5
Cryptantha maritima	0.52	43.8

Scientific Name	Avg. % Cover	% Constancy
Caulanthus lasiophyllus	0.45	50.0
Silene antirrhina	0.45	43.8
Chenopodium neomexicana	0.44	50.0
Chorizanthe brevicornus	0.42	62.5
Sisymbrium irio	0.41	37.5
Phacelia	0.39	31.3
Pectocarya recurvata	0.36	43.8
Androsace occidentalis	0.34	25.0
Plantago ovata	0.33	43.8
Salvia pinguifolia	0.31	6.3
Cryptantha barbigera	0.30	37.5
Plantago patagonica	0.25	37.5
Gilia	0.25	31.3
Sphaeralcea ambigua	0.23	37.5
Linanthus jonesii	0.22	68.8
Camissonia californica	0.22	50.0
Draba cuneifolia	0.22	50.0
Camissonia	0.22	50.0
Eriastrum diffusum	0.19	56.3
Chaenactis stevioides	0.19	56.3
Daucus pusillus	0.17	31.3
Euphorbia polycarpa	0.16	18.8
Herissantia crispa	0.14	12.5
Lappula occidentalis	0.14	12.5
Eriogonum maculatum	0.14	12.5
Acourtia wrightii	0.14	12.5
Stylocline micropoides	0.13	50.0
Calycoseris wrightii	0.13	31.3
Lupinus sparsiflorus	0.13	31.3
Amsinckia tessellata	0.13	6.3
Phacelia distans	0.13	6.3
Filago	0.11	43.8
Rafinesquia neomexicana	0.11	43.8
Stephanomeria pauciflora	0.11	25.0

Scientific Name	Avg. % Cover	% Constancy
Eriogonum abertianum	0.11	25.0
Uropappus lindleyi	0.11	25.0
Hedeona nanum var marocalyx	0.09	18.8
Eriogonum inflatum	0.09	18.8
Astragalus nuttallianus	0.09	18.8
Eriophyllum lanosum	0.08	31.3
Chorizanthe rigida	0.08	12.5
Camissonia chamaenerioides	0.08	12.5
Eriogonum thomasii	0.08	12.5
Filago arizonica	0.08	12.5
Pectocarya	0.08	12.5
Acleisanthes longiflora	0.08	12.5
Thysanocarpis curvipes	0.06	25.0
Ditaxis neomexicana	0.06	25.0
Mentzelia	0.06	25.0
Dichelostemma capitatum ssp.	0.06	25.0
Amsinkia	0.06	6.3
Mentzelia affinis	0.06	6.3
Mentzelia involucrata	0.06	6.3
Linanthus bigelovii	0.06	6.3
Eriogonum deflexum	0.05	18.8
Allionia incarnata	0.05	18.8
Eschscholzia mexicana	0.05	18.8
Marina parryi	0.05	18.8
Delphinium scaposum	0.05	18.8
Sphaeralcea coulteri	0.05	18.8
Nemacladus glanduliferous var.	0.05	18.8
Euphorbia albomarginata	0.03	12.5
Lactuca serrulata	0.03	12.5
Streptanthus carinatus	0.03	12.5
Euphorbia	0.03	12.5
Cryptantha micrantha	0.03	12.5
Lotus	0.03	12.5
Castilleja exserta ssp. Exserta	0.02	6.3

Scientific Name	Avg. % Cover	% Constancy
Senecio lemmonii	0.02	6.3
Trifolium wormskioldii	0.02	6.3
Sphaeralcea laxa	0.02	6.3
unknown herb 1	0.02	6.3
Verbena neomexicana	0.02	6.3
Castilleja lanata	0.02	6.3
Sonchus oleraceus	0.02	6.3
Silene	0.02	6.3
Lupinus	0.02	6.3
Eriogonum	0.02	6.3
Astragalus arizonicus	0.02	6.3
Machaeranthera tagetina	0.02	6.3
Malocothrix sonoraae	0.02	6.3
Acourtia nana	0.02	6.3
Lesquerella tenella	0.02	6.3
Malvastrum bicuspidatum	0.02	6.3
Penstemon pseudospectabilis	0.02	6.3
Perityle emoryii	0.02	6.3
Filago californica	0.02	6.3
Ambrosia confertifolia	0.02	6.3
Euphorbia pediculifera	0.02	6.3
Plagiobothrys jonesii	0.02	6.3
Euphorbia eriantha	0.02	6.3
Euphorbia arizonica	0.02	6.3
Rafinesquia californica	0.02	6.3
Parietaria floridana	0.02	6.3
Sum for Structure Class:	25.41	

Structural Growth Form 5. Grasses

Scientific Name	Avg. % Cover	% Constancy
Poa bigelovii	2.53	75.0
Schismus arabicus	2.36	81.3
Muhlenbergia porteri	1.86	43.8
Vulpia octoflora	1.30	75.0
Bromus rubens	1.00	43.8

Scientific Name	Avg. % Cover	% Constancy
Pleuraphis	0.33	12.5
Pleuraphis rigida	0.14	12.5
Aristida purpurea	0.09	18.8
unknown grass 1	0.06	6.3
Pleuraphis mutica	0.06	6.3
unknown grass 2	0.06	6.3
Heteropogon contortus	0.05	18.8
Bromus carinatus	0.03	12.5
Aristida	0.03	12.5
Trisetum interruptum	0.02	6.3
Bouteloua curtipendula	0.02	6.3
Pennisetum ciliare	0.02	6.3
Erioneuron pulchellum	0.02	6.3
Aristida adsensionis	0.02	6.3
Sum for Structure Class:	9.98	

Structural Growth Form 6. Vines

Scientific Name	Avg. % Cover	% Constancy
Janusia gracile	0.73	56.3
Sarcostemma cynanchoides	0.05	18.8
Rhynchosia senna var. texana	0.02	6.3
Nissolia schottii	0.02	6.3
Matelea parvifolia	0.02	6.3
Galium aparine	0.02	6.3
Cucurbita digitata	0.02	6.3
Antirrhinum filipes	0.02	6.3
Lyrocarpa coulteri	0.02	6.3
Sum for Structure Class:	0.89	

Structural Growth Form 7. Ferns

Scientific Name	Avg. % Cover	% Constancy
Selaginella arizonica	0.64	12.5
Astrolepis cochisensis	0.14	12.5
Pellaea truncata	0.05	18.8
Notholaena standleyi	0.02	6.3
Sum for Structure Class:	0.84	

Scientific Name	Avg. % Cover	% Constancy

Paloverde - Mixed Cacti - Mixed Scrub on Bajadas
(Summary Data Based on 35 Plots)

Structural Growth Form 1. Trees

Scientific Name	Avg. % Cover	% Constancy
Parkinsonia microphylla	3.05	71.4
Olneya tesota	1.75	28.6
Parkinsonia florida	0.49	11.4
Prosopis velutina	0.29	11.4
Phoradendron californicum	0.04	14.3
Sum for Structure Class:	5.62	

Structural Growth Form 2. Shrubs

Scientific Name	Avg. % Cover	% Constancy
Larrea divaricata tridentata	5.51	100.0
Ambrosia deltoidea	4.69	97.1
Krameria grayi	0.86	51.4
Hymenoclea salsola	0.55	11.4
Fouquieria splendens	0.47	45.7
Ambrosia dumosa	0.26	22.9
Acacia constricta	0.24	20.0
Lycium	0.18	25.7
Lycium macrodon	0.09	2.9
Trixis californica	0.06	8.6
Lycium parishii	0.06	5.7
Krameria erecta	0.06	2.9
Acacia greggii	0.06	2.9
Ditaxis lanceolata	0.04	17.1
Encelia farinosa farinosa	0.04	14.3
Jatropha cardiophylla	0.03	2.9
Fagonia californica ssp longipes	0.03	2.9
Ephedra aspera	0.03	2.9
Lycium andersonii	0.01	5.7
Calliandra eriophylla	0.01	2.9
Ayenia filiformis	0.01	2.9
Lycium berlandieri	0.01	2.9
Sum for Structure Class:	13.29	

Scientific Name	Avg. % Cover	% Constancy
Structural Growth Form 3. Cactus		
Cylindropuntia acanthocarpa	0.92	68.6
Carnegiea gigantea	0.40	65.7
Opuntia	0.29	5.7
Cylindropuntia fulgida	0.15	22.9
Cylindropuntia leptocaulis	0.09	14.3
Mammillaria grahamii	0.06	22.9
Ferocactus emoryi	0.06	14.3
Echinocereus engelmannii	0.04	17.1
Cylindropuntia	0.03	2.9
Cylindropuntia bigelovii	0.02	8.6
Echinocereus	0.01	5.7
Peniocereus greggii	0.01	2.9
Mammillaria	0.01	2.9
Opuntia engelmannii	0.01	2.9
Ferocactus	0.01	2.9
Mammillaria tetrancistra	0.01	2.9
Sum for Structure Class:	2.11	
Structural Growth Form 4. Herbs		
Lepidium lasiocarpum	4.52	94.3
Pectocarya	2.80	45.7
Pectocarya recurvata	1.81	31.4
Cryptantha maritima	1.79	48.6
Plantago ovata	1.28	74.3
Chorizanthe brevicornus	1.26	74.3
Lesquerella gordonii	1.03	57.1
Eriogonum thomasii	0.74	11.4
Caulanthus lasiophyllus	0.54	62.9
Pectocarya platycarpa	0.46	28.6
Cryptantha pterocarya	0.45	62.9
Chorizanthe rigida	0.36	60.0
Chaenactis stevioides	0.34	37.1
Cryptantha barbigera	0.26	17.1

Scientific Name	Avg. % Cover	% Constancy
Amsinckia intermedia	0.25	37.1
Phacelia ambigua	0.24	22.9
Eriophyllum lanosum	0.23	42.9
Descurania pinnata	0.18	31.4
Cryptantha	0.18	8.6
Camissonia chamaenerioides	0.14	14.3
Erodium cicutarium	0.12	5.7
Euphorbia polycarpa	0.11	20.0
Amsinckia tessellata	0.11	8.6
Phacelia	0.11	17.1
Draba cuneifolia	0.08	14.3
Filago	0.07	11.4
Sisymbrium irio	0.07	8.6
Amsinkia	0.06	17.1
Lappula occidentalis	0.06	2.9
Eriastrum diffusum	0.05	20.0
Camissonia	0.05	20.0
Filago arizonica	0.05	11.4
Stylocline micropoides	0.04	17.1
Camissonia californica	0.04	8.6
Euphorbia	0.04	8.6
Gilia	0.04	5.7
Ditaxis neomexicana	0.04	5.7
Eriogonum	0.04	5.7
Eucrypta micrantha	0.03	11.4
Eschscholzia mexicana	0.03	2.9
Astragalus	0.03	2.9
Lotus salsuginosus	0.03	2.9
Mentzelia involucrata	0.03	2.9
Plagiobothrys	0.03	2.9
Linanthus jonesii	0.02	8.6
Mentzelia	0.02	8.6
Lupinus sparsiflorus	0.02	8.6
Nama hispidum	0.01	5.7

Scientific Name	Avg. % Cover	% Constancy
Rafinesquia neomexicana	0.01	5.7
Orobanche cooperi	0.01	5.7
Eriogonum inflatum	0.01	5.7
Calycoseris wrightii	0.01	5.7
Daucus pusillus	0.01	5.7
Erodium texanum	0.01	5.7
Lotus	0.01	5.7
Loeflingia squarrosa ssp.	0.01	5.7
Monoptilon bellioides	0.01	2.9
Lupinus	0.01	2.9
Thysanocarpis curvipes	0.01	2.9
Sphaeralcea	0.01	2.9
Chaenactis carphoclinia	0.01	2.9
Eriogonum deflexum	0.01	2.9
Cryptantha micrantha	0.01	2.9
Allium macropetalon	0.01	2.9
Marina parryi	0.01	2.9
Parietaria floridana	0.01	2.9
Oligomeris linifolia	0.01	2.9
Nicotiana obtusifolia	0.01	2.9
Euphorbia pediculifera	0.01	2.9
Senecio	0.01	2.9
Sum for Structure Class:	20.49	
Structural Growth Form 5. Grasses		
Schismus arabicus	7.44	100.0
Vulpia octoflora	0.24	28.6
Erioneuron pulchellum	0.05	11.4
Aristida	0.04	8.6
Poa bigelovii	0.04	8.6
Aristida adsensionis	0.01	2.9
Aristida purpurea	0.01	2.9
Muhlenbergia porteri	0.01	2.9
Sum for Structure Class:	7.84	
Structural Growth Form 6. Vines		
Janusia gracile	0.04	5.7
Sum for Structure Class:	0.04	

Scientific Name	Avg. % Cover	% Constancy

Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes
(Summary Data Based on 64 Plots)

Structural Growth Form 1. Trees

Parkinsonia microphylla	6.02	92.2
Olneya tesota	0.36	15.6
Parkinsonia florida	0.16	3.1
Phoradendron californicum	0.01	4.7
Sum for Structure Class:	6.54	

Structural Growth Form 2. Shrubs

Ambrosia deltoidea	3.32	67.2
Encelia farinosa farinosa	2.72	73.4
Larrea divaricata tridentata	1.88	70.3
Fouquieria splendens	1.68	82.8
Krameria grayi	0.80	57.8
Lycium	0.69	59.4
Viguiera parishii	0.53	20.3
Eriogonum fasiculatum	0.52	18.8
Ephedra aspera	0.46	39.1
Hyptis emoryi	0.41	20.3
Acacia constricta	0.30	20.3
Calliandra eriophylla	0.22	12.5
Gallium stellatum	0.21	17.2
Jatropha cardiophylla	0.21	12.5
Lycium berlandieri	0.20	14.1
Fagonia californica ssp longipes	0.19	25.0
Ditaxis lanceolata	0.12	32.8
Eriogonum wrightii	0.11	4.7
Agave deserti simplex	0.11	18.8
Menodora scabra	0.11	12.5
Acacia greggii	0.10	9.4
Trixis californica	0.09	21.9
Krameria erecta	0.08	3.1
Mirabilis laevis v villosa	0.07	10.9

Scientific Name	Avg. % Cover	% Constancy
Brickellia coulteri	0.07	7.8
Hibiscus denudatus	0.07	3.1
Ambrosia dumosa	0.06	3.1
Sebastiania bilocularis	0.06	1.6
Machaeranthera pinnatifida	0.05	12.5
Porophyllum gracile	0.05	6.3
Ayenia microphylla	0.03	7.8
Adenophyllum porophylloides	0.03	6.3
Celtis pallida pallida	0.03	6.3
Condalia warnockii	0.02	4.7
Crossosma bigelovii	0.02	3.1
Tiquilia canescens	0.02	3.1
Ziziphus obtusifolia canescens	0.02	1.6
Simmondsia chinensis	0.02	1.6
Lycium exsertum	0.02	1.6
Lycium parishii	0.02	1.6
Lycium andersonii	0.01	3.1
Abutilon	0.00	1.6
Carlowrightii arizonica	0.00	1.6
Senna covesii	0.00	1.6
Koeberlinia spinosa	0.00	1.6
Aloysia wrightii	0.00	1.6
Gymnosperma glutinosum	0.00	1.6
Abutilon incanum	0.00	1.6
Sum for Structure Class:	15.77	

Structural Growth Form 3. Cactus

Cylindropuntia acanthocarpa	1.34	82.8
Cylindropuntia bigelovii	0.77	15.6
Carnegiea gigantea	0.36	76.6
Echinocereus engelmannii	0.14	40.6
Opuntia phaeacantha	0.09	9.4
Mammillaria grahamii	0.08	31.3
Cylindropuntia leptocaulis	0.08	10.9

Scientific Name	Avg. % Cover	% Constancy
Cylindropuntia fulgida	0.07	6.3
Opuntia	0.07	6.3
Opuntia engelmannii	0.05	4.7
Ferocactus emoryi	0.04	15.6
Ferocactus cylindraceus	0.02	7.8
Ferocactus	0.02	7.8
Echinocereus	0.02	7.8
Opuntia chlorotica	0.02	1.6
Mammillaria	0.01	3.1
Mammillaria tetrancistra	0.00	1.6
Cylindropuntia	0.00	1.6
Sum for Structure Class:	3.18	

Structural Growth Form 4. Herbs

Lepidium lasiocarpum	5.86	85.9
Cryptantha pterocarya	2.81	70.3
Lesquerella gordonii	2.05	31.3
Erodium cicutarium	1.38	21.9
Plantago ovata	1.26	42.2
Perityle emoryii	1.16	25.0
Pectocarya recurvata	1.13	42.2
Phacelia	1.07	35.9
Pectocarya	0.96	15.6
Cryptantha barbigera	0.95	29.7
Caulanthus lasiophyllus	0.78	56.3
Phacelia coerulea	0.74	17.2
Cryptantha maritima	0.72	39.1
Amsinckia intermedia	0.63	42.2
Eucrypta micrantha	0.54	35.9
Descurania pinnata	0.35	48.4
Phacelia ambigua	0.32	25.0
Chorizanthe brevicornus	0.29	60.9
Thysanocarpis curvipes	0.26	25.0
Sphaeralcea ambigua	0.26	25.0

Scientific Name	Avg. % Cover	% Constancy
Phacelia distans	0.25	4.7
Gilia	0.24	31.3
Daucus pusillus	0.21	29.7
Stylocline micropoides	0.21	20.3
Linanthus jonesii	0.20	21.9
Chenopodium neomexicana	0.15	17.2
Gilia stellata	0.14	18.8
Sisymbrium irio	0.13	3.1
Eriophyllum lanosum	0.11	26.6
Plantago patagonica	0.11	7.8
Eriogonum inflatum	0.09	12.5
Euphorbia	0.09	10.9
Amsinkia	0.08	12.5
Camissonia	0.08	21.9
Rafinesquia neomexicana	0.08	10.9
Chenopodium	0.08	1.6
Draba cuneifolia	0.07	25.0
Stephanomeria pauciflora	0.07	7.8
Pectocarya platycarpa	0.07	7.8
Erodium texanum	0.07	6.3
Plantago	0.07	3.1
Sphaeralcea	0.07	3.1
Eriastrum diffusum	0.06	15.6
Camissonia chamaenerioides	0.06	15.6
Chaenactis stevioides	0.06	15.6
Amsinckia tessellata	0.06	6.3
Filago arizonica	0.06	9.4
Euphorbia polycarpa	0.06	7.8
Senecio lemmonii	0.05	6.3
Androsace occidentalis	0.05	3.1
Lupinus sparsiflorus	0.05	14.1
Chaenactis carphoclinia	0.05	1.6
Filago	0.04	12.5
Camissonia californica	0.04	12.5

Scientific Name	Avg. % Cover	% Constancy
Lotus	0.04	7.8
Astragalus nuttallianus	0.04	9.4
Dichelostemma capitatum ssp.	0.03	10.9
Eriogonum abertianum	0.03	10.9
Calycoseris wrightii	0.03	6.3
Marina parryi	0.03	6.3
Silene antirrhina	0.03	6.3
Sphaeralcea coulteri	0.03	6.3
Eriogonum thomasii	0.03	6.3
Eschscholzia mexicana	0.03	6.3
unknown herb 1	0.02	4.7
Mentzelia involucrata	0.02	4.7
Eriogonum deflexum	0.02	7.8
Linum perenne ssp lewisii	0.02	3.1
Streptanthus carinatus	0.02	3.1
Cryptantha	0.02	3.1
Calandrinia ciliata	0.02	6.3
Gilia flavocincta	0.02	6.3
Uropappus lindleyi	0.02	6.3
Ditaxis neomexicana	0.02	6.3
Allionia incarnata	0.02	1.6
Pholistoma auritum var	0.02	1.6
Delphinium scaposum	0.01	4.7
Bowlesia incana	0.01	4.7
Lotus salsuginosus	0.01	4.7
Chorizanthe rigida	0.01	4.7
Linanthus bigelovii	0.01	4.7
Astragalus	0.01	4.7
Acleisanthes longiflora	0.01	4.7
Senecio	0.01	3.1
Sonchus	0.01	3.1
Cryptantha micrantha	0.01	3.1
Parietaria floridana	0.01	3.1
Nicotiana obtusifolia	0.01	3.1

Scientific Name	Avg. % Cover	% Constancy
Euphorbia arizonica	0.01	3.1
Eriogonum	0.01	3.1
Lesquerella tenella	0.00	1.6
Salsola tragus	0.00	1.6
Crassula connata	0.00	1.6
Euphorbia capitellata	0.00	1.6
Euphorbia pediculifera	0.00	1.6
Antirrhinum cyathiferum	0.00	1.6
Dudleya arizonica	0.00	1.6
Ditaxis adenophora	0.00	1.6
Brassica tournefortii	0.00	1.6
Camissonia boothii ssp	0.00	1.6
Nemacladus glanduliferous var.	0.00	1.6
Lappula occidentalis	0.00	1.6
Monoptilon bellioides	0.00	1.6
Lupinus	0.00	1.6
Euphorbia albomarginata	0.00	1.6
Mentzelia	0.00	1.6
Eucrypta chrysanthemifolia	0.00	1.6
Silene	0.00	1.6
Lupinus Arizonicus	0.00	1.6
Sum for Structure Class:	27.55	

Structural Growth Form 5. Grasses

Scientific Name	Avg. % Cover	% Constancy
Schismus arabicus	3.37	85.9
Muhlenbergia porteri	1.17	34.4
Vulpia octoflora	1.01	57.8
Tridens muticus	0.32	9.4
Erioneuron pulchellum	0.17	12.5
Aristida	0.11	18.8
Poa bigelovii	0.09	21.9
unknown grass 1	0.06	7.8
Aristida purpurea	0.06	7.8
Bromus rubens	0.05	7.8

Scientific Name	Avg. % Cover	% Constancy
Muhlenbergia	0.05	3.1
Muhlenbergia microsperma	0.04	4.7
Pleuraphis rigida	0.02	4.7
Pleuraphis mutica	0.01	3.1
Aristida adsensionis	0.01	3.1
Trisetum interruptum	0.00	1.6
Sum for Structure Class:	6.55	
Structural Growth Form 6. Vines		
Janusia gracile	0.94	43.8
Matelea parvifolia	0.00	1.6
Sarcostemma cynanchoides	0.00	1.6
Sum for Structure Class:	0.95	
Structural Growth Form 7. Ferns		
Selaginella arizonica	4.66	29.7
Notholaena standleyi	0.07	21.9
Astrolepis cochisensis	0.03	10.9
Pellaea truncata	0.01	3.1
Cheilanthes parryi	0.01	3.1
Astrolepis sinuata sinuata	0.00	1.6
Sum for Structure Class:	4.78	

Scientific Name	Avg. % Cover	% Constancy

Rock Outcrop
(Summary Data Based on 7 Plots)

Structural Growth Form 1. Trees

Parkinsonia microphylla	0.68	57.1
Vauquelinia californica ssp.	0.14	14.3
Prosopis velutina	0.04	14.3

Sum for Structure Class: 0.86

Structural Growth Form 2. Shrubs

Encelia farinosa farinosa	2.50	85.7
Larrea divaricata tridentata	1.21	71.4
Eriogonum wrightii	1.14	42.9
Ephedra aspera	0.46	42.9
Acacia greggii	0.46	42.9
Viguiera parishii	0.43	42.9
Ambrosia deltoidea	0.43	28.6
Lycium	0.39	57.1
Hyptis emoryi	0.32	28.6
Trixis californica	0.32	28.6
Gutierrezia sarothrae	0.29	14.3
Brickellia coulteri	0.21	42.9
Aloysia wrightii	0.18	28.6
Krameria erecta	0.14	14.3
Agave deserti simplex	0.07	28.6
Gallium stellatum	0.07	28.6
Celtis pallida pallida	0.07	28.6
Fouquieria splendens	0.07	28.6
Ayenia microphylla	0.04	14.3
Bebbia juncea aspera	0.04	14.3
unknown shrub 1	0.04	14.3
Koeberlinia spinosa	0.04	14.3
Menodora scabra	0.04	14.3
Ditaxis lanceolata	0.04	14.3
Krameria grayi	0.04	14.3

Scientific Name	Avg. % Cover	% Constancy
Eriogonum fasiculatum	0.04	14.3
Hibiscus coulteri	0.04	14.3
Gymnosperma glutinosum	0.04	14.3
Acacia constricta	0.04	14.3
Senna covesii	0.04	14.3
Sum for Structure Class:	9.21	

Structural Growth Form 3. Cactus

Scientific Name	Avg. % Cover	% Constancy
Carnegiea gigantea	0.39	71.4
Opuntia	0.18	28.6
Cylindropuntia bigelovii	0.18	28.6
Cylindropuntia acanthocarpa	0.14	57.1
Mammillaria grahamii	0.07	28.6
Echinocereus engelmannii	0.07	28.6
Ferocactus emoryi	0.04	14.3
Mammillaria	0.04	14.3
Sum for Structure Class:	1.11	

Structural Growth Form 4. Herbs

Scientific Name	Avg. % Cover	% Constancy
Lepidium lasiocarpum	0.54	57.1
Cryptantha	0.43	14.3
Perityle emoryii	0.32	42.9
Sphaeralcea ambigua	0.21	85.7
Descurania pinnata	0.18	71.4
Eucrypta micrantha	0.18	28.6
Stephanomeria pauciflora	0.18	28.6
Phacelia	0.14	57.1
Nicotiana obtusifolia	0.14	14.3
Pholistoma auritum var	0.14	14.3
Trifolium wormskioldii	0.14	14.3
Chorizanthe brevicornus	0.14	14.3
Cirsium neomexicana	0.14	14.3
Euphorbia melanadenia	0.07	28.6
Lotus	0.07	28.6
Plantago patagonica	0.07	28.6

Scientific Name	Avg. % Cover	% Constancy
Phacelia ambigua	0.07	28.6
Cryptantha pterocarya	0.07	28.6
Thysanocarpis curvipes	0.07	28.6
Camissonia	0.07	28.6
Cryptantha maritima	0.07	28.6
Rafinesquia californica	0.04	14.3
Stylocline micropoides	0.04	14.3
unknown herb 1	0.04	14.3
Uropappus lindleyi	0.04	14.3
Penstemon parryi	0.04	14.3
Pectocarya recurvata	0.04	14.3
Verbena	0.04	14.3
Delphinium scaposum	0.04	14.3
Filago	0.04	14.3
Acourtia nana	0.04	14.3
Amsinckia intermedia	0.04	14.3
Castilleja lanata	0.04	14.3
Parietaria floridana	0.04	14.3
Chaenactis carphoclinia	0.04	14.3
Draba cuneifolia	0.04	14.3
Eriogonum abertianum	0.04	14.3
Erodium cicutarium	0.04	14.3
Erodium texanum	0.04	14.3
Euphorbia albomarginata	0.04	14.3
Filago arizonica	0.04	14.3
Gutierrezia arizonica	0.04	14.3
Myosurus cupulatus	0.04	14.3
Caulanthus lasiophyllus	0.04	14.3
Sum for Structure Class:	4.29	

Structural Growth Form 5. Grasses

Muhlenbergia porteri	0.32	28.6
Schismus arabicus	0.18	71.4
Vulpia octoflora	0.18	28.6

Scientific Name	Avg. % Cover	% Constancy
Pleuraphis mutica	0.14	14.3
Aristida purpurea	0.14	14.3
Poa bigelovii	0.11	42.9
Bouteloua	0.07	28.6
Bromus rubens	0.07	28.6
Aristida parishii	0.04	14.3
Aristida adsensionis	0.04	14.3
Muhlenbergia microsperma	0.04	14.3
Sum for Structure Class:	1.32	
Structural Growth Form 6. Vines		
Janusia gracile	0.11	42.9
Matelea parvifolia	0.04	14.3
Maurandya antirrhinifolia	0.04	14.3
Rhynchosia texana	0.04	14.3
Sum for Structure Class:	0.21	
Structural Growth Form 7. Ferns		
Selaginella arizonica	1.43	14.3
Astrolepis cochisensis	0.07	28.6
Notholaena standleyi	0.07	28.6
Astrolepis sinuata sinuata	0.04	14.3
Sum for Structure Class:	1.61	

Scientific Name	Avg. % Cover	% Constancy

Desert Spring
(Summary Data Based on 3 Plots)

Structural Growth Form 1. Trees

Prosopis velutina	5.00	100.0
Parkinsonia microphylla	3.00	66.7
Sum for Structure Class:	8.00	

Structural Growth Form 2. Shrubs

Acacia greggii	3.00	100.0
Coursetia glandulosa	2.08	100.0
Eriogonum wrightii	2.00	66.7
Celtis pallida pallida	1.67	66.7
Ephedra aspera	1.42	100.0
Simmondsia chinensis	1.42	66.7
Encelia farinosa farinosa	1.42	66.7
Acacia constricta	1.33	100.0
Lycium	1.33	66.7
Brickellia coulteri	1.08	100.0
Eriogonum fasiculatum	1.00	66.7
Calliandra eriophylla	0.75	66.7
Abutilon incanum	0.75	66.7
Jatropha cardiophylla	0.67	66.7
Justicia longii	0.67	66.7
Condalia warnockii	0.67	33.3
Krameria grayi	0.42	66.7
Menodora scabra	0.33	33.3
Trixis californica	0.33	33.3
Mirabilis laevis v villosa	0.33	33.3
Larrea divaricata tridentata	0.33	33.3
Fouquieria splendens	0.33	33.3
Ditaxis lanceolata	0.17	66.7
Ayenia filiformis	0.17	66.7
Ambrosia deltoidea	0.08	33.3
Aloysia wrightii	0.08	33.3

Scientific Name	Avg. % Cover	% Constancy
Ziziphus obtusifolia canescens	0.08	33.3
Hibiscus coulteri	0.08	33.3
Senna covesii	0.08	33.3
Gutierrezia sarothrae	0.08	33.3
Tiquilia canescens	0.08	33.3
Viguiera parishii	0.08	33.3
Yucca baccata	0.08	33.3
Sum for Structure Class:	24.42	

Structural Growth Form 3. Cactus

Scientific Name	Avg. % Cover	% Constancy
Cylindropuntia acanthocarpa	0.67	66.7
Carnegiea gigantea	0.50	100.0
Opuntia phaeacantha	0.08	33.3
Cylindropuntia bigelovii	0.08	33.3
Echinocereus engelmannii	0.08	33.3
Ferocactus emoryi	0.08	33.3
Mammillaria grahamii	0.08	33.3
Opuntia	0.08	33.3
Sum for Structure Class:	1.67	

Structural Growth Form 4. Herbs

Scientific Name	Avg. % Cover	% Constancy
Amsinckia intermedia	6.33	100.0
Lepidium lasiocarpum	5.00	100.0
Phacelia coerulea	3.67	100.0
Cryptantha pterocarya	3.33	100.0
Caulanthus lasiophyllus	1.75	100.0
Chenopodium neomexicana	1.67	66.7
Cryptantha barbigera	1.33	66.7
Silene antirrhina	1.08	100.0
Pholistoma auritum var	1.08	66.7
Ambrosia ambrosioides	1.00	66.7
Sphaeralcea coulteri	1.00	66.7
Euphorbia albomarginata	0.75	66.7
Gilia stellata	0.67	66.7
Euphorbia polycarpa	0.67	33.3

Scientific Name	Avg. % Cover	% Constancy
Daucus pusillus	0.50	100.0
Eucrypta micrantha	0.42	66.7
Eriogonum abertianum	0.42	66.7
Eschscholzia mexicana	0.42	66.7
Allionia incarnata	0.42	66.7
Plantago patagonica	0.42	66.7
Sphaeralcea ambigua	0.42	66.7
Lotus	0.33	33.3
Lesquerella gordonii	0.33	33.3
Pectocarya recurvata	0.33	33.3
Descurania pinnata	0.33	33.3
Phacelia ambigua	0.33	33.3
Castilleja exserta ssp. Exserta	0.17	66.7
Rafinesquia neomexicana	0.17	66.7
Erigeron divergens	0.17	66.7
Thysanocarpis curvipes	0.17	66.7
Erodium cicutarium	0.17	66.7
Linanthus jonesii	0.17	66.7
Lupinus sparsiflorus	0.17	66.7
Stylocline micropoides	0.08	33.3
Uropappus lindleyi	0.08	33.3
Plantago ovata	0.08	33.3
Perityle emoryii	0.08	33.3
Penstemon parryi	0.08	33.3
Chorizanthe brevicornus	0.08	33.3
Parietaria floridana	0.08	33.3
Ambrosia confertifolia	0.08	33.3
Typha domingensis	0.08	33.3
Atriplex elegans	0.08	33.3
Acourtia wrightii	0.08	33.3
Camissonia californica	0.08	33.3
Cryptantha maritima	0.08	33.3
Draba cuneifolia	0.08	33.3
Eriogonum deflexum	0.08	33.3

Scientific Name	Avg. % Cover	% Constancy
Filago	0.08	33.3
Filago arizonica	0.08	33.3
Gilia	0.08	33.3
Marina parryi	0.08	33.3
Camissonia	0.08	33.3
Sum for Structure Class:	36.83	
Structural Growth Form 5. Grasses		
Bromus rubens	6.00	66.7
Schismus arabicus	4.67	66.7
Poa bigelovii	3.00	66.7
Pleuraphis rigida	0.67	66.7
Bouteloua repens	0.67	33.3
Vulpia octoflora	0.42	66.7
Muhlenbergia porteri	0.33	33.3
Heteropogon contortus	0.08	33.3
Pleuraphis mutica	0.08	33.3
Aristida ternipes var. ternipes	0.08	33.3
Aristida purpurea	0.08	33.3
unknown grass 1	0.08	33.3
Bromus carinatus	0.08	33.3
Sum for Structure Class:	16.25	
Structural Growth Form 6. Vines		
Janusia gracile	1.75	66.7
Sarcostemma cynanchoides	0.67	33.3
Nissolia schottii	0.33	33.3
Vicia ludoviciana var. ludoviciana	0.08	33.3
Lyrocarpa coulteri	0.08	33.3
Rhynchosia texana	0.08	33.3
Sum for Structure Class:	3.00	
Structural Growth Form 7. Ferns		
Astrolepis cochisensis	0.08	33.3
Notholaena standleyi	0.08	33.3
Selaginella arizonica	0.08	33.3
Sum for Structure Class:	0.25	

Scientific Name	Avg. % Cover	% Constancy

Braided Channel Floodplain
(Summary Data Based on 21 Plots)

Structural Growth Form 1. Trees

Parkinsonia florida	6.04	61.9
Prosopis velutina	2.76	47.6
Olneya tesota	2.76	19.0
Phoradendron californicum	1.01	28.6
Parkinsonia microphylla	0.25	9.5
Sum for Structure Class:	12.82	

Structural Growth Form 2. Shrubs

Lycium andersonii	2.76	23.8
Larrea divaricata tridentata	2.68	52.4
Acacia greggii	1.93	28.6
Hymenoclea salsola	1.21	42.9
Baccharis sarothroides	0.75	38.1
Lycium	0.45	19.0
Chilopsis linearis arcuata	0.23	28.6
Ambrosia deltoidea	0.18	23.8
Celtis pallida pallida	0.10	4.8
Bebbia juncea aspera	0.05	19.0
Acacia constricta	0.05	4.8
Petalonyx thurberi	0.01	4.8
Sum for Structure Class:	10.39	

Structural Growth Form 3. Cactus

Cylindropuntia acanthocarpa	0.05	4.8
Cylindropuntia leptocaulis	0.05	4.8
Carnegiea gigantea	0.02	9.5
Echinocereus engelmannii	0.01	4.8
Ferocactus cylindraceus	0.01	4.8
Cylindropuntia bigelovii	0.01	4.8
Sum for Structure Class:	0.15	

Scientific Name	Avg. % Cover	% Constancy
Structural Growth Form 4. Herbs		
Pectocarya	3.99	57.1
Lepidium lasiocarpum	1.95	81.0
Ambrosia ambrosioides	1.54	61.9
Plantago ovata	1.26	47.6
Pectocarya platycarpa	1.25	33.3
Amsinckia intermedia	0.99	85.7
Lupinus sparsiflorus	0.80	47.6
Sisymbrium irio	0.77	52.4
Descurania pinnata	0.62	61.9
Parietaria floridana	0.55	19.0
Cryptantha maritima	0.52	47.6
Cryptantha pterocarya	0.44	42.9
Lesquerella gordonii	0.39	66.7
Chorizanthe brevicornus	0.35	42.9
Pectocarya recurvata	0.33	9.5
Cryptantha	0.31	19.0
Gilia	0.31	14.3
Erodium cicutarium	0.30	52.4
Stylocline micropoides	0.24	28.6
Eriophyllum lanosum	0.23	61.9
Caulanthus lasiophyllus	0.20	33.3
Lappula occidentalis	0.20	28.6
Chaenactis stevioides	0.19	47.6
Camissonia chamaenerioides	0.18	42.9
Eriogonum deflexum	0.13	23.8
Euphorbia setiloba	0.12	19.0
Eucrypta micrantha	0.11	14.3
Cryptantha micrantha	0.08	19.0
Cryptantha barbigera	0.08	19.0
Lupinus concinnus	0.08	19.0
Euphorbia polycarpa	0.08	19.0
Chorizanthe rigida	0.06	23.8
Linanthus bigelovii	0.05	19.0

Scientific Name	Avg. % Cover	% Constancy
Calycoseris wrightii	0.05	19.0
Phacelia ambigua	0.05	4.8
Nicotiana obtusifolia	0.05	4.8
Chenopodium	0.05	4.8
Sphaeralcea	0.04	14.3
Euphorbia albomarginata	0.04	14.3
Silene	0.04	14.3
Camissonia	0.04	14.3
Draba cuneifolia	0.04	14.3
Monoptilon bellioides	0.04	14.3
Mentzelia	0.04	14.3
Ambrosia confertifolia	0.02	9.5
Phacelia	0.02	9.5
Camissonia boothii ssp	0.02	9.5
Linanthus	0.02	9.5
Sphaeralcea ambigua	0.02	9.5
Perityle emoryii	0.01	4.8
Lotus strigosa var tomentellum	0.01	4.8
Oligomeris linifolia	0.01	4.8
Sphaeralcea coulteri	0.01	4.8
Gilia stellata	0.01	4.8
Euphorbia	0.01	4.8
Erodium texanum	0.01	4.8
Salvia columbariae	0.01	4.8
Astragalus	0.01	4.8
Plagiobothrys	0.01	4.8
Eriogonum	0.01	4.8
unknown herb 1	0.01	4.8
Eriastrum diffusum	0.01	4.8
Camissonia claviformis	0.01	4.8
Linanthus jonesii	0.01	4.8
Chenopodium neomexicana	0.01	4.8
Crassula connata	0.01	4.8
Lotus	0.01	4.8

Scientific Name	Avg. % Cover	% Constancy
Lotus salsuginosus	0.01	4.8
Daucus pusillus	0.01	4.8
Ditaxis neomexicana	0.01	4.8
Bowlesia incana	0.01	4.8
Sum for Structure Class:	19.52	
Structural Growth Form 5. Grasses		
Schismus arabicus	22.45	95.2
Poa bigelovii	0.27	47.6
Vulpia octoflora	0.17	19.0
Erioneuron pulchellum	0.01	4.8
Sum for Structure Class:	22.90	
Structural Growth Form 6. Vines		
Clematis drummondii	0.06	9.5
Sarcostemma cynanchoides	0.01	4.8
Sum for Structure Class:	0.07	

Scientific Name	Avg. % Cover	% Constancy

Valley Xeroriparian Scrub
(Summary Data Based on 25 Plots)

Structural Growth Form 1. Trees

Scientific Name	Avg. % Cover	% Constancy
Parkinsonia microphylla	8.37	68.0
Olneya tesota	6.24	52.0
Parkinsonia florida	4.96	44.0
Prosopis velutina	3.89	56.0
Phoradendron californicum	0.80	40.0
Sum for Structure Class:	24.26	

Structural Growth Form 2. Shrubs

Scientific Name	Avg. % Cover	% Constancy
Larrea divaricata tridentata	2.77	92.0
Acacia greggii	2.07	32.0
Ambrosia deltoidea	1.59	68.0
Acacia constricta	1.49	36.0
Lycium andersonii	1.12	20.0
Lycium berlandieri	1.04	16.0
Hymenoclea salsola	0.96	20.0
Lycium	0.92	40.0
Condalia warnockii	0.65	12.0
Calliandra eriophylla	0.42	16.0
Celtis pallida pallida	0.33	20.0
Bebbia juncea aspera	0.24	8.0
Encelia farinosa farinosa	0.23	24.0
Krameria grayi	0.23	24.0
Ziziphus obtusifolia canescens	0.22	20.0
Brickellia coulteri	0.20	28.0
Trixis californica	0.19	24.0
Ephedra aspera	0.17	16.0
Lycium parishii	0.16	8.0
Ditaxis lanceolata	0.14	44.0
Anisacathus thurberi	0.12	8.0
Hyptis emoryi	0.10	16.0
Senna covesii	0.10	16.0

Scientific Name	Avg. % Cover	% Constancy
Fouquieria splendens	0.09	12.0
Lycium macrodon	0.08	4.0
Fagonia californica ssp longipes	0.06	12.0
Abutilon incanum	0.05	8.0
Jatropha cardiophylla	0.05	8.0
unknown shrub 1	0.05	8.0
Ambrosia dumosa	0.04	4.0
Aloysia wrightii	0.04	4.0
Lycium fremontii	0.04	4.0
Eriogonum fasiculatum	0.04	4.0
Mirabilis laevis v villosa	0.04	4.0
Sebastiania bilocularis	0.01	4.0
Tragia nepetifolia var dissecta	0.01	4.0
Atriplex canescens	0.01	4.0
Baccharis sarothroides	0.01	4.0
Hibiscus coulteri	0.01	4.0
Sum for Structure Class:	16.09	
Structural Growth Form 3. Cactus		
Cylindropuntia acanthocarpa	0.15	36.0
Carnegiea gigantea	0.07	28.0
Cylindropuntia leptocaulis	0.05	20.0
Mammillaria grahamii	0.01	4.0
Sum for Structure Class:	0.28	
Structural Growth Form 4. Herbs		
Lepidium lasiocarpum	3.55	96.0
Cryptantha pterocarya	2.51	92.0
Lesquerella gordonii	1.08	88.0
Sisymbrium irio	1.08	44.0
Pectocarya	1.05	32.0
Amsinckia intermedia	0.88	52.0
Pectocarya recurvata	0.82	44.0
Pectocarya platycarpa	0.80	28.0
Descurania pinnata	0.73	72.0

Scientific Name	Avg. % Cover	% Constancy
Ambrosia ambrosioides	0.73	40.0
Erodium cicutarium	0.73	32.0
Caulanthus lasiophyllus	0.68	68.0
Plantago ovata	0.63	44.0
Cryptantha maritima	0.60	52.0
Cryptantha barbigera	0.50	40.0
Nicotiana obtusifolia	0.45	32.0
Eucrypta micrantha	0.44	52.0
Chorizanthe brevicornus	0.43	68.0
Phacelia	0.43	40.0
Gilia	0.38	32.0
Phacelia coerulea	0.38	24.0
Parietaria floridana	0.33	12.0
Camissonia chamaenerioides	0.30	36.0
Chorizanthe rigida	0.27	24.0
Stylocline micropoides	0.25	48.0
Chaenactis stevioides	0.24	44.0
Perityle emoryii	0.23	16.0
Lupinus sparsiflorus	0.21	48.0
Draba cuneifolia	0.20	36.0
Euphorbia	0.19	28.0
Cryptantha micrantha	0.19	20.0
Eriophyllum lanosum	0.18	32.0
Camissonia californica	0.18	20.0
Rafinesquia neomexicana	0.17	8.0
Linanthus jonesii	0.16	40.0
Eriastrum diffusum	0.15	32.0
Phacelia ambigua	0.14	16.0
Sphaeralcea ambigua	0.14	16.0
Amsinckia tessellata	0.13	12.0
Phacelia distans	0.13	8.0
Acourtia nana	0.12	4.0
Amsinkia	0.11	20.0
Gilia stellata	0.10	28.0

Scientific Name	Avg. % Cover	% Constancy
Silene antirrhina	0.08	32.0
Daucus pusillus	0.08	20.0
Filago	0.08	20.0
Sphaeralcea coulteri	0.08	20.0
Pholistoma auritum var	0.08	4.0
Loeflingia squarrosa ssp.	0.08	4.0
Euphorbia polycarpa	0.07	16.0
Chenopodium neomexicana	0.07	16.0
Calycoseris wrightii	0.06	24.0
Eriogonum deflexum	0.06	24.0
Crassula connata	0.06	12.0
Camissonia	0.05	20.0
Euphorbia albomarginata	0.05	20.0
Filago arizonica	0.05	20.0
Eriogonum thomasii	0.05	8.0
Mentzelia	0.05	8.0
Eschscholzia mexicana	0.04	16.0
Nama hispidum	0.04	4.0
Ambrosia confertifolia	0.04	4.0
Evax multicaulis	0.04	4.0
Lupinus Arizonicus	0.04	4.0
Chaenactis carphoclinia	0.04	4.0
Allionia incarnata	0.03	12.0
Astragalus nuttallianus	0.03	12.0
Salvia columbariae	0.03	12.0
Plantago patagonica	0.02	8.0
Mentzelia affinis	0.02	8.0
Marina parryi	0.02	8.0
Eriogonum abertianum	0.02	8.0
unknown herb 1	0.02	8.0
Chenopodium murale	0.02	8.0
Monoptilon bellioides	0.02	8.0
Orobanche cooperi	0.01	4.0
Acourtia wrightii	0.01	4.0

Scientific Name	Avg. % Cover	% Constancy
Delphinium scaposum	0.01	4.0
Sphaeralcea	0.01	4.0
Eriogonum maculatum	0.01	4.0
Plagiobothrys	0.01	4.0
Lupinus	0.01	4.0
Cryptantha angustifolia	0.01	4.0
Lappula occidentalis	0.01	4.0
Erodium texanum	0.01	4.0
Lotus strigosa var tomentellum	0.01	4.0
Lupinus concinnus	0.01	4.0
Camissonia claviformis	0.01	4.0
Nemacladus glanduliferous var.	0.01	4.0
Langloisia setosissima ssp.	0.01	4.0
Ditaxis neomexicana	0.01	4.0
Camissonia boothii ssp	0.01	4.0
Euphorbia arizonica	0.01	4.0
Lotus salsuginosus	0.01	4.0
Sum for Structure Class:	24.71	

Structural Growth Form 5. Grasses

Scientific Name	Avg. % Cover	% Constancy
Schismus arabicus	9.38	100.0
Poa bigelovii	0.57	52.0
Vulpia octoflora	0.46	48.0
Aristida purpurea	0.13	12.0
Muhlenbergia microsperma	0.09	8.0
Bromus rubens	0.06	12.0
Aristida	0.03	12.0
Muhlenbergia porteri	0.02	8.0
unknown grass 1	0.02	8.0
Pleuraphis mutica	0.01	4.0
Erioneuron pulchellum	0.01	4.0
Sum for Structure Class:	10.78	

Structural Growth Form 6. Vines

Scientific Name	Avg. % Cover	% Constancy
Janusia gracile	0.18	20.0

Scientific Name	Avg. % Cover	% Constancy
Lyrocarpa coulteri	0.10	12.0
Asclepias subulata	0.04	4.0
Commicarpas scandens	0.02	8.0
Clematis drummondii	0.01	4.0
Maurandya antirrhinifolia	0.01	4.0
Sum for Structure Class:	0.36	

Structural Growth Form 7. Ferns

Notholaena standleyi	0.01	4.0
Astrolepis cochisensis	0.01	4.0
Sum for Structure Class:	0.02	

APPENDIX D

Natural Community Composition and Structure

Sorted by Constancy

Scientific Name	% Constancy	Avg. % Cover

Creosotebush-Bursage Desert Scrub

(Summary Data Based on 87 Plots)

Structural Growth Form 1. Trees

Scientific Name	% Constancy	Avg. % Cover
Prosopis velutina	28.7	1.46
Parkinsonia florida	9.2	0.61
Olneya tesota	9.2	0.28
Parkinsonia microphylla	8.0	0.07
Phoradendron californicum	4.6	0.04
Sum for Structure Class:		2.47

Structural Growth Form 2. Shrubs

Scientific Name	% Constancy	Avg. % Cover
Larrea divaricata tridentata	97.7	7.92
Ambrosia deltoidea	42.5	0.84
Krameria grayi	12.6	0.13
Ambrosia dumosa	12.6	0.09
Acacia constricta	8.0	0.05
Fouquieria splendens	6.9	0.10
Encelia farinosa farinosa	4.6	0.04
Lycium	4.6	0.03
Acacia greggii	4.6	0.02
Lycium andersonii	4.6	0.01
Ditaxis lanceolata	3.4	0.02
Senna covesii	3.4	0.01
Fagonia californica ssp longipes	2.3	0.01
Celtis pallida pallida	2.3	0.01
Baccharis sarothroides	1.1	0.03
Krameria erecta	1.1	0.01
Tamarix ramosissima	1.1	0.01
Boerhavia wrightii	1.1	0.00
Abutilon incanum	1.1	0.00
Physalis crassifolia	1.1	0.00

Scientific Name	% Constancy	Avg. % Cover
Yucca baccata	1.1	0.00
Ziziphus obtusifolia canescens	1.1	0.00
Hymenoclea salsola	1.1	0.00
Sum for Structure Class:		9.34
Structural Growth Form 3. Cactus		
Cylindropuntia acanthocarpa	19.5	0.11
Carnegiea gigantea	17.2	0.04
Cylindropuntia fulgida	5.7	0.16
Cylindropuntia bigelovii	3.4	0.05
Cylindropuntia leptocaulis	3.4	0.02
Ferocactus	3.4	0.01
Ferocactus wislizeni	3.4	0.01
Mammillaria grahamii	2.3	0.01
Echinocereus	1.1	0.00
Echinocereus engelmannii	1.1	0.00
Ferocactus cylindraceus	1.1	0.00
Ferocactus emoryi	1.1	0.00
Grusonia parishii	1.1	0.00
Mammillaria	1.1	0.00
Opuntia	1.1	0.00
Sum for Structure Class:		0.43
Structural Growth Form 4. Herbs		
Lepidium lasiocarpum	92.0	7.16
Plantago ovata	77.0	5.55
Lesquerella gordonii	71.3	1.32
Amsinckia intermedia	54.0	0.51
Caulanthus lasiophyllus	39.1	0.41
Chaenactis stevioides	39.1	0.26
Chorizanthe rigida	39.1	0.19
Erodium cicutarium	37.9	2.37
Pectocarya	34.5	1.78
Eriophyllum lanosum	34.5	0.22
Chorizanthe brevicornus	34.5	0.22

Scientific Name	% Constancy	Avg. % Cover
Erodium texanum	31.0	0.44
Cryptantha maritima	28.7	0.29
Pectocarya platycarpa	21.8	1.35
Amsinkia	17.2	0.14
Sisymbrium irio	16.1	0.94
Cryptantha pterocarya	16.1	0.16
Pectocarya recurvata	11.5	1.07
Brassica tournefortii	11.5	0.09
Phacelia	11.5	0.08
Lupinus sparsiflorus	10.3	0.03
Eriogonum deflexum	8.0	0.08
Descurania pinnata	8.0	0.03
Cryptantha	8.0	0.03
Draba cuneifolia	8.0	0.02
Sphaeralcea coulteri	6.9	0.18
Cryptantha barbigera	6.9	0.09
Camissonia chamaenerioides	6.9	0.03
Daucus pusillus	6.9	0.02
Camissonia	6.9	0.02
Astragalus nuttallianus	5.7	0.04
Filago	5.7	0.03
Linanthus jonesii	5.7	0.01
Nicotiana obtusifolia	4.6	0.07
Euphorbia	4.6	0.04
Chenopodium murale	4.6	0.04
Malva parviflora	4.6	0.03
Cryptantha micrantha	4.6	0.02
Sphaeralcea ambigua	4.6	0.02
Eriastrum diffusum	4.6	0.02
Oligomeris linifolia	4.6	0.01
Filago arizonica	4.6	0.01
Gilia	4.6	0.01
Ambrosia ambrosioides	3.4	0.20
Monoptilon bellioides	3.4	0.09

Scientific Name	% Constancy	Avg. % Cover
Euphorbia polycarpa	3.4	0.07
Ditaxis neomexicana	3.4	0.03
Sonchus	3.4	0.03
Amsinckia tessellata	3.4	0.02
Astragalus	3.4	0.02
unknown herb 1	3.4	0.01
Lappula occidentalis	3.4	0.01
Eriogonum thomasii	2.3	0.26
Chaenactis carphoclinia	2.3	0.05
Verbena bracteata	2.3	0.05
Teucrium cubense ssp depressum	2.3	0.04
Phacelia ambigua	2.3	0.04
Plagiobothrys	2.3	0.03
Loeflingia squarrosa ssp.	2.3	0.03
Veronica peregrina ssp xalapsis	2.3	0.01
Eriogonum	2.3	0.01
Eucrypta micrantha	2.3	0.01
Lupinus	2.3	0.01
Lotus salsuginosus	2.3	0.01
Chenopodium	2.3	0.01
Rafinesquia neomexicana	2.3	0.01
Chenopodium neomexicana	2.3	0.01
Herniaria cinerea	2.3	0.01
Nama hispidum	2.3	0.01
Chenopodium pratericola	2.3	0.01
Sphaeralcea	1.1	0.06
Monolepis nuttalliana	1.1	0.02
Conyza canadensis	1.1	0.01
Datura discolor	1.1	0.01
Amaranthus albus	1.1	0.00
Uropappus lindleyi	1.1	0.00
unknown herb 2	1.1	0.00
Phacelia coerulea	1.1	0.00
Spermolepis echinata	1.1	0.00

Scientific Name	% Constancy	Avg. % Cover
Sphaeralcea laxa	1.1	0.00
Salsola tragus	1.1	0.00
Plantago	1.1	0.00
Sonchus oleraceus	1.1	0.00
Silene antirrhina	1.1	0.00
Penstemon parryi	1.1	0.00
Silene	1.1	0.00
Salvia columbariae	1.1	0.00
Stylocline micropoides	1.1	0.00
Gilia stellata	1.1	0.00
Castilleja exserta ssp. Exserta	1.1	0.00
Cirsium neomexicana	1.1	0.00
Conyza coulteri	1.1	0.00
Camissonia californica	1.1	0.00
Dalea mollissima	1.1	0.00
Eriogonum abertianum	1.1	0.00
Eriogonum trichopes	1.1	0.00
Calycoseris wrightii	1.1	0.00
Eschscholzia mexicana	1.1	0.00
Eucrypta chrysanthemifolia	1.1	0.00
Euphorbia albomarginata	1.1	0.00
Perityle emoryii	1.1	0.00
Filago depressa	1.1	0.00
Plantago patagonica	1.1	0.00
Ambrosia confertifolia	1.1	0.00
Chaenactis	1.1	0.00
Linanthus bigelovii	1.1	0.00
Machaeranthera tagetina	1.1	0.00
Malocothrix	1.1	0.00
Mentzelia affinis	1.1	0.00
Nemacladus glanduliferous var.	1.1	0.00
Oenothera	1.1	0.00
Oenothera primaveris	1.1	0.00
Orthocarpus purpurascens	1.1	0.00

Scientific Name	% Constancy	Avg. % Cover
Bowlesia incana	1.1	0.00
Evax multicaulis	1.1	0.00
Sum for Structure Class:		26.70
Structural Growth Form 5. Grasses		
Schismus arabicus	93.1	11.11
Vulpia octoflora	12.6	0.07
Poa bigelovii	9.2	0.04
Pleuraphis mutica	4.6	0.34
Muhlenbergia porteri	3.4	0.03
Cynodon dactylon	2.3	0.05
Erioneuron pulchellum	2.3	0.04
Phalaris minor	1.1	0.09
Eragrostis lehmanniana	1.1	0.01
Bromus rubens	1.1	0.00
Heteropogon contortus	1.1	0.00
Pleuraphis rigida	1.1	0.00
Bromus	1.1	0.00
Aristida	1.1	0.00
Bromus carinatus	1.1	0.00
Sum for Structure Class:		11.80
Structural Growth Form 6. Vines		
Janusia gracile	1.1	0.00
Sum for Structure Class:		0.00

Scientific Name	% Constancy	Avg. % Cover
Desert Grassland		
(Summary Data Based on 13 Plots)		
Structural Growth Form 1. Trees		
Prosopis velutina	100.0	3.15
Sum for Structure Class:		3.15
Structural Growth Form 2. Shrubs		
Koeberlinia spinosa	7.7	0.08
Larrea divaricata tridentata	7.7	0.02
Lycium	7.7	0.02
Acacia constricta	7.7	0.02
Sum for Structure Class:		0.13
Structural Growth Form 3. Cactus		
Grusonia parishii	23.1	0.06
Cylindropuntia spinosior	15.4	0.04
Cylindropuntia	7.7	0.08
Cylindropuntia fulgida	7.7	0.02
Ferocactus	7.7	0.02
Sum for Structure Class:		0.21
Structural Growth Form 4. Herbs		
Lesquerella gordonii	100.0	9.69
Erodium cicutarium	100.0	6.54
Monolepis nuttalliana	84.6	2.12
Sphaeralcea coulteri	61.5	0.21
Amsinkia	53.8	1.33
Chaenactis stevioides	53.8	0.19
Astragalus nuttallianus	46.2	0.62
Amsinckia tessellata	46.2	0.58
Eriophyllum lanosum	46.2	0.17
Plantago rodosperma	38.5	1.12
Plantago	38.5	1.00
Plantago patagonica	38.5	0.56
Plantago ovata	30.8	0.13

Scientific Name	% Constancy	Avg. % Cover
Calycoseris wrightii	30.8	0.13
Bowlesia incana	23.1	0.17
Sisymbrium irio	23.1	0.12
Taraxacum	23.1	0.12
Cryptantha maritima	23.1	0.06
Uropappus lindleyi	23.1	0.06
Phacelia ambigua	23.1	0.06
Mavella sagittiloba	23.1	0.06
Malocothrix	23.1	0.06
Erigeron divergens	15.4	0.10
Atriplex elegans	15.4	0.04
Erodium texanum	15.4	0.04
Monoptilon bellioides	15.4	0.04
Pectocarya platycarpa	7.7	0.08
Argemone pleiacantha	7.7	0.02
Astragalus	7.7	0.02
Camissonia chamaenerioides	7.7	0.02
Chenopodium	7.7	0.02
Sonchus	7.7	0.02
Chorizanthe brevicornus	7.7	0.02
Cryptantha angustifolia	7.7	0.02
Descurania pinnata	7.7	0.02
Draba cuneifolia	7.7	0.02
Eriogonum deflexum	7.7	0.02
Linanthus jonesii	7.7	0.02
Euphorbia albomarginata	7.7	0.02
Pectocarya	7.7	0.02
Oligomeris linifolia	7.7	0.02
Evax verna	7.7	0.02
Lactuca	7.7	0.02
Mentzelia affinis	7.7	0.02
Lappula occidentalis	7.7	0.02
Matricaria discoidea	7.7	0.02
Malocothrix fendleri	7.7	0.02

Scientific Name	% Constancy	Avg. % Cover
Malocothrix coulteri	7.7	0.02
Lepidium lasiocarpum	7.7	0.02
Phacelia	7.7	0.02
Sum for Structure Class:		25.81
Structural Growth Form 5. Grasses		
Pleuraphis mutica	100.0	15.23
Schismus arabicus	84.6	1.77
Pleuraphis rigida	7.7	0.02
Sum for Structure Class:		17.02

Scientific Name	% Constancy	Avg. % Cover

Mesquite Woodland
(Summary Data Based on 13 Plots)

Structural Growth Form 1. Trees

Scientific Name	% Constancy	Avg. % Cover
Prosopis velutina	100.0	49.92
Parkinsonia florida	30.8	1.10
Phoradendron californicum	15.4	0.31
Olneya tesota	7.7	0.02
Sum for Structure Class:		51.35

Structural Growth Form 2. Shrubs

Scientific Name	% Constancy	Avg. % Cover
Larrea divaricata tridentata	84.6	17.38
Ambrosia deltoidea	69.2	3.19
Lycium	46.2	1.67
Ambrosia dumosa	38.5	1.38
Lycium andersonii	30.8	0.37
Castela emoryi	15.4	0.04
Celtis pallida pallida	7.7	0.02
Sum for Structure Class:		24.06

Structural Growth Form 3. Cactus

Scientific Name	% Constancy	Avg. % Cover
Ferocactus	7.7	0.02
Cylindropuntia leptocaulis	7.7	0.02
Sum for Structure Class:		0.04

Structural Growth Form 4. Herbs

Scientific Name	% Constancy	Avg. % Cover
Erodium cicutarium	84.6	15.29
Lepidium lasiocarpum	84.6	1.13
Amsinckia intermedia	76.9	2.52
Lesquerella gordonii	76.9	1.77
Sisymbrium irio	69.2	7.63
Filago arizonica	61.5	2.85
Sphaeralcea coulteri	61.5	0.87
Plantago ovata	61.5	0.85
Bowlesia incana	46.2	1.35
Herniaria cinerea	38.5	1.08

Scientific Name	% Constancy	Avg. % Cover
Daucus pusillus	38.5	0.37
Pectocarya platycarpa	30.8	2.25
Pectocarya	30.8	0.73
Evax multicaulis	30.8	0.38
Descurania pinnata	30.8	0.35
Plagiobothrys	30.8	0.19
Camissonia chamaenerioides	30.8	0.13
Draba cuneifolia	30.8	0.08
Cryptantha	23.1	0.12
Erodium texanum	23.1	0.12
Eriophyllum lanosum	23.1	0.06
Allionia incarnata	15.4	0.54
Matricaria discoidea	15.4	0.15
unknown herb 1	15.4	0.10
Ambrosia confertifolia	15.4	0.10
Astragalus	15.4	0.10
Ambrosia ambrosioides	15.4	0.04
Oenothera	15.4	0.04
Crassula connata	15.4	0.04
Sonchus oleraceus	15.4	0.04
Parietaria floridana	7.7	0.08
Uropappus lindleyi	7.7	0.02
Lappula occidentalis	7.7	0.02
Mentzelia	7.7	0.02
Brassica tournefortii	7.7	0.02
Sum for Structure Class:		41.38

Structural Growth Form 5. Grasses

Schismus arabicus	92.3	17.08
Muhlenbergia microsperma	46.2	10.33
Vulpia octoflora	23.1	0.19
Cynodon dactylon	15.4	0.10
Poa bigelovii	7.7	0.02
Bromus	7.7	0.02
Sum for Structure Class:	27.73	

Scientific Name	% Constancy	Avg. % Cover

Mountain Upland
(Summary Data Based on 36 Plots)

Structural Growth Form 1. Trees

Scientific Name	% Constancy	Avg. % Cover
Parkinsonia microphylla	38.9	0.94
Prosopis velutina	19.4	0.29
Vauquelinia californica ssp.	2.8	0.03
Quercus turbinella	2.8	0.01
Phoradendron californicum	2.8	0.01
Sum for Structure Class:		1.28

Structural Growth Form 2. Shrubs

Scientific Name	% Constancy	Avg. % Cover
Ephedra aspera	86.1	2.56
Fouquieria splendens	75.0	1.66
Canotia holacantha	69.4	3.85
Viguiera parishii	66.7	1.69
Yucca baccata	63.9	3.05
Lycium	61.1	1.25
Agave deserti simplex	55.6	0.24
Aloysia wrightii	47.2	1.35
Larrea divaricata tridentata	44.4	1.26
Menodora scabra	44.4	0.45
Eriogonum fasiculatum	41.7	0.92
Zinnia acerosa	38.9	1.05
Acacia constricta	36.1	0.94
Gallium stellatum	33.3	0.54
Krameria grayi	33.3	0.47
Tiquilia canescens	27.8	0.88
Acacia greggii	27.8	0.71
Calliandra eriophylla	22.2	0.37
Artemisia ludoviciana	22.2	0.25
Krameria erecta	22.2	0.25
Psilostrophe cooperi	22.2	0.16
Trixis californica	22.2	0.10
Encelia farinosa farinosa	19.4	0.51

Scientific Name	% Constancy	Avg. % Cover
Condalia warnockii	19.4	0.26
Celtis pallida pallida	16.7	0.51
unknown shrub 1	16.7	0.24
Eriogonum wrightii	13.9	0.31
Bernardia incana	13.9	0.20
Gutierrezia sarothrae	13.9	0.20
Ayenia microphylla	11.1	0.05
Hibiscus coulteri	11.1	0.03
Gymnosperma glutinosum	8.3	0.11
Koeberlinia spinosa	8.3	0.06
Jatropha cardiophylla	8.3	0.04
Porophyllum gracile	8.3	0.04
Brickellia coulteri	8.3	0.04
Lycium berlandieri	5.6	0.09
Ziziphus obtusifolia canescens	5.6	0.06
Carlowrightii arizonica	5.6	0.06
Ericameria laricifolia	5.6	0.06
Crossosma bigelovii	5.6	0.06
Ditaxis lanceolata	5.6	0.03
Atriplex canescens	5.6	0.03
Machaeranthera pinnatifida	5.6	0.01
Ambrosia deltoidea	2.8	0.19
Coursetia glandulosa	2.8	0.11
Lycium exsertum	2.8	0.08
Bebbia juncea aspera	2.8	0.03
Keckiella antirrhinoides	2.8	0.03
Hyptis emoryi	2.8	0.03
Forestiera phillyreiodes	2.8	0.01
Abutilon	2.8	0.01
Abutilon incanum	2.8	0.01
Tidestromia lanuginosa	2.8	0.01
Thymophylla pentachaeta	2.8	0.01
Talinum auantiacum Englemann	2.8	0.01
Anisacathus thurberi	2.8	0.01

Scientific Name	% Constancy	Avg. % Cover
Mirabilis laevis v villosa	2.8	0.01
Tragia nepetifolia var dissecta	2.8	0.01
Sum for Structure Class:		27.53
Structural Growth Form 3. Cactus		
Cylindropuntia acanthocarpa	52.8	0.36
Opuntia	36.1	1.79
Echinocereus engelmannii	36.1	0.27
Carnegiea gigantea	22.2	0.10
Ferocactus emoryi	19.4	0.05
Echinocereus	16.7	0.21
Opuntia engelmannii	11.1	0.90
Opuntia chlorotica	11.1	0.44
Cylindropuntia leptocaulis	11.1	0.08
Mammillaria grahamii	8.3	0.04
Opuntia phaeacantha	2.8	0.03
Ferocactus cylindraceus	2.8	0.01
Mammillaria	2.8	0.01
Sum for Structure Class:		4.27
Structural Growth Form 4. Herbs		
Cryptantha pterocarya	75.0	2.42
Lepidium lasiocarpum	61.1	4.47
Descurania pinnata	61.1	1.21
Uropappus lindleyi	50.0	0.17
Phacelia coerulea	47.2	2.62
Thysanocarpis curvipes	47.2	0.52
Sphaeralcea ambigua	44.4	0.31
Daucus pusillus	41.7	0.19
Plantago patagonica	38.9	0.94
Eucrypta micrantha	38.9	0.91
Amsinckia intermedia	38.9	0.88
Lesquerella gordonii	36.1	1.54
Draba cuneifolia	33.3	0.19
Rafinesquia neomexicana	33.3	0.15

Scientific Name	% Constancy	Avg. % Cover
Caulanthus lasiophyllus	30.6	0.60
Eriastrum diffusum	30.6	0.25
Androsace occidentalis	27.8	0.45
Erodium cicutarium	27.8	0.35
Dichelostemma capitatum ssp.	27.8	0.07
Eriogonum abertianum	25.0	0.17
Pholistoma auritum var	22.2	0.47
Parietaria floridana	22.2	0.15
Streptanthus carinatus	22.2	0.13
Acourtia nana	22.2	0.10
Plantago ovata	19.4	0.30
Gilia	19.4	0.07
Senecio lemmonii	19.4	0.07
Stylocline micropoides	19.4	0.07
Gilia stellata	19.4	0.05
Phacelia distans	16.7	1.63
Lappula occidentalis	16.7	0.24
Acleisanthes longiflora	16.7	0.10
Stephanomeria pauciflora	16.7	0.08
Calycoseris wrightii	16.7	0.08
Delphinium scaposum	16.7	0.06
Acourtia wrightii	13.9	0.08
Pectocarya recurvata	13.9	0.08
Phacelia ambigua	13.9	0.08
Hedeona nanum var marocalyx	13.9	0.03
Linanthus jonesii	13.9	0.03
Eschscholzia mexicana	11.1	1.51
Lappula texana	11.1	0.36
Phacelia	11.1	0.19
Chaenactis stevioides	11.1	0.05
Chenopodium neomexicana	11.1	0.05
Cryptantha barbigera	11.1	0.03
Silene antirrhina	11.1	0.03
Yabea microcarpa	11.1	0.03

Scientific Name	% Constancy	Avg. % Cover
Rafinesquia californica	11.1	0.03
Eriophyllum lanosum	11.1	0.03
unknown herb 1	11.1	0.03
Allium macropetalon	11.1	0.03
Chorizanthe brevicornus	8.3	0.21
Sphaeralcea coulteri	8.3	0.04
Castilleja lanata	8.3	0.02
Cryptantha maritima	5.6	0.20
Plantago	5.6	0.14
Gutierrezia arizonica	5.6	0.14
Eucrypta chrysanthemifolia	5.6	0.06
Myosurus cupulatus	5.6	0.03
Mentzelia	5.6	0.03
Teucrium glandulosum	5.6	0.03
Sisymbrium irio	5.6	0.03
Cryptantha	5.6	0.01
Cirsium neomexicana	5.6	0.01
Erodium texanum	5.6	0.01
Pectocarya platycarpa	5.6	0.01
Pectocarya	5.6	0.01
Euphorbia eriantha	5.6	0.01
Filago	5.6	0.01
Lupinus	5.6	0.01
Filago arizonica	5.6	0.01
Astragalus nuttallianus	5.6	0.01
Euphorbia	5.6	0.01
Amsinckia tessellata	2.8	0.06
Gilia flavocincta	2.8	0.06
Verbena	2.8	0.03
Sphaeralcea laxa	2.8	0.03
Chenopodium murale	2.8	0.03
Chenopodium	2.8	0.01
Penstemon pseudospectabilis	2.8	0.01
Atriplex elegans	2.8	0.01

Scientific Name	% Constancy	Avg. % Cover
Bowlesia incana	2.8	0.01
Calocortus kennedeyi	2.8	0.01
Camissonia	2.8	0.01
Camissonia californica	2.8	0.01
Chaenactis	2.8	0.01
Arabis perennans	2.8	0.01
Eriogonum maculatum	2.8	0.01
Euphorbia polycarpa	2.8	0.01
Monoptilon bellioides	2.8	0.01
Penstemon	2.8	0.01
Camissonia chamaenerioides	2.8	0.01
Oenothera primaveris	2.8	0.01
Sphaeralcea	2.8	0.01
Mentzelia affinis	2.8	0.01
Malocothrix sonoraae	2.8	0.01
Rafinesquia	2.8	0.01
Hybanthus verticillatus var.	2.8	0.01
Lupinus sparsiflorus	2.8	0.01
Lotus	2.8	0.01
Linum perenne ssp lewisii	2.8	0.01
Lactuca serrulata	2.8	0.01
Sum for Structure Class:		26.13
Structural Growth Form 5. Grasses		
Muhlenbergia porteri	80.6	6.45
Vulpia octoflora	66.7	0.71
Poa bigelovii	63.9	1.32
Schismus arabicus	47.2	0.67
Bromus rubens	33.3	0.53
Pleuraphis mutica	30.6	3.94
unknown grass 1	25.0	0.78
Pleuraphis rigida	11.1	0.62
Tridens muticus	11.1	0.07
Elymus elymoides	8.3	0.50

Scientific Name	% Constancy	Avg. % Cover
Aristida purpurea	8.3	0.07
Bouteloua	2.8	0.17
Bouteloua repens	2.8	0.03
Muhlenbergia microsperma	2.8	0.03
Heteropogon contortus	2.8	0.01
Heptochloa panicea ssp.	2.8	0.01
Digitaria californica	2.8	0.01
unknown grass 2	2.8	0.01
Bromus carinatus	2.8	0.01
Sum for Structure Class:		15.90

Structural Growth Form 6. Vines

Scientific Name	% Constancy	Avg. % Cover
Janusia gracile	66.7	1.12
Sarcostemma cynanchoides	13.9	0.03
Matelea parvifolia	8.3	0.04
Galium aparine	5.6	0.01
Metastelma arizonicum	2.8	0.01
Nissolia schottii	2.8	0.01
Phaseolus filiformis	2.8	0.01
Maurandya antirrhinifolia	2.8	0.01
Sum for Structure Class:		1.24

Structural Growth Form 7. Ferns

Scientific Name	% Constancy	Avg. % Cover
Astrolepis cochisensis	33.3	0.17
Selaginella arizonica	27.8	4.53
Pellaea truncata	25.0	0.10
Notholaena standleyi	11.1	0.05
Astrolepis sinuata sinuata	8.3	0.02
unknown fern 1	5.6	0.03
Cheilanthes yavapensis	2.8	0.03
Sum for Structure Class:		4.93

Scientific Name	% Constancy	Avg. % Cover

Mountain Xeroriparian Scrub
(Summary Data Based on 16 Plots)

Structural Growth Form 1. Trees

Scientific Name	% Constancy	Avg. % Cover
Parkinsonia microphylla	75.0	5.00
Olneya tesota	43.8	0.97
Prosopis velutina	37.5	1.44
Phoradendron californicum	37.5	0.19
Parkinsonia florida	18.8	2.88
Quercus turbinella	6.3	0.13
Vauquelinia californica ssp.	6.3	0.02
Sum for Structure Class:		10.61

Structural Growth Form 2. Shrubs

Scientific Name	% Constancy	Avg. % Cover
Lycium	75.0	1.39
Acacia constricta	68.8	4.70
Ephedra aspera	68.8	2.47
Eriogonum fasiculatum	68.8	1.08
Acacia greggii	62.5	2.70
Encelia farinosa farinosa	62.5	1.17
Fouquieria splendens	62.5	0.67
Trixis californica	62.5	0.56
Larrea divaricata tridentata	56.3	1.08
Ditaxis lanceolata	56.3	0.38
Calliandra eriophylla	50.0	1.58
Krameria grayi	50.0	0.56
Ambrosia deltoidea	43.8	1.16
Celtis pallida pallida	37.5	3.63
Brickellia coulteri	37.5	1.08
Viguiera parishii	31.3	0.41
Jatropha cardiophylla	31.3	0.39
Eriogonum wrightii	31.3	0.34
Gallium stellatum	25.0	0.11
Tragia nepetifolia var dissecta	25.0	0.06
Lycium berlandieri	18.8	1.19

Scientific Name	% Constancy	Avg. % Cover
Menodora scabra	18.8	0.14
Mirabilis laevis v villosa	18.8	0.09
Artemisia ludoviciana	18.8	0.05
Abutilon incanum	18.8	0.05
unknown shrub 1	18.8	0.05
Coursetia glandulosa	12.5	0.69
Condalia warnockii	12.5	0.52
Anisacathus thurberi	12.5	0.38
Hyptis emoryi	12.5	0.31
Bernardia incana	12.5	0.31
Fagonia californica ssp longipes	12.5	0.19
Carlowrightii arizonica	12.5	0.08
Aloysia wrightii	12.5	0.08
Ziziphus obtusifolia canescens	12.5	0.08
Psilostrophe cooperi	12.5	0.03
Gymnosperma glutinosum	12.5	0.03
Hibiscus coulteri	12.5	0.03
Ayenia microphylla	12.5	0.03
Senna covesii	12.5	0.03
Simmondsia chinensis	6.3	0.63
Lycium exsertum	6.3	0.31
Lycium andersonii	6.3	0.31
Brickellia fructescens	6.3	0.31
Sebastiania bilocularis	6.3	0.25
Crossosma bigelovii	6.3	0.19
Forestiera phillyreiodes	6.3	0.13
Ambrosia dumosa	6.3	0.13
Baccharis sarothroides	6.3	0.06
Justicia longii	6.3	0.02
Agave deserti simplex	6.3	0.02
Zinnia acerosa	6.3	0.02
Atriplex canescens	6.3	0.02
Tiquilia canescens	6.3	0.02
Bebbia juncea aspera	6.3	0.02

Scientific Name	% Constancy	Avg. % Cover
Brickellia atrostyloides	6.3	0.02
Canotia holacantha	6.3	0.02
Adenophyllum porophylloides	6.3	0.02
Machaeranthera pinnatifida	6.3	0.02
Ericameria laricifolia	6.3	0.02
Hibiscus denudatus	6.3	0.02
Ayenia filiformis	6.3	0.02
Sum for Structure Class:		32.38

Structural Growth Form 3. Cactus

Scientific Name	% Constancy	Avg. % Cover
Cylindropuntia acanthocarpa	62.5	0.45
Carnegiea gigantea	50.0	0.22
Opuntia	25.0	0.27
Echinocereus engelmannii	25.0	0.06
Cylindropuntia leptocaulis	18.8	0.28
Ferocactus emoryi	12.5	0.03
Mammillaria grahamii	6.3	0.02
Cylindropuntia	6.3	0.02
Opuntia engelmannii	6.3	0.02
Sum for Structure Class:		1.36

Structural Growth Form 4. Herbs

Scientific Name	% Constancy	Avg. % Cover
Lepidium lasiocarpum	87.5	2.45
Cryptantha pterocarya	81.3	2.19
Descurania pinnata	75.0	0.89
Amsinckia intermedia	68.8	1.30
Eucrypta micrantha	68.8	1.28
Linanthus jonesii	68.8	0.22
Chorizanthe brevicornus	62.5	0.42
Gilia stellata	56.3	0.61
Eriastrum diffusum	56.3	0.19
Chaenactis stevioides	56.3	0.19
Phacelia coerulea	50.0	2.20
Phacelia ambigua	50.0	0.53
Caulanthus lasiophyllus	50.0	0.45

Scientific Name	% Constancy	Avg. % Cover
Chenopodium neomexicana	50.0	0.44
Camissonia	50.0	0.22
Camissonia californica	50.0	0.22
Draba cuneifolia	50.0	0.22
Stylocline micropoides	50.0	0.13
Erodium cicutarium	43.8	1.02
Lesquerella gordonii	43.8	0.78
Cryptantha maritima	43.8	0.52
Silene antirrhina	43.8	0.45
Pectocarya recurvata	43.8	0.36
Plantago ovata	43.8	0.33
Filago	43.8	0.11
Rafinesquia neomexicana	43.8	0.11
Ambrosia ambrosioides	37.5	0.59
Pholistoma auritum var	37.5	0.53
Sisymbrium irio	37.5	0.41
Cryptantha barbigera	37.5	0.30
Plantago patagonica	37.5	0.25
Sphaeralcea ambigua	37.5	0.23
Phacelia	31.3	0.39
Gilia	31.3	0.25
Daucus pusillus	31.3	0.17
Lupinus sparsiflorus	31.3	0.13
Calycoseris wrightii	31.3	0.13
Eriophyllum lanosum	31.3	0.08
Androsace occidentalis	25.0	0.34
Uropappus lindleyi	25.0	0.11
Eriogonum abertianum	25.0	0.11
Stephanomeria pauciflora	25.0	0.11
Thysanocarpis curvipes	25.0	0.06
Mentzelia	25.0	0.06
Dichelostemma capitatum ssp.	25.0	0.06
Ditaxis neomexicana	25.0	0.06
Euphorbia polycarpa	18.8	0.16

Scientific Name	% Constancy	Avg. % Cover
Hedeona nanum var marocalyx	18.8	0.09
Astragalus nuttallianus	18.8	0.09
Eriogonum inflatum	18.8	0.09
Eschscholzia mexicana	18.8	0.05
Marina parryi	18.8	0.05
Allionia incarnata	18.8	0.05
Eriogonum deflexum	18.8	0.05
Nemacladus glanduliferous var.	18.8	0.05
Sphaeralcea coulteri	18.8	0.05
Delphinium scaposum	18.8	0.05
Acourtia wrightii	12.5	0.14
Eriogonum maculatum	12.5	0.14
Herissantia crispa	12.5	0.14
Lappula occidentalis	12.5	0.14
Pectocarya	12.5	0.08
Acleisanthes longiflora	12.5	0.08
Camissonia chamaenerioides	12.5	0.08
Eriogonum thomasii	12.5	0.08
Chorizanthe rigida	12.5	0.08
Filago arizonica	12.5	0.08
Cryptantha micrantha	12.5	0.03
Euphorbia	12.5	0.03
Euphorbia albomarginata	12.5	0.03
Streptanthus carinatus	12.5	0.03
Lotus	12.5	0.03
Lactuca serrulata	12.5	0.03
Salvia pinguifolia	6.3	0.31
Phacelia distans	6.3	0.13
Amsinckia tessellata	6.3	0.13
Amsinkia	6.3	0.06
Mentzelia involucrata	6.3	0.06
Mentzelia affinis	6.3	0.06
Linanthus bigelovii	6.3	0.06
Euphorbia pediculifera	6.3	0.02

Scientific Name	% Constancy	Avg. % Cover
Parietaria floridana	6.3	0.02
Sonchus oleraceus	6.3	0.02
Castilleja exserta ssp. Exserta	6.3	0.02
Sphaeralcea laxa	6.3	0.02
Filago californica	6.3	0.02
Acourtia nana	6.3	0.02
Trifolium wormskioldii	6.3	0.02
unknown herb 1	6.3	0.02
Euphorbia eriantha	6.3	0.02
Verbena neomexicana	6.3	0.02
Euphorbia arizonica	6.3	0.02
Castilleja lanata	6.3	0.02
Malvastrum bicuspidatum	6.3	0.02
Penstemon pseudospectabilis	6.3	0.02
Perityle emoryii	6.3	0.02
Eriogonum	6.3	0.02
Lesquerella tenella	6.3	0.02
Astragalus arizonicus	6.3	0.02
Silene	6.3	0.02
Plagiobothrys jonesii	6.3	0.02
Malocothrix sonoraae	6.3	0.02
Ambrosia confertifolia	6.3	0.02
Rafinesquia californica	6.3	0.02
Machaeranthera tagetina	6.3	0.02
Lupinus	6.3	0.02
Senecio lemmonii	6.3	0.02
Sum for Structure Class:		25.41

Structural Growth Form 5. Grasses

Scientific Name	% Constancy	Avg. % Cover
Schismus arabicus	81.3	2.36
Poa bigelovii	75.0	2.53
Vulpia octoflora	75.0	1.30
Muhlenbergia porteri	43.8	1.86
Bromus rubens	43.8	1.00

Scientific Name	% Constancy	Avg. % Cover
Aristida purpurea	18.8	0.09
Heteropogon contortus	18.8	0.05
Pleuraphis	12.5	0.33
Pleuraphis rigida	12.5	0.14
Bromus carinatus	12.5	0.03
Aristida	12.5	0.03
unknown grass 1	6.3	0.06
Pleuraphis mutica	6.3	0.06
unknown grass 2	6.3	0.06
Aristida adsensionis	6.3	0.02
Pennisetum ciliare	6.3	0.02
Trisetum interruptum	6.3	0.02
Bouteloua curtipendula	6.3	0.02
Erioneuron pulchellum	6.3	0.02
Sum for Structure Class:		9.98

Structural Growth Form 6. Vines

Scientific Name	% Constancy	Avg. % Cover
Janusia gracile	56.3	0.73
Sarcostemma cynanchoides	18.8	0.05
Antirrhinum filipes	6.3	0.02
Rhynchosia senna var. texana	6.3	0.02
Nissolia schottii	6.3	0.02
Matelea parvifolia	6.3	0.02
Lyrocarpa coulteri	6.3	0.02
Galium aparine	6.3	0.02
Cucurbita digitata	6.3	0.02
Sum for Structure Class:		0.89

Structural Growth Form 7. Ferns

Scientific Name	% Constancy	Avg. % Cover
Pellaea truncata	18.8	0.05
Selaginella arizonica	12.5	0.64
Astrolepis cochisensis	12.5	0.14
Notholaena standleyi	6.3	0.02
Sum for Structure Class:		0.84

Scientific Name	% Constancy	Avg. % Cover

Paloverde - Mixed Cacti - Mixed Scrub on Bajadas
(Summary Data Based on 35 Plots)

Structural Growth Form 1. Trees

Scientific Name	% Constancy	Avg. % Cover
Parkinsonia microphylla	71.4	3.05
Olneya tesota	28.6	1.75
Phoradendron californicum	14.3	0.04
Parkinsonia florida	11.4	0.49
Prosopis velutina	11.4	0.29
Sum for Structure Class:		5.62

Structural Growth Form 2. Shrubs

Scientific Name	% Constancy	Avg. % Cover
Larrea divaricata tridentata	100.0	5.51
Ambrosia deltoidea	97.1	4.69
Krameria grayi	51.4	0.86
Fouquieria splendens	45.7	0.47
Lycium	25.7	0.18
Ambrosia dumosa	22.9	0.26
Acacia constricta	20.0	0.24
Ditaxis lanceolata	17.1	0.04
Encelia farinosa farinosa	14.3	0.04
Hymenoclea salsola	11.4	0.55
Trixis californica	8.6	0.06
Lycium parishii	5.7	0.06
Lycium andersonii	5.7	0.01
Lycium macrodon	2.9	0.09
Acacia greggii	2.9	0.06
Krameria erecta	2.9	0.06
Ephedra aspera	2.9	0.03
Fagonia californica ssp longipes	2.9	0.03
Jatropha cardiophylla	2.9	0.03
Lycium berlandieri	2.9	0.01
Ayenia filiformis	2.9	0.01
Calliandra eriophylla	2.9	0.01
Sum for Structure Class:		13.29

Scientific Name	% Constancy	Avg. % Cover
Structural Growth Form 3. Cactus		
Cylindropuntia acanthocarpa	68.6	0.92
Carnegiea gigantea	65.7	0.40
Cylindropuntia fulgida	22.9	0.15
Mammillaria grahamii	22.9	0.06
Echinocereus engelmannii	17.1	0.04
Cylindropuntia leptocaulis	14.3	0.09
Ferocactus emoryi	14.3	0.06
Cylindropuntia bigelovii	8.6	0.02
Opuntia	5.7	0.29
Echinocereus	5.7	0.01
Cylindropuntia	2.9	0.03
Ferocactus	2.9	0.01
Mammillaria	2.9	0.01
Mammillaria tetrancistra	2.9	0.01
Opuntia engelmannii	2.9	0.01
Peniocereus greggii	2.9	0.01
Sum for Structure Class:		2.11
Structural Growth Form 4. Herbs		
Lepidium lasiocarpum	94.3	4.52
Plantago ovata	74.3	1.28
Chorizanthe brevicornus	74.3	1.26
Caulanthus lasiophyllus	62.9	0.54
Cryptantha pterocarya	62.9	0.45
Chorizanthe rigida	60.0	0.36
Lesquerella gordonii	57.1	1.03
Cryptantha maritima	48.6	1.79
Pectocarya	45.7	2.80
Eriophyllum lanosum	42.9	0.23
Chaenactis stevioides	37.1	0.34
Amsinckia intermedia	37.1	0.25
Pectocarya recurvata	31.4	1.81
Descurania pinnata	31.4	0.18

Scientific Name	% Constancy	Avg. % Cover
Pectocarya platycarpa	28.6	0.46
Phacelia ambigua	22.9	0.24
Euphorbia polycarpa	20.0	0.11
Eriastrum diffusum	20.0	0.05
Camissonia	20.0	0.05
Cryptantha barbigera	17.1	0.26
Phacelia	17.1	0.11
Amsinkia	17.1	0.06
Stylocline micropoides	17.1	0.04
Camissonia chamaenerioides	14.3	0.14
Draba cuneifolia	14.3	0.08
Eriogonum thomasii	11.4	0.74
Filago	11.4	0.07
Filago arizonica	11.4	0.05
Eucrypta micrantha	11.4	0.03
Cryptantha	8.6	0.18
Amsinckia tessellata	8.6	0.11
Sisymbrium irio	8.6	0.07
Camissonia californica	8.6	0.04
Euphorbia	8.6	0.04
Linanthus jonesii	8.6	0.02
Mentzelia	8.6	0.02
Lupinus sparsiflorus	8.6	0.02
Erodium cicutarium	5.7	0.12
Ditaxis neomexicana	5.7	0.04
Eriogonum	5.7	0.04
Gilia	5.7	0.04
Orobanche cooperi	5.7	0.01
Lotus	5.7	0.01
Loeflingia squarrosa ssp.	5.7	0.01
Erodium texanum	5.7	0.01
Nama hispidum	5.7	0.01
Eriogonum inflatum	5.7	0.01
Daucus pusillus	5.7	0.01

Scientific Name	% Constancy	Avg. % Cover
Rafinesquia neomexicana	5.7	0.01
Calycoseris wrightii	5.7	0.01
Lappula occidentalis	2.9	0.06
Plagiobothrys	2.9	0.03
Eschscholzia mexicana	2.9	0.03
Mentzelia involucrata	2.9	0.03
Astragalus	2.9	0.03
Lotus salsuginosus	2.9	0.03
Marina parryi	2.9	0.01
Thysanocarpis curvipes	2.9	0.01
Sphaeralcea	2.9	0.01
Chaenactis carphoclinia	2.9	0.01
Senecio	2.9	0.01
Eriogonum deflexum	2.9	0.01
Euphorbia pediculifera	2.9	0.01
Lupinus	2.9	0.01
Parietaria floridana	2.9	0.01
Allium macropetalon	2.9	0.01
Oligomeris linifolia	2.9	0.01
Nicotiana obtusifolia	2.9	0.01
Monoptilon bellioides	2.9	0.01
Cryptantha micrantha	2.9	0.01
Sum for Structure Class:		20.49
Structural Growth Form 5. Grasses		
Schismus arabicus	100.0	7.44
Vulpia octoflora	28.6	0.24
Erioneuron pulchellum	11.4	0.05
Aristida	8.6	0.04
Poa bigelovii	8.6	0.04
Aristida adsensionis	2.9	0.01
Muhlenbergia porteri	2.9	0.01
Aristida purpurea	2.9	0.01
Sum for Structure Class:		7.84
Structural Growth Form 6. Vines		
Janusia gracile	5.7	0.04
Sum for Structure Class:	0.04	

Scientific Name	% Constancy	Avg. % Cover

Paloverde - Mixed Cacti - Mixed Scrub on Rocky Slopes
(Summary Data Based on 64 Plots)

Structural Growth Form 1. Trees

Parkinsonia microphylla	92.2	6.02
Olneya tesota	15.6	0.36
Phoradendron californicum	4.7	0.01
Parkinsonia florida	3.1	0.16
Sum for Structure Class:		6.54

Structural Growth Form 2. Shrubs

Fouquieria splendens	82.8	1.68
Encelia farinosa farinosa	73.4	2.72
Larrea divaricata tridentata	70.3	1.88
Ambrosia deltoidea	67.2	3.32
Lycium	59.4	0.69
Krameria grayi	57.8	0.80
Ephedra aspera	39.1	0.46
Ditaxis lanceolata	32.8	0.12
Fagonia californica ssp longipes	25.0	0.19
Trixis californica	21.9	0.09
Viguiera parishii	20.3	0.53
Hyptis emoryi	20.3	0.41
Acacia constricta	20.3	0.30
Eriogonum fasiculatum	18.8	0.52
Agave deserti simplex	18.8	0.11
Gallium stellatum	17.2	0.21
Lycium berlandieri	14.1	0.20
Calliandra eriophylla	12.5	0.22
Jatropha cardiophylla	12.5	0.21
Menodora scabra	12.5	0.11
Machaeranthera pinnatifida	12.5	0.05
Mirabilis laevis v villosa	10.9	0.07
Acacia greggii	9.4	0.10
Brickellia coulteri	7.8	0.07

Scientific Name	% Constancy	Avg. % Cover
Ayenia microphylla	7.8	0.03
Porophyllum gracile	6.3	0.05
Adenophyllum porophylloides	6.3	0.03
Celtis pallida pallida	6.3	0.03
Eriogonum wrightii	4.7	0.11
Condalia warnockii	4.7	0.02
Krameria erecta	3.1	0.08
Hibiscus denudatus	3.1	0.07
Ambrosia dumosa	3.1	0.06
Tiquilia canescens	3.1	0.02
Crossosma bigelovii	3.1	0.02
Lycium andersonii	3.1	0.01
Sebastiania bilocularis	1.6	0.06
Lycium parishii	1.6	0.02
Ziziphus obtusifolia canescens	1.6	0.02
Simmondsia chinensis	1.6	0.02
Lycium exsertum	1.6	0.02
Aloysia wrightii	1.6	0.00
Carlowrightii arizonica	1.6	0.00
Abutilon incanum	1.6	0.00
Abutilon	1.6	0.00
Senna covesii	1.6	0.00
Gymnosperma glutinosum	1.6	0.00
Koeberlinia spinosa	1.6	0.00
Sum for Structure Class:		15.77

Structural Growth Form 3. Cactus

Cylindropuntia acanthocarpa	82.8	1.34
Carnegiea gigantea	76.6	0.36
Echinocereus engelmannii	40.6	0.14
Mammillaria grahamii	31.3	0.08
Cylindropuntia bigelovii	15.6	0.77
Ferocactus emoryi	15.6	0.04
Cylindropuntia leptocaulis	10.9	0.08

Scientific Name	% Constancy	Avg. % Cover
Opuntia phaeacantha	9.4	0.09
Echinocereus	7.8	0.02
Ferocactus	7.8	0.02
Ferocactus cylindraceus	7.8	0.02
Cylindropuntia fulgida	6.3	0.07
Opuntia	6.3	0.07
Opuntia engelmannii	4.7	0.05
Mammillaria	3.1	0.01
Opuntia chlorotica	1.6	0.02
Mammillaria tetrancistra	1.6	0.00
Cylindropuntia	1.6	0.00
Sum for Structure Class:		3.18

Structural Growth Form 4. Herbs

Lepidium lasiocarpum	85.9	5.86
Cryptantha pterocarya	70.3	2.81
Chorizanthe brevicornus	60.9	0.29
Caulanthus lasiophyllus	56.3	0.78
Descurania pinnata	48.4	0.35
Plantago ovata	42.2	1.26
Pectocarya recurvata	42.2	1.13
Amsinckia intermedia	42.2	0.63
Cryptantha maritima	39.1	0.72
Phacelia	35.9	1.07
Eucrypta micrantha	35.9	0.54
Lesquerella gordonii	31.3	2.05
Gilia	31.3	0.24
Cryptantha barbigera	29.7	0.95
Daucus pusillus	29.7	0.21
Eriophyllum lanosum	26.6	0.11
Perityle emoryii	25.0	1.16
Phacelia ambigua	25.0	0.32
Sphaeralcea ambigua	25.0	0.26
Thysanocarpis curvipes	25.0	0.26

Scientific Name	% Constancy	Avg. % Cover
Draba cuneifolia	25.0	0.07
Erodium cicutarium	21.9	1.38
Linanthus jonesii	21.9	0.20
Camissonia	21.9	0.08
Stylocline micropoides	20.3	0.21
Gilia stellata	18.8	0.14
Phacelia coerulea	17.2	0.74
Chenopodium neomexicana	17.2	0.15
Pectocarya	15.6	0.96
Chaenactis stevioides	15.6	0.06
Camissonia chamaenerioides	15.6	0.06
Eriastrum diffusum	15.6	0.06
Lupinus sparsiflorus	14.1	0.05
Eriogonum inflatum	12.5	0.09
Amsinkia	12.5	0.08
Filago	12.5	0.04
Camissonia californica	12.5	0.04
Euphorbia	10.9	0.09
Rafinesquia neomexicana	10.9	0.08
Dichelostemma capitatum ssp.	10.9	0.03
Eriogonum abertianum	10.9	0.03
Filago arizonica	9.4	0.06
Astragalus nuttallianus	9.4	0.04
Plantago patagonica	7.8	0.11
Stephanomeria pauciflora	7.8	0.07
Pectocarya platycarpa	7.8	0.07
Euphorbia polycarpa	7.8	0.06
Lotus	7.8	0.04
Eriogonum deflexum	7.8	0.02
Erodium texanum	6.3	0.07
Amsinckia tessellata	6.3	0.06
Senecio lemmonii	6.3	0.05
Silene antirrhina	6.3	0.03
Calycoseris wrightii	6.3	0.03

Scientific Name	% Constancy	Avg. % Cover
Marina parryi	6.3	0.03
Sphaeralcea coulteri	6.3	0.03
Eschscholzia mexicana	6.3	0.03
Eriogonum thomasii	6.3	0.03
Gilia flavocincta	6.3	0.02
Calandrinia ciliata	6.3	0.02
Ditaxis neomexicana	6.3	0.02
Uropappus lindleyi	6.3	0.02
Phacelia distans	4.7	0.25
Mentzelia involucrata	4.7	0.02
unknown herb 1	4.7	0.02
Bowlesia incana	4.7	0.01
Lotus salsuginosus	4.7	0.01
Astragalus	4.7	0.01
Linanthus bigelovii	4.7	0.01
Chorizanthe rigida	4.7	0.01
Delphinium scaposum	4.7	0.01
Acleisanthes longiflora	4.7	0.01
Sisymbrium irio	3.1	0.13
Plantago	3.1	0.07
Sphaeralcea	3.1	0.07
Androsace occidentalis	3.1	0.05
Linum perenne ssp lewisii	3.1	0.02
Cryptantha	3.1	0.02
Streptanthus carinatus	3.1	0.02
Senecio	3.1	0.01
Sonchus	3.1	0.01
Nicotiana obtusifolia	3.1	0.01
Parietaria floridana	3.1	0.01
Eriogonum	3.1	0.01
Cryptantha micrantha	3.1	0.01
Euphorbia arizonica	3.1	0.01
Chenopodium	1.6	0.08
Chaenactis carphoclinia	1.6	0.05

Scientific Name	% Constancy	Avg. % Cover
Pholistoma auritum var	1.6	0.02
Allionia incarnata	1.6	0.02
Crassula connata	1.6	0.00
Salsola tragus	1.6	0.00
Ditaxis adenophora	1.6	0.00
Eucrypta chrysanthemifolia	1.6	0.00
Euphorbia pediculifera	1.6	0.00
Lappula occidentalis	1.6	0.00
Mentzelia	1.6	0.00
Brassica tournefortii	1.6	0.00
Nemacladus glanduliferous var.	1.6	0.00
Euphorbia capitellata	1.6	0.00
Antirrhinum cyathiferum	1.6	0.00
Silene	1.6	0.00
Lupinus Arizonicus	1.6	0.00
Camissonia boothii ssp	1.6	0.00
Lesquerella tenella	1.6	0.00
Lupinus	1.6	0.00
Dudleya arizonica	1.6	0.00
Monoptilon bellioides	1.6	0.00
Euphorbia albomarginata	1.6	0.00
Sum for Structure Class:		27.55

Structural Growth Form 5. Grasses

Scientific Name	% Constancy	Avg. % Cover
Schismus arabicus	85.9	3.37
Vulpia octoflora	57.8	1.01
Muhlenbergia porteri	34.4	1.17
Poa bigelovii	21.9	0.09
Aristida	18.8	0.11
Erioneuron pulchellum	12.5	0.17
Tridens muticus	9.4	0.32
unknown grass 1	7.8	0.06
Aristida purpurea	7.8	0.06
Bromus rubens	7.8	0.05

Scientific Name	% Constancy	Avg. % Cover
Muhlenbergia microsperma	4.7	0.04
Pleuraphis rigida	4.7	0.02
Muhlenbergia	3.1	0.05
Aristida adsensionis	3.1	0.01
Pleuraphis mutica	3.1	0.01
Trisetum interruptum	1.6	0.00
Sum for Structure Class:		6.55
Structural Growth Form 6. Vines		
Janusia gracile	43.8	0.94
Matelea parvifolia	1.6	0.00
Sarcostemma cynanchoides	1.6	0.00
Sum for Structure Class:		0.95
Structural Growth Form 7. Ferns		
Selaginella arizonica	29.7	4.66
Notholaena standleyi	21.9	0.07
Astrolepis cochisensis	10.9	0.03
Cheilanthes parryi	3.1	0.01
Pellaea truncata	3.1	0.01
Astrolepis sinuata sinuata	1.6	0.00
Sum for Structure Class:		4.78

Scientific Name	% Constancy	Avg. % Cover

Rock Outcrop
(Summary Data Based on 7 Plots)

Structural Growth Form 1. Trees

Parkinsonia microphylla	57.1	0.68
Vauquelinia californica ssp.	14.3	0.14
Prosopis velutina	14.3	0.04
Sum for Structure Class:		0.86

Structural Growth Form 2. Shrubs

Encelia farinosa farinosa	85.7	2.50
Larrea divaricata tridentata	71.4	1.21
Lycium	57.1	0.39
Eriogonum wrightii	42.9	1.14
Acacia greggii	42.9	0.46
Ephedra aspera	42.9	0.46
Viguiera parishii	42.9	0.43
Brickellia coulteri	42.9	0.21
Ambrosia deltoidea	28.6	0.43
Trixis californica	28.6	0.32
Hyptis emoryi	28.6	0.32
Aloysia wrightii	28.6	0.18
Gallium stellatum	28.6	0.07
Fouquieria splendens	28.6	0.07
Celtis pallida pallida	28.6	0.07
Agave deserti simplex	28.6	0.07
Gutierrezia sarothrae	14.3	0.29
Krameria erecta	14.3	0.14
Ayenia microphylla	14.3	0.04
Acacia constricta	14.3	0.04
Eriogonum fasiculatum	14.3	0.04
unknown shrub 1	14.3	0.04
Menodora scabra	14.3	0.04
Bebbia juncea aspera	14.3	0.04
Krameria grayi	14.3	0.04

Scientific Name	% Constancy	Avg. % Cover
Koeberlinia spinosa	14.3	0.04
Hibiscus coulteri	14.3	0.04
Gymnosperma glutinosum	14.3	0.04
Ditaxis lanceolata	14.3	0.04
Senna covesii	14.3	0.04
Sum for Structure Class:		9.21

Structural Growth Form 3. Cactus

Scientific Name	% Constancy	Avg. % Cover
Carnegiea gigantea	71.4	0.39
Cylindropuntia acanthocarpa	57.1	0.14
Cylindropuntia bigelovii	28.6	0.18
Opuntia	28.6	0.18
Echinocereus engelmannii	28.6	0.07
Mammillaria grahamii	28.6	0.07
Ferocactus emoryi	14.3	0.04
Mammillaria	14.3	0.04
Sum for Structure Class:		1.11

Structural Growth Form 4. Herbs

Scientific Name	% Constancy	Avg. % Cover
Sphaeralcea ambigua	85.7	0.21
Descurania pinnata	71.4	0.18
Lepidium lasiocarpum	57.1	0.54
Phacelia	57.1	0.14
Perityle emoryii	42.9	0.32
Eucrypta micrantha	28.6	0.18
Stephanomeria pauciflora	28.6	0.18
Cryptantha pterocarya	28.6	0.07
Cryptantha maritima	28.6	0.07
Phacelia ambigua	28.6	0.07
Camissonia	28.6	0.07
Thysanocarpis curvipes	28.6	0.07
Euphorbia melanadenia	28.6	0.07
Lotus	28.6	0.07
Plantago patagonica	28.6	0.07
Cryptantha	14.3	0.43

Scientific Name	% Constancy	Avg. % Cover
Nicotiana obtusifolia	14.3	0.14
Pholistoma auritum var	14.3	0.14
Cirsium neomexicana	14.3	0.14
Chorizanthe brevicornus	14.3	0.14
Trifolium wormskioldii	14.3	0.14
Rafinesquia californica	14.3	0.04
Stylocline micropoides	14.3	0.04
Pectocarya recurvata	14.3	0.04
Uropappus lindleyi	14.3	0.04
Penstemon parryi	14.3	0.04
Verbena	14.3	0.04
unknown herb 1	14.3	0.04
Chaenactis carphoclinia	14.3	0.04
Filago arizonica	14.3	0.04
Parietaria floridana	14.3	0.04
Acourtia nana	14.3	0.04
Amsinckia intermedia	14.3	0.04
Caulanthus lasiophyllus	14.3	0.04
Delphinium scaposum	14.3	0.04
Draba cuneifolia	14.3	0.04
Eriogonum abertianum	14.3	0.04
Erodium cicutarium	14.3	0.04
Erodium texanum	14.3	0.04
Euphorbia albomarginata	14.3	0.04
Filago	14.3	0.04
Gutierrezia arizonica	14.3	0.04
Myosurus cupulatus	14.3	0.04
Castilleja lanata	14.3	0.04
Sum for Structure Class:		4.29

Structural Growth Form 5. Grasses

Scientific Name	% Constancy	Avg. % Cover
Schismus arabicus	71.4	0.18
Poa bigelovii	42.9	0.11
Muhlenbergia porteri	28.6	0.32

Scientific Name	% Constancy	Avg. % Cover
Vulpia octoflora	28.6	0.18
Bouteloua	28.6	0.07
Bromus rubens	28.6	0.07
Pleuraphis mutica	14.3	0.14
Aristida purpurea	14.3	0.14
Muhlenbergia microsperma	14.3	0.04
Aristida adsensionis	14.3	0.04
Aristida parishii	14.3	0.04
Sum for Structure Class:		1.32
Structural Growth Form 6. Vines		
Janusia gracile	42.9	0.11
Matelea parvifolia	14.3	0.04
Maurandya antirrhinifolia	14.3	0.04
Rhynchosia texana	14.3	0.04
Sum for Structure Class:		0.21
Structural Growth Form 7. Ferns		
Astrolepis cochisensis	28.6	0.07
Notholaena standleyi	28.6	0.07
Selaginella arizonica	14.3	1.43
Astrolepis sinuata sinuata	14.3	0.04
Sum for Structure Class:		1.61

Scientific Name	% Constancy	Avg. % Cover

Desert Spring
(Summary Data Based on 3 Plots)

Structural Growth Form 1. Trees

Prosopis velutina	100.0	5.00
Parkinsonia microphylla	66.7	3.00
Sum for Structure Class:		8.00

Structural Growth Form 2. Shrubs

Acacia greggii	100.0	3.00
Coursetia glandulosa	100.0	2.08
Ephedra aspera	100.0	1.42
Acacia constricta	100.0	1.33
Brickellia coulteri	100.0	1.08
Eriogonum wrightii	66.7	2.00
Celtis pallida pallida	66.7	1.67
Simmondsia chinensis	66.7	1.42
Encelia farinosa farinosa	66.7	1.42
Lycium	66.7	1.33
Eriogonum fasiculatum	66.7	1.00
Abutilon incanum	66.7	0.75
Calliandra eriophylla	66.7	0.75
Jatropha cardiophylla	66.7	0.67
Justicia longii	66.7	0.67
Krameria grayi	66.7	0.42
Ditaxis lanceolata	66.7	0.17
Ayenia filiformis	66.7	0.17
Condalia warnockii	33.3	0.67
Mirabilis laevis v villosa	33.3	0.33
Menodora scabra	33.3	0.33
Trixis californica	33.3	0.33
Larrea divaricata tridentata	33.3	0.33
Fouquieria splendens	33.3	0.33
Ambrosia deltoidea	33.3	0.08
Ziziphus obtusifolia canescens	33.3	0.08

Scientific Name	% Constancy	Avg. % Cover
Senna covesii	33.3	0.08
Viguiera parishii	33.3	0.08
Tiquilia canescens	33.3	0.08
Gutierrezia sarothrae	33.3	0.08
Aloysia wrightii	33.3	0.08
Hibiscus coulteri	33.3	0.08
Yucca baccata	33.3	0.08
Sum for Structure Class:		24.42
Structural Growth Form 3. Cactus		
Carnegiea gigantea	100.0	0.50
Cylindropuntia acanthocarpa	66.7	0.67
Cylindropuntia bigelovii	33.3	0.08
Opuntia phaeacantha	33.3	0.08
Opuntia	33.3	0.08
Mammillaria grahamii	33.3	0.08
Echinocereus engelmannii	33.3	0.08
Ferocactus emoryi	33.3	0.08
Sum for Structure Class:		1.67
Structural Growth Form 4. Herbs		
Amsinckia intermedia	100.0	6.33
Lepidium lasiocarpum	100.0	5.00
Phacelia coerulea	100.0	3.67
Cryptantha pterocarya	100.0	3.33
Caulanthus lasiophyllus	100.0	1.75
Silene antirrhina	100.0	1.08
Daucus pusillus	100.0	0.50
Chenopodium neomexicana	66.7	1.67
Cryptantha barbigera	66.7	1.33
Pholistoma auritum var	66.7	1.08
Ambrosia ambrosioides	66.7	1.00
Sphaeralcea coulteri	66.7	1.00
Euphorbia albomarginata	66.7	0.75
Gilia stellata	66.7	0.67

Scientific Name	% Constancy	Avg. % Cover
Plantago patagonica	66.7	0.42
Allionia incarnata	66.7	0.42
Eucrypta micrantha	66.7	0.42
Eschscholzia mexicana	66.7	0.42
Sphaeralcea ambigua	66.7	0.42
Eriogonum abertianum	66.7	0.42
Erigeron divergens	66.7	0.17
Erodium cicutarium	66.7	0.17
Castilleja exserta ssp. Exserta	66.7	0.17
Thysanocarpis curvipes	66.7	0.17
Rafinesquia neomexicana	66.7	0.17
Lupinus sparsiflorus	66.7	0.17
Linanthus jonesii	66.7	0.17
Euphorbia polycarpa	33.3	0.67
Descurania pinnata	33.3	0.33
Pectocarya recurvata	33.3	0.33
Phacelia ambigua	33.3	0.33
Lesquerella gordonii	33.3	0.33
Lotus	33.3	0.33
Typha domingensis	33.3	0.08
Uropappus lindleyi	33.3	0.08
Perityle emoryii	33.3	0.08
Stylocline micropoides	33.3	0.08
Penstemon parryi	33.3	0.08
Plantago ovata	33.3	0.08
Atriplex elegans	33.3	0.08
Acourtia wrightii	33.3	0.08
Camissonia	33.3	0.08
Camissonia californica	33.3	0.08
Draba cuneifolia	33.3	0.08
Eriogonum deflexum	33.3	0.08
Filago	33.3	0.08
Filago arizonica	33.3	0.08
Gilia	33.3	0.08

Scientific Name	% Constancy	Avg. % Cover
Ambrosia confertifolia	33.3	0.08
Chorizanthe brevicornus	33.3	0.08
Marina parryi	33.3	0.08
Parietaria floridana	33.3	0.08
Cryptantha maritima	33.3	0.08
Sum for Structure Class:		36.83
Structural Growth Form 5. Grasses		
Bromus rubens	66.7	6.00
Schismus arabicus	66.7	4.67
Poa bigelovii	66.7	3.00
Pleuraphis rigida	66.7	0.67
Vulpia octoflora	66.7	0.42
Bouteloua repens	33.3	0.67
Muhlenbergia porteri	33.3	0.33
unknown grass 1	33.3	0.08
Pleuraphis mutica	33.3	0.08
Heteropogon contortus	33.3	0.08
Bromus carinatus	33.3	0.08
Aristida purpurea	33.3	0.08
Aristida ternipes var. ternipes	33.3	0.08
Sum for Structure Class:		16.25
Structural Growth Form 6. Vines		
Janusia gracile	66.7	1.75
Sarcostemma cynanchoides	33.3	0.67
Nissolia schottii	33.3	0.33
Rhynchosia texana	33.3	0.08
Lyrocarpa coulteri	33.3	0.08
Vicia ludoviciana var. ludoviciana	33.3	0.08
Sum for Structure Class:		3.00
Structural Growth Form 7. Ferns		
Astrolepis cochisensis	33.3	0.08
Notholaena standleyi	33.3	0.08
Selaginella arizonica	33.3	0.08
Sum for Structure Class:	0.25	

Scientific Name	% Constancy	Avg. % Cover

Braided Channel Floodplain
(Summary Data Based on 21 Plots)

Scientific Name	% Constancy	Avg. % Cover
Structural Growth Form 1. Trees		
Parkinsonia florida	61.9	6.04
Prosopis velutina	47.6	2.76
Phoradendron californicum	28.6	1.01
Olneya tesota	19.0	2.76
Parkinsonia microphylla	9.5	0.25
Sum for Structure Class:		12.82
Structural Growth Form 2. Shrubs		
Larrea divaricata tridentata	52.4	2.68
Hymenoclea salsola	42.9	1.21
Baccharis sarothroides	38.1	0.75
Acacia greggii	28.6	1.93
Chilopsis linearis arcuata	28.6	0.23
Lycium andersonii	23.8	2.76
Ambrosia deltoidea	23.8	0.18
Lycium	19.0	0.45
Bebbia juncea aspera	19.0	0.05
Celtis pallida pallida	4.8	0.10
Acacia constricta	4.8	0.05
Petalonyx thurberi	4.8	0.01
Sum for Structure Class:		10.39
Structural Growth Form 3. Cactus		
Carnegiea gigantea	9.5	0.02
Cylindropuntia leptocaulis	4.8	0.05
Cylindropuntia acanthocarpa	4.8	0.05
Echinocereus engelmannii	4.8	0.01
Ferocactus cylindraceus	4.8	0.01
Cylindropuntia bigelovii	4.8	0.01
Sum for Structure Class:		0.15

Scientific Name	% Constancy	Avg. % Cover
Structural Growth Form 4. Herbs		
Amsinckia intermedia	85.7	0.99
Lepidium lasiocarpum	81.0	1.95
Lesquerella gordonii	66.7	0.39
Ambrosia ambrosioides	61.9	1.54
Descurania pinnata	61.9	0.62
Eriophyllum lanosum	61.9	0.23
Pectocarya	57.1	3.99
Sisymbrium irio	52.4	0.77
Erodium cicutarium	52.4	0.30
Plantago ovata	47.6	1.26
Lupinus sparsiflorus	47.6	0.80
Cryptantha maritima	47.6	0.52
Chaenactis stevioides	47.6	0.19
Cryptantha pterocarya	42.9	0.44
Chorizanthe brevicornus	42.9	0.35
Camissonia chamaenerioides	42.9	0.18
Pectocarya platycarpa	33.3	1.25
Caulanthus lasiophyllus	33.3	0.20
Stylocline micropoides	28.6	0.24
Lappula occidentalis	28.6	0.20
Eriogonum deflexum	23.8	0.13
Chorizanthe rigida	23.8	0.06
Parietaria floridana	19.0	0.55
Cryptantha	19.0	0.31
Euphorbia setiloba	19.0	0.12
Lupinus concinnus	19.0	0.08
Euphorbia polycarpa	19.0	0.08
Cryptantha barbigera	19.0	0.08
Cryptantha micrantha	19.0	0.08
Calycoseris wrightii	19.0	0.05
Linanthus bigelovii	19.0	0.05
Gilia	14.3	0.31
Eucrypta micrantha	14.3	0.11

Scientific Name	% Constancy	Avg. % Cover
Silene	14.3	0.04
Mentzelia	14.3	0.04
Sphaeralcea	14.3	0.04
Camissonia	14.3	0.04
Monoptilon bellioides	14.3	0.04
Draba cuneifolia	14.3	0.04
Euphorbia albomarginata	14.3	0.04
Pectocarya recurvata	9.5	0.33
Phacelia	9.5	0.02
Ambrosia confertifolia	9.5	0.02
Linanthus	9.5	0.02
Camissonia boothii ssp	9.5	0.02
Sphaeralcea ambigua	9.5	0.02
Phacelia ambigua	4.8	0.05
Nicotiana obtusifolia	4.8	0.05
Chenopodium	4.8	0.05
Eriastrum diffusum	4.8	0.01
Sphaeralcea coulteri	4.8	0.01
Astragalus	4.8	0.01
Gilia stellata	4.8	0.01
Plagiobothrys	4.8	0.01
unknown herb 1	4.8	0.01
Eriogonum	4.8	0.01
Perityle emoryii	4.8	0.01
Salvia columbariae	4.8	0.01
Lotus salsuginosus	4.8	0.01
Crassula connata	4.8	0.01
Chenopodium neomexicana	4.8	0.01
Bowlesia incana	4.8	0.01
Lotus	4.8	0.01
Lotus strigosa var tomentellum	4.8	0.01
Daucus pusillus	4.8	0.01
Camissonia claviformis	4.8	0.01
Euphorbia	4.8	0.01

Scientific Name	% Constancy	Avg. % Cover
Oligomeris linifolia	4.8	0.01
Erodium texanum	4.8	0.01
Ditaxis neomexicana	4.8	0.01
Linanthus jonesii	4.8	0.01
Sum for Structure Class:		19.52
Structural Growth Form 5. Grasses		
Schismus arabicus	95.2	22.45
Poa bigelovii	47.6	0.27
Vulpia octoflora	19.0	0.17
Erioneuron pulchellum	4.8	0.01
Sum for Structure Class:		22.90
Structural Growth Form 6. Vines		
Clematis drummondii	9.5	0.06
Sarcostemma cynanchoides	4.8	0.01
Sum for Structure Class:		0.07

Scientific Name	% Constancy	Avg. % Cover

Valley Xeroriparian Scrub
(Summary Data Based on 25 Plots)

Structural Growth Form 1. Trees

Scientific Name	% Constancy	Avg. % Cover
Parkinsonia microphylla	68.0	8.37
Prosopis velutina	56.0	3.89
Olneya tesota	52.0	6.24
Parkinsonia florida	44.0	4.96
Phoradendron californicum	40.0	0.80
Sum for Structure Class:		24.26

Structural Growth Form 2. Shrubs

Scientific Name	% Constancy	Avg. % Cover
Larrea divaricata tridentata	92.0	2.77
Ambrosia deltoidea	68.0	1.59
Ditaxis lanceolata	44.0	0.14
Lycium	40.0	0.92
Acacia constricta	36.0	1.49
Acacia greggii	32.0	2.07
Brickellia coulteri	28.0	0.20
Encelia farinosa farinosa	24.0	0.23
Krameria grayi	24.0	0.23
Trixis californica	24.0	0.19
Lycium andersonii	20.0	1.12
Hymenoclea salsola	20.0	0.96
Celtis pallida pallida	20.0	0.33
Ziziphus obtusifolia canescens	20.0	0.22
Lycium berlandieri	16.0	1.04
Calliandra eriophylla	16.0	0.42
Ephedra aspera	16.0	0.17
Senna covesii	16.0	0.10
Hyptis emoryi	16.0	0.10
Condalia warnockii	12.0	0.65
Fouquieria splendens	12.0	0.09
Fagonia californica ssp longipes	12.0	0.06
Bebbia juncea aspera	8.0	0.24

Scientific Name	% Constancy	Avg. % Cover
Lycium parishii	8.0	0.16
Anisacathus thurberi	8.0	0.12
Jatropha cardiophylla	8.0	0.05
unknown shrub 1	8.0	0.05
Abutilon incanum	8.0	0.05
Lycium macrodon	4.0	0.08
Lycium fremontii	4.0	0.04
Eriogonum fasiculatum	4.0	0.04
Ambrosia dumosa	4.0	0.04
Aloysia wrightii	4.0	0.04
Mirabilis laevis v villosa	4.0	0.04
Atriplex canescens	4.0	0.01
Baccharis sarothroides	4.0	0.01
Sebastiania bilocularis	4.0	0.01
Tragia nepetifolia var dissecta	4.0	0.01
Hibiscus coulteri	4.0	0.01
Sum for Structure Class:		16.09

Structural Growth Form 3. Cactus

Cylindropuntia acanthocarpa	36.0	0.15
Carnegiea gigantea	28.0	0.07
Cylindropuntia leptocaulis	20.0	0.05
Mammillaria grahamii	4.0	0.01
Sum for Structure Class:		0.28

Structural Growth Form 4. Herbs

Lepidium lasiocarpum	96.0	3.55
Cryptantha pterocarya	92.0	2.51
Lesquerella gordonii	88.0	1.08
Descurania pinnata	72.0	0.73
Caulanthus lasiophyllus	68.0	0.68
Chorizanthe brevicornus	68.0	0.43
Amsinckia intermedia	52.0	0.88
Cryptantha maritima	52.0	0.60
Eucrypta micrantha	52.0	0.44

Scientific Name	% Constancy	Avg. % Cover
Stylocline micropoides	48.0	0.25
Lupinus sparsiflorus	48.0	0.21
Sisymbrium irio	44.0	1.08
Pectocarya recurvata	44.0	0.82
Plantago ovata	44.0	0.63
Chaenactis stevioides	44.0	0.24
Ambrosia ambrosioides	40.0	0.73
Cryptantha barbigera	40.0	0.50
Phacelia	40.0	0.43
Linanthus jonesii	40.0	0.16
Camissonia chamaenerioides	36.0	0.30
Draba cuneifolia	36.0	0.20
Pectocarya	32.0	1.05
Erodium cicutarium	32.0	0.73
Nicotiana obtusifolia	32.0	0.45
Gilia	32.0	0.38
Eriophyllum lanosum	32.0	0.18
Eriastrum diffusum	32.0	0.15
Silene antirrhina	32.0	0.08
Pectocarya platycarpa	28.0	0.80
Euphorbia	28.0	0.19
Gilia stellata	28.0	0.10
Phacelia coerulea	24.0	0.38
Chorizanthe rigida	24.0	0.27
Eriogonum deflexum	24.0	0.06
Calycoseris wrightii	24.0	0.06
Cryptantha micrantha	20.0	0.19
Camissonia californica	20.0	0.18
Amsinkia	20.0	0.11
Filago	20.0	0.08
Sphaeralcea coulteri	20.0	0.08
Daucus pusillus	20.0	0.08
Camissonia	20.0	0.05
Euphorbia albomarginata	20.0	0.05

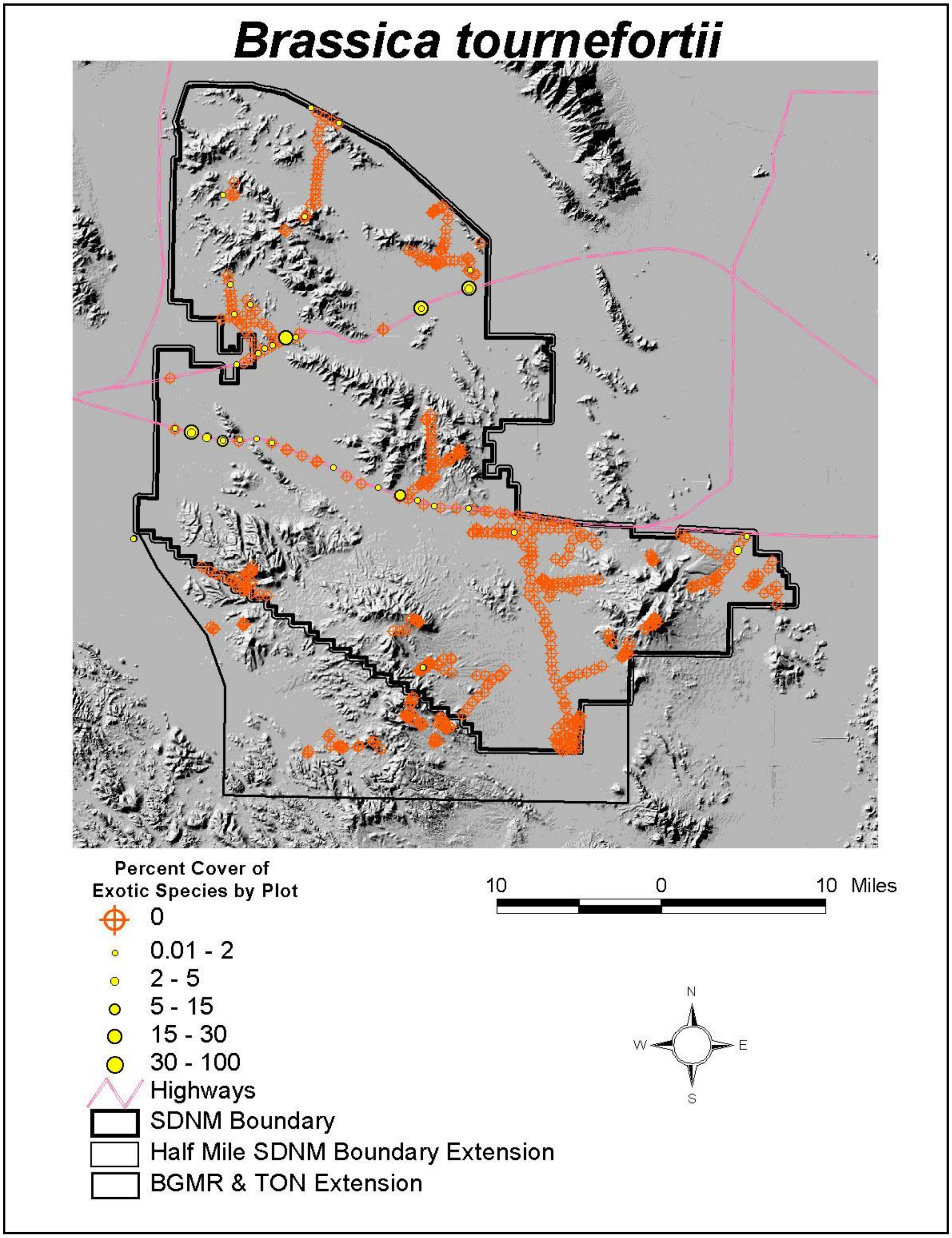
Scientific Name	% Constancy	Avg. % Cover
Filago arizonica	20.0	0.05
Perityle emoryii	16.0	0.23
Sphaeralcea ambigua	16.0	0.14
Phacelia ambigua	16.0	0.14
Chenopodium neomexicana	16.0	0.07
Euphorbia polycarpa	16.0	0.07
Eschscholzia mexicana	16.0	0.04
Parietaria floridana	12.0	0.33
Amsinckia tessellata	12.0	0.13
Crassula connata	12.0	0.06
Astragalus nuttallianus	12.0	0.03
Allionia incarnata	12.0	0.03
Salvia columbariae	12.0	0.03
Rafinesquia neomexicana	8.0	0.17
Phacelia distans	8.0	0.13
Eriogonum thomasii	8.0	0.05
Mentzelia	8.0	0.05
Plantago patagonica	8.0	0.02
Eriogonum abertianum	8.0	0.02
Chenopodium murale	8.0	0.02
unknown herb 1	8.0	0.02
Marina parryi	8.0	0.02
Mentzelia affinis	8.0	0.02
Monoptilon bellioides	8.0	0.02
Acourtia nana	4.0	0.12
Pholistoma auritum var	4.0	0.08
Loeflingia squarrosa ssp.	4.0	0.08
Nama hispidum	4.0	0.04
Chaenactis carphoclinia	4.0	0.04
Ambrosia confertifolia	4.0	0.04
Lupinus Arizonicus	4.0	0.04
Evax multicaulis	4.0	0.04
Acourtia wrightii	4.0	0.01
Langloisia setosissima ssp.	4.0	0.01

Scientific Name	% Constancy	Avg. % Cover
Plagiobothrys	4.0	0.01
Lappula occidentalis	4.0	0.01
Nemacladus glanduliferous var.	4.0	0.01
Sphaeralcea	4.0	0.01
Euphorbia arizonica	4.0	0.01
Erodium texanum	4.0	0.01
Lotus salsuginosus	4.0	0.01
Ditaxis neomexicana	4.0	0.01
Lotus strigosa var tomentellum	4.0	0.01
Orobanche cooperi	4.0	0.01
Delphinium scaposum	4.0	0.01
Cryptantha angustifolia	4.0	0.01
Eriogonum maculatum	4.0	0.01
Lupinus concinnus	4.0	0.01
Camissonia claviformis	4.0	0.01
Camissonia boothii ssp	4.0	0.01
Lupinus	4.0	0.01
Sum for Structure Class:		24.71
Structural Growth Form 5. Grasses		
Schismus arabicus	100.0	9.38
Poa bigelovii	52.0	0.57
Vulpia octoflora	48.0	0.46
Aristida purpurea	12.0	0.13
Bromus rubens	12.0	0.06
Aristida	12.0	0.03
Muhlenbergia microsperma	8.0	0.09
unknown grass 1	8.0	0.02
Muhlenbergia porteri	8.0	0.02
Pleuraphis mutica	4.0	0.01
Erioneuron pulchellum	4.0	0.01
Sum for Structure Class:		10.78
Structural Growth Form 6. Vines		
Janusia gracile	20.0	0.18

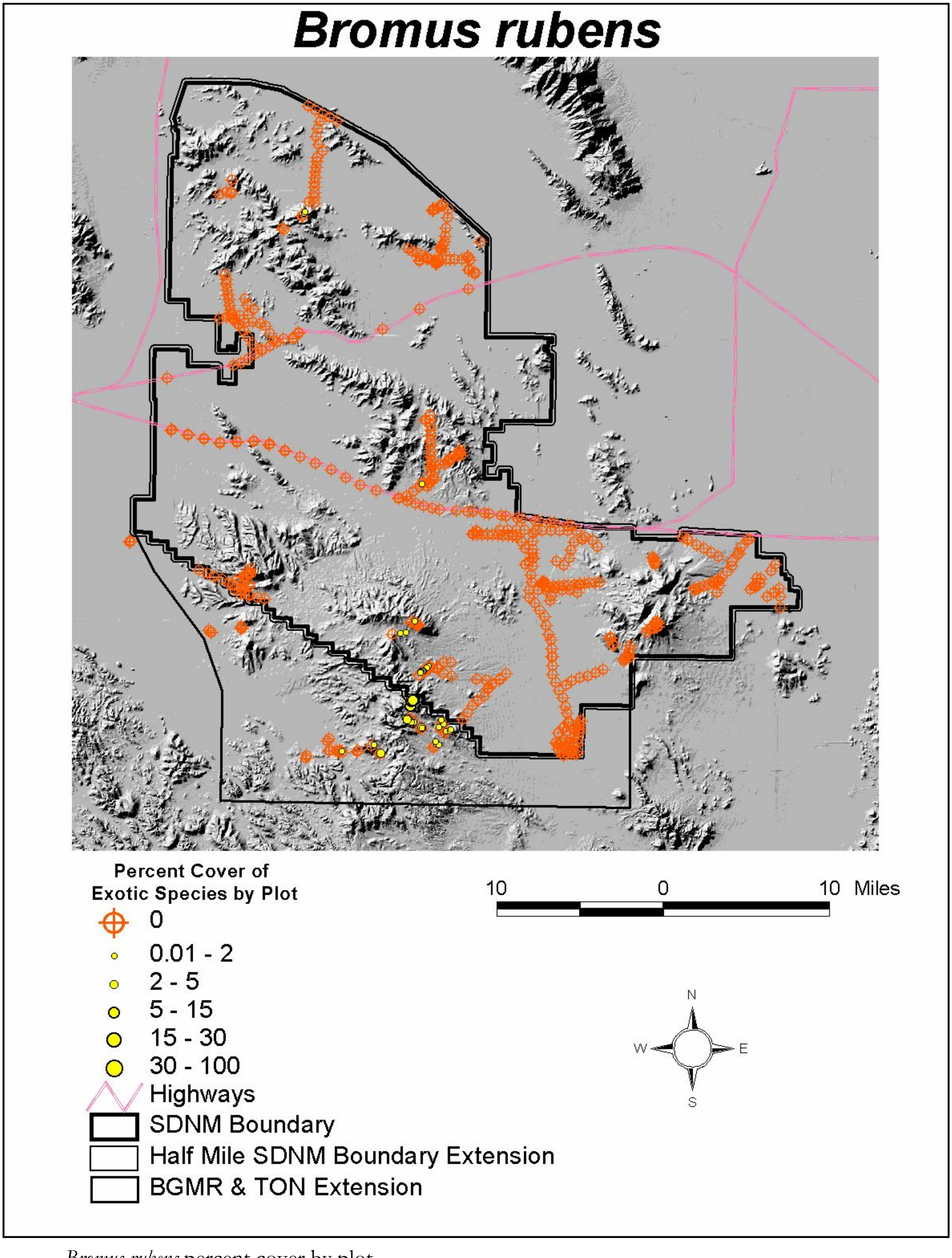
Scientific Name	% Constancy	Avg. % Cover
Lyrocarpa coulteri	12.0	0.10
Commicarpas scandens	8.0	0.02
Asclepias subulata	4.0	0.04
Clematis drummondii	4.0	0.01
Maurandya antirrhinifolia	4.0	0.01
Sum for Structure Class:		0.36
Structural Growth Form 7. Ferns		
Notholaena standleyi	4.0	0.01
Astrolepis cochisensis	4.0	0.01
Sum for Structure Class:		0.02

APPENDIX E

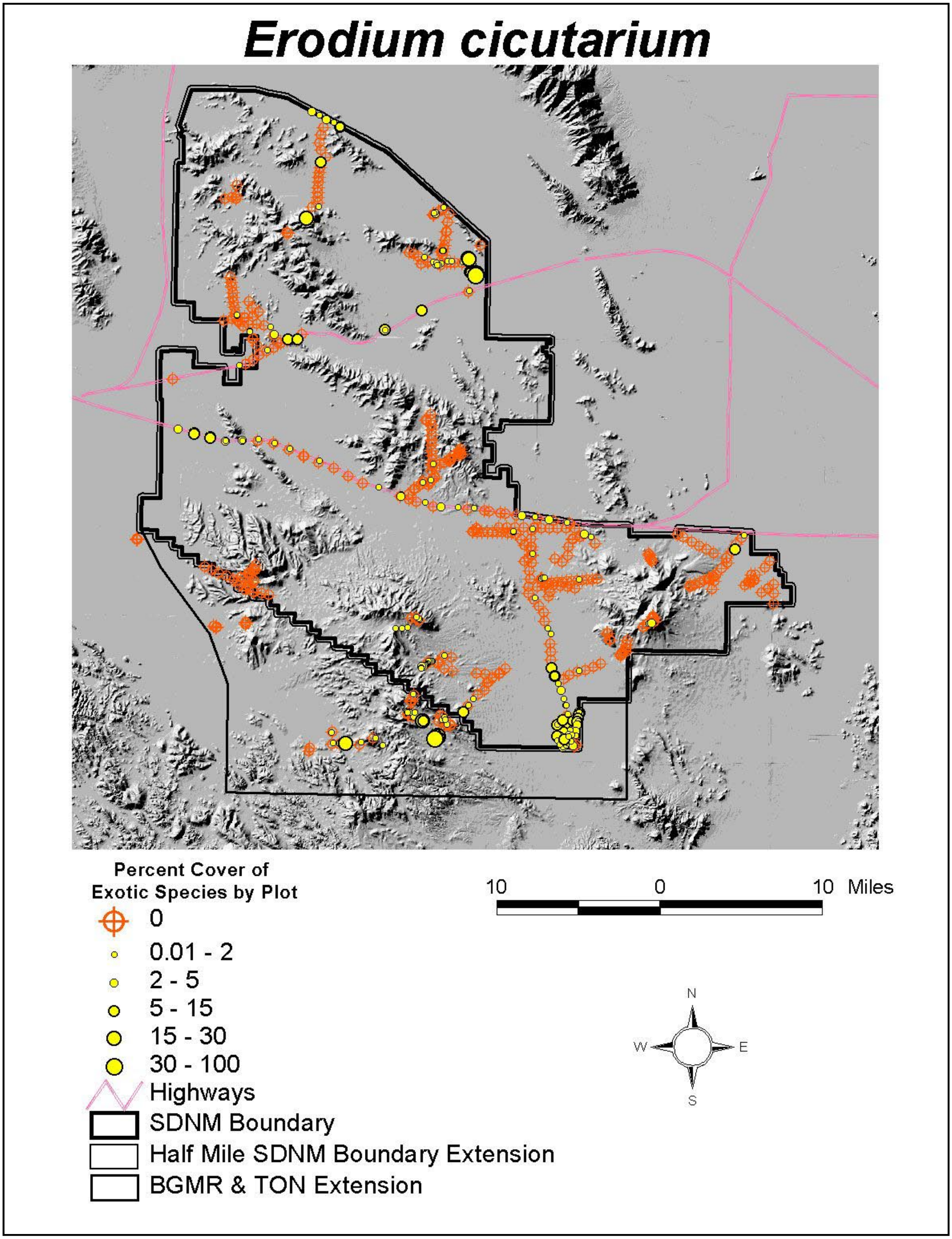
DISTRIBUTION OF INDIVIDUAL EXOTIC SPECIES



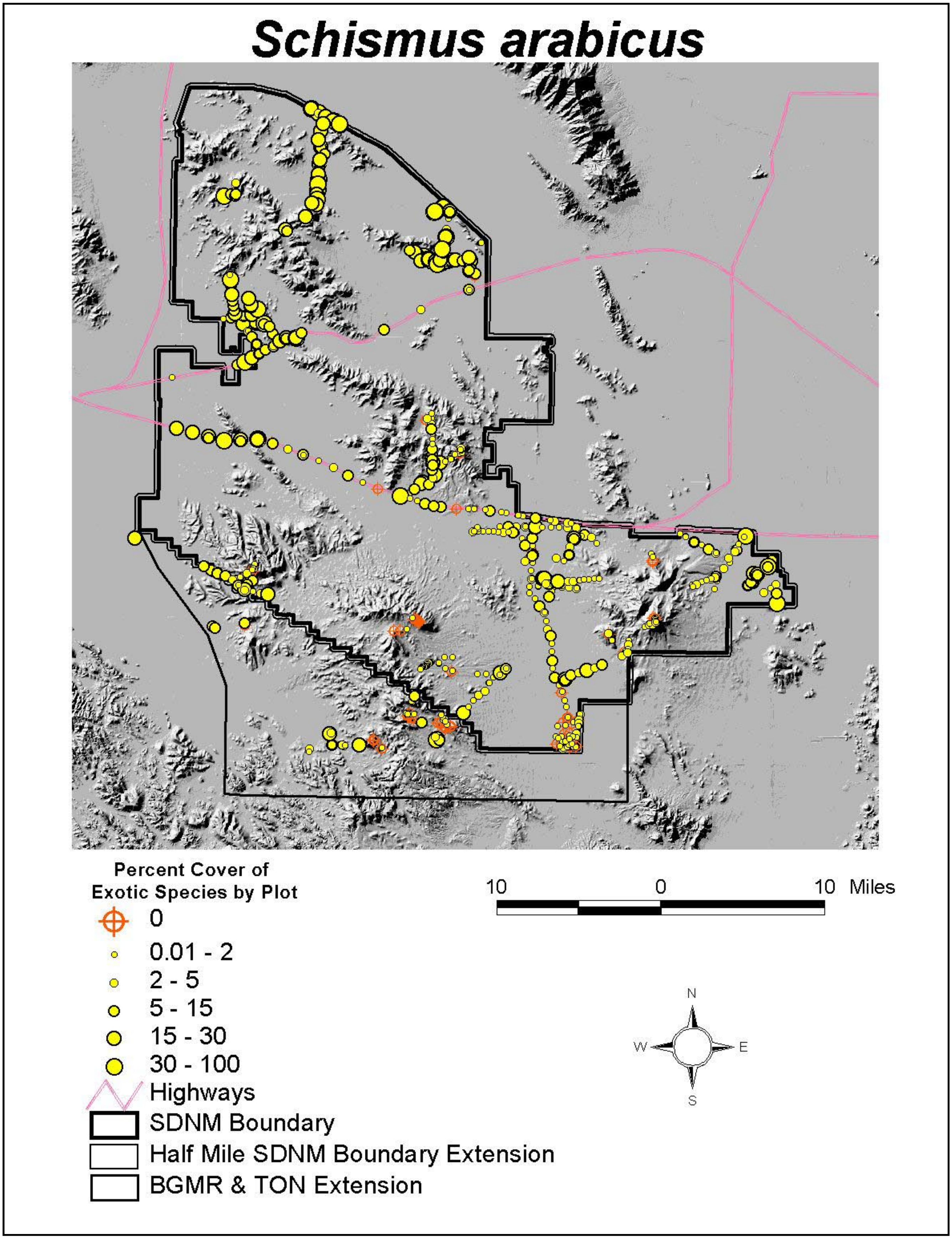
Brassica tournefortii percent cover by plot.



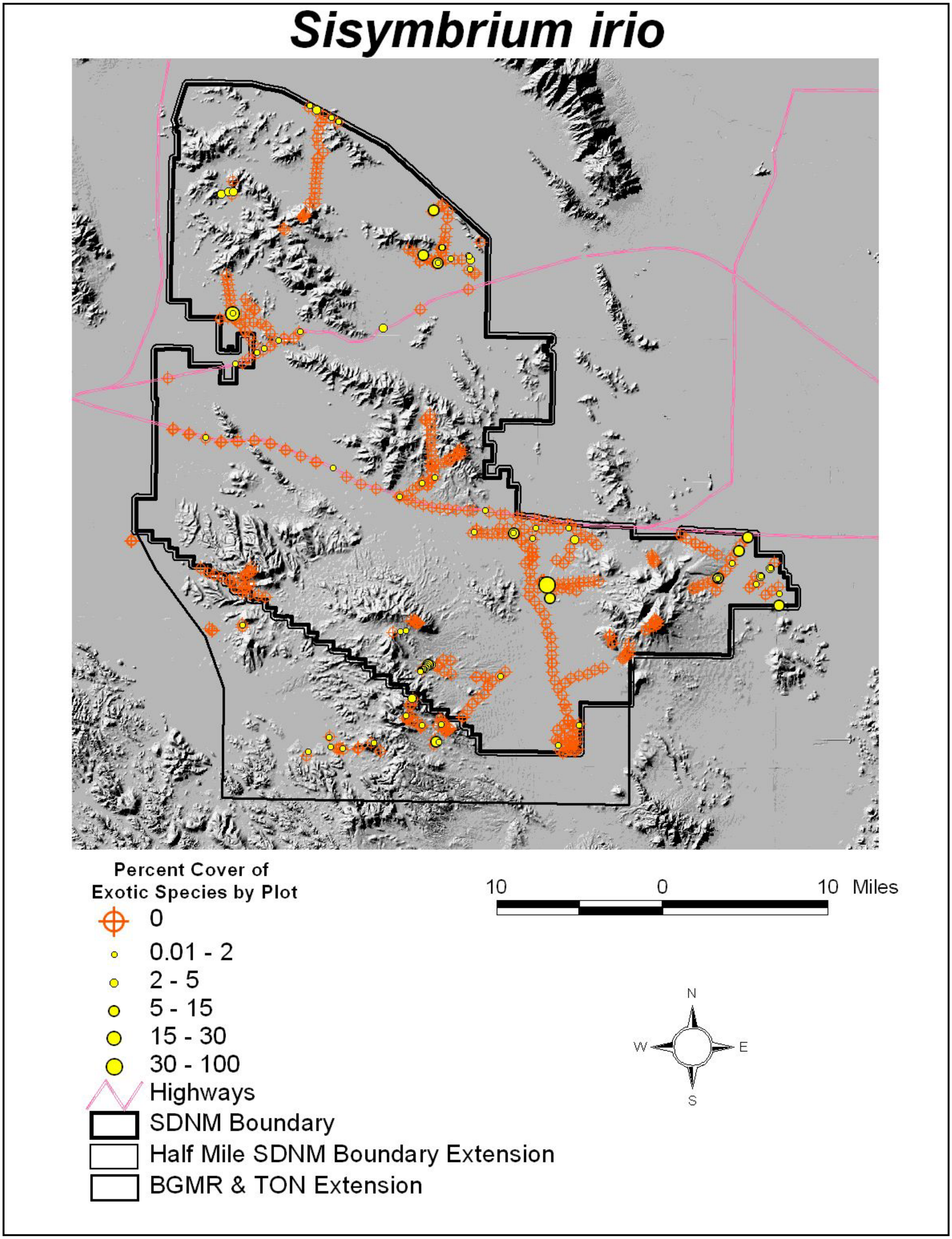
Bromus rubens percent cover by plot.



Erodium cicutarium percent cover by plot.

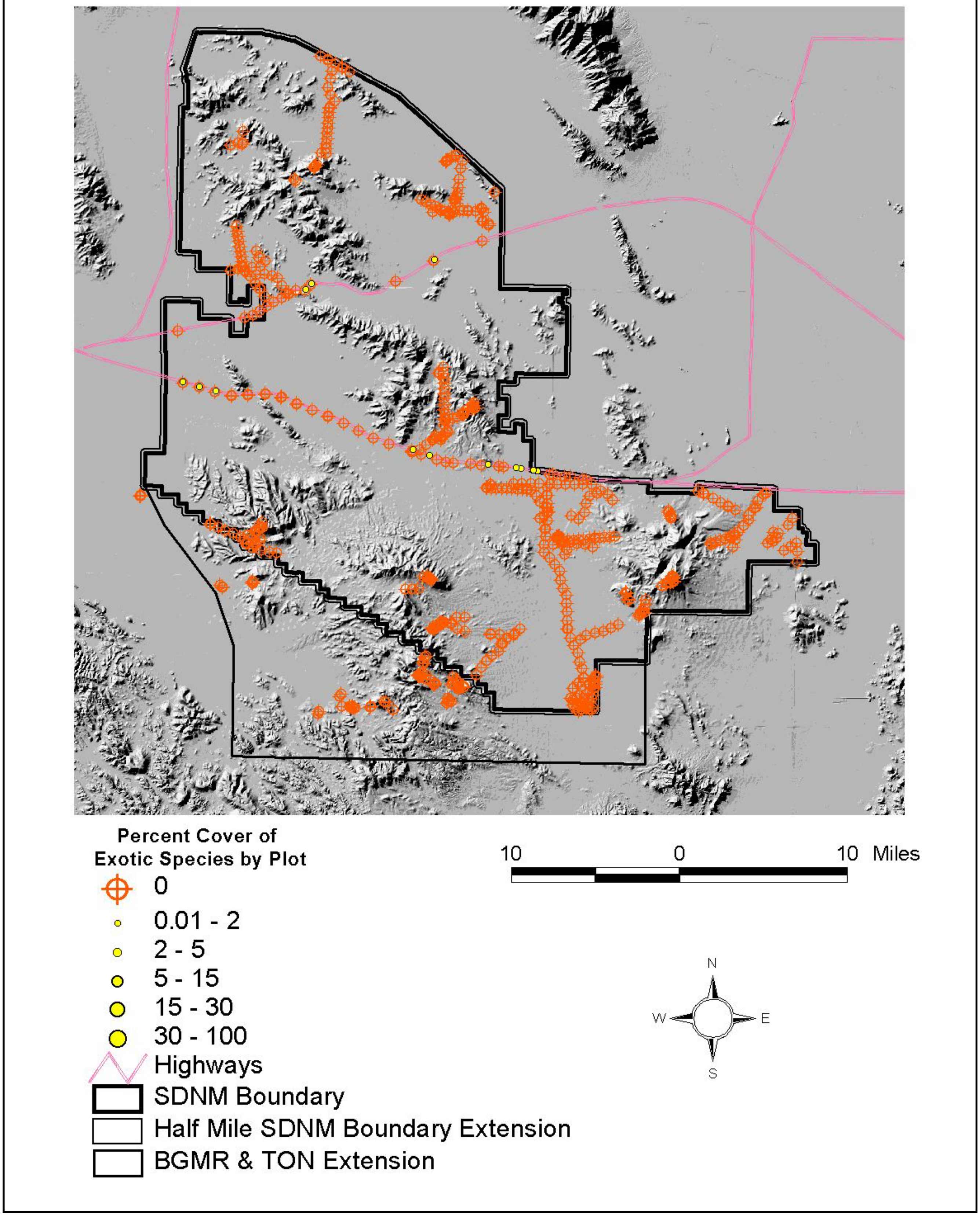


Schismus arabicus percent cover by plot.

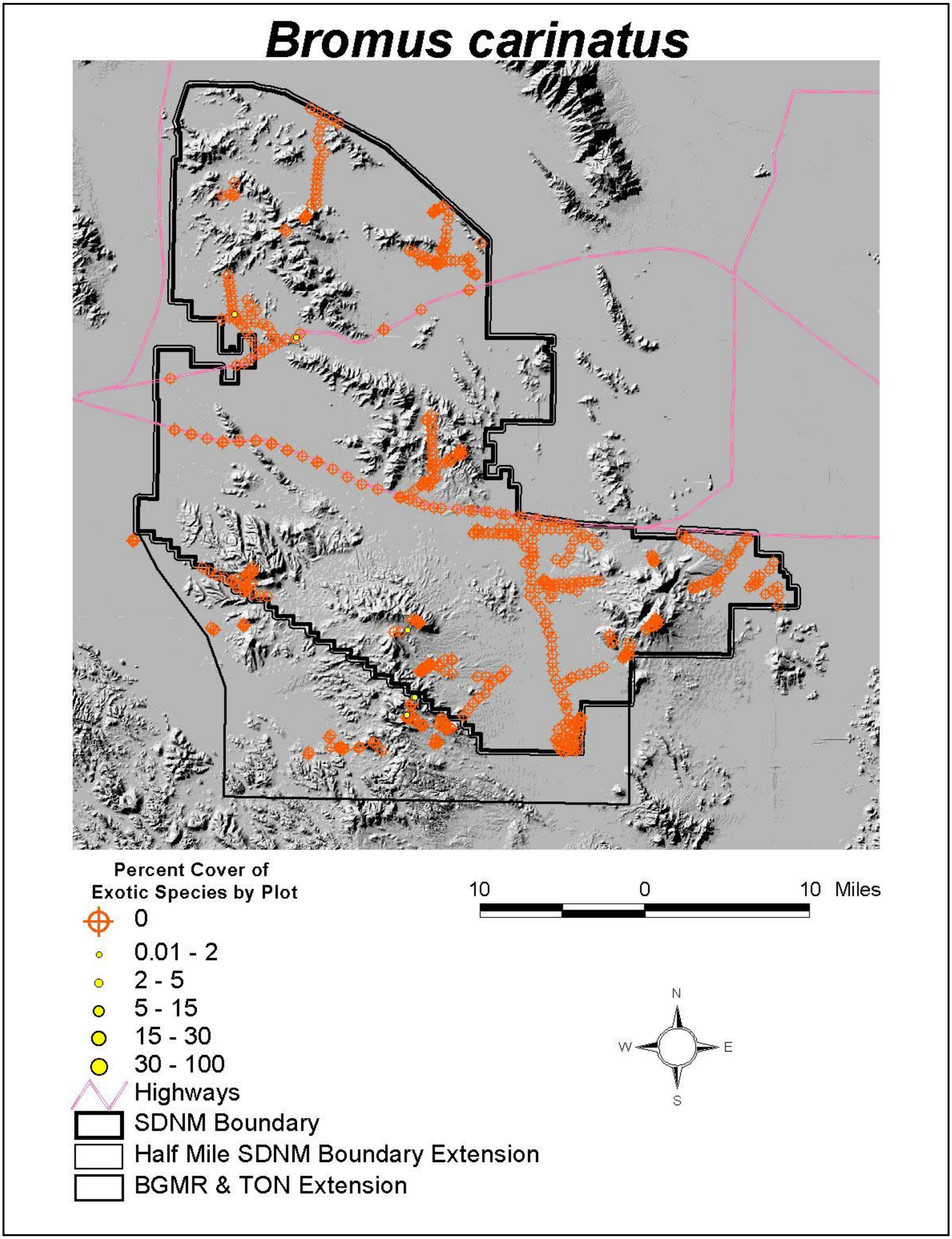


Sisymbrium irio percent cover by plot.

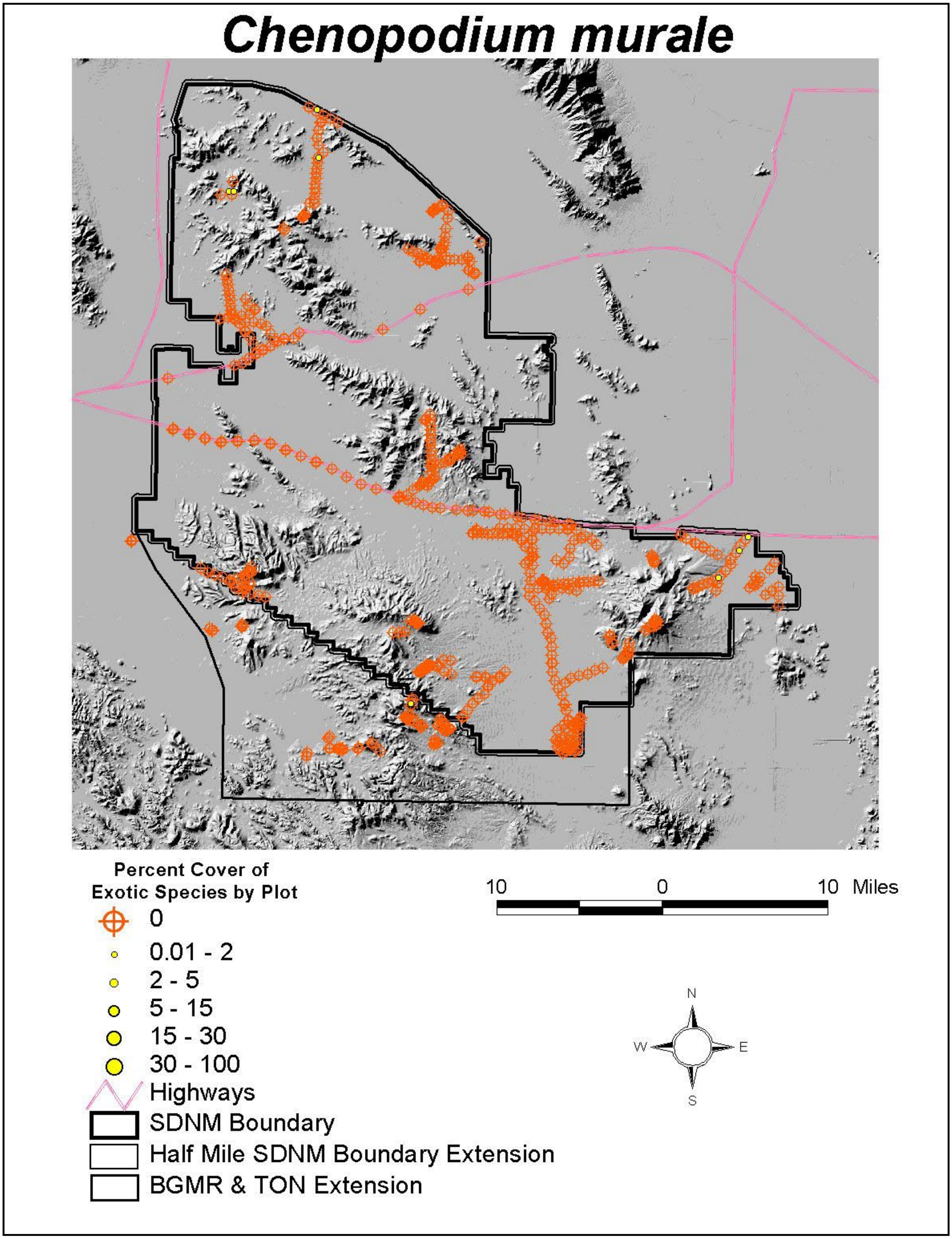
Avena fatua



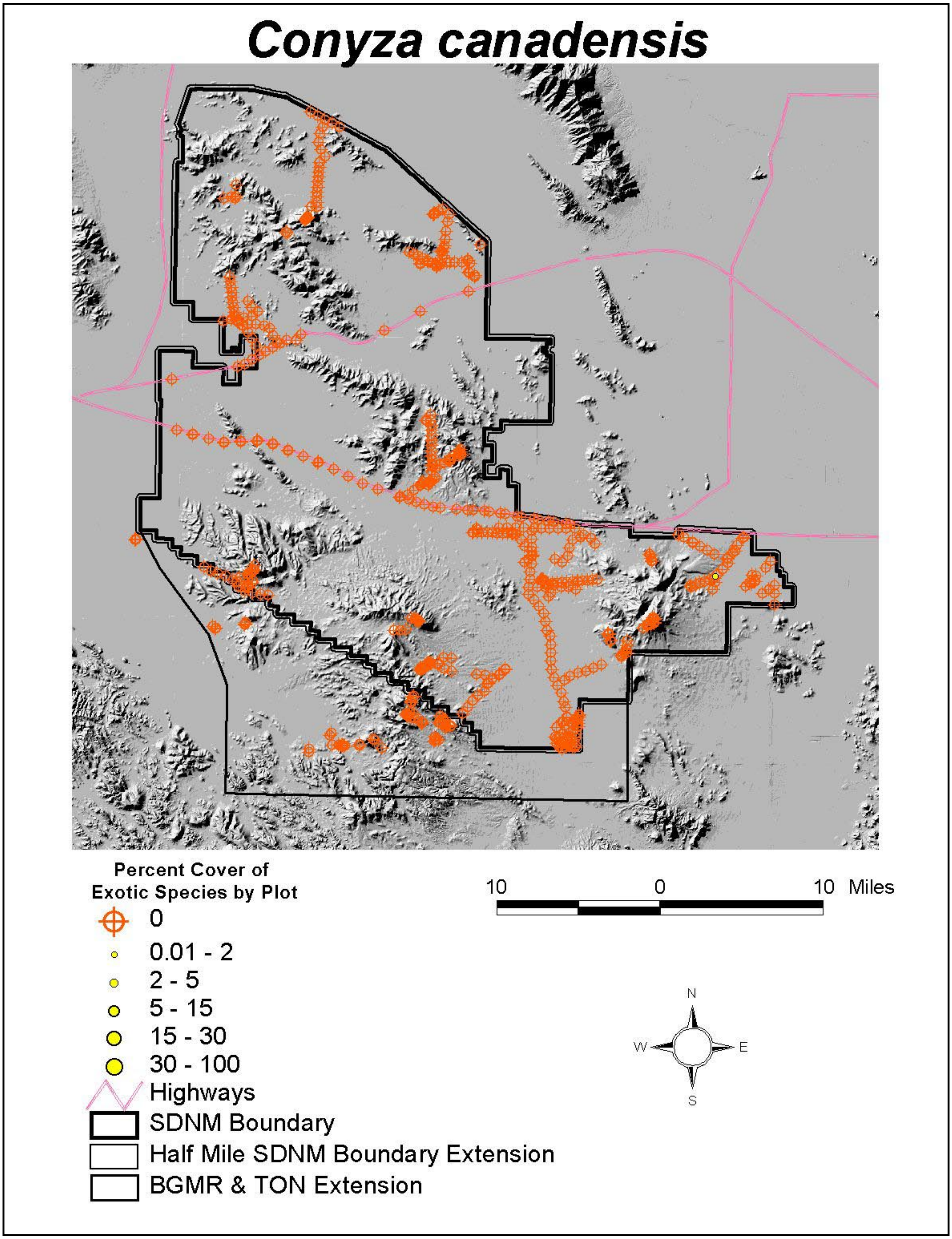
Avena fatua percent cover by plot.



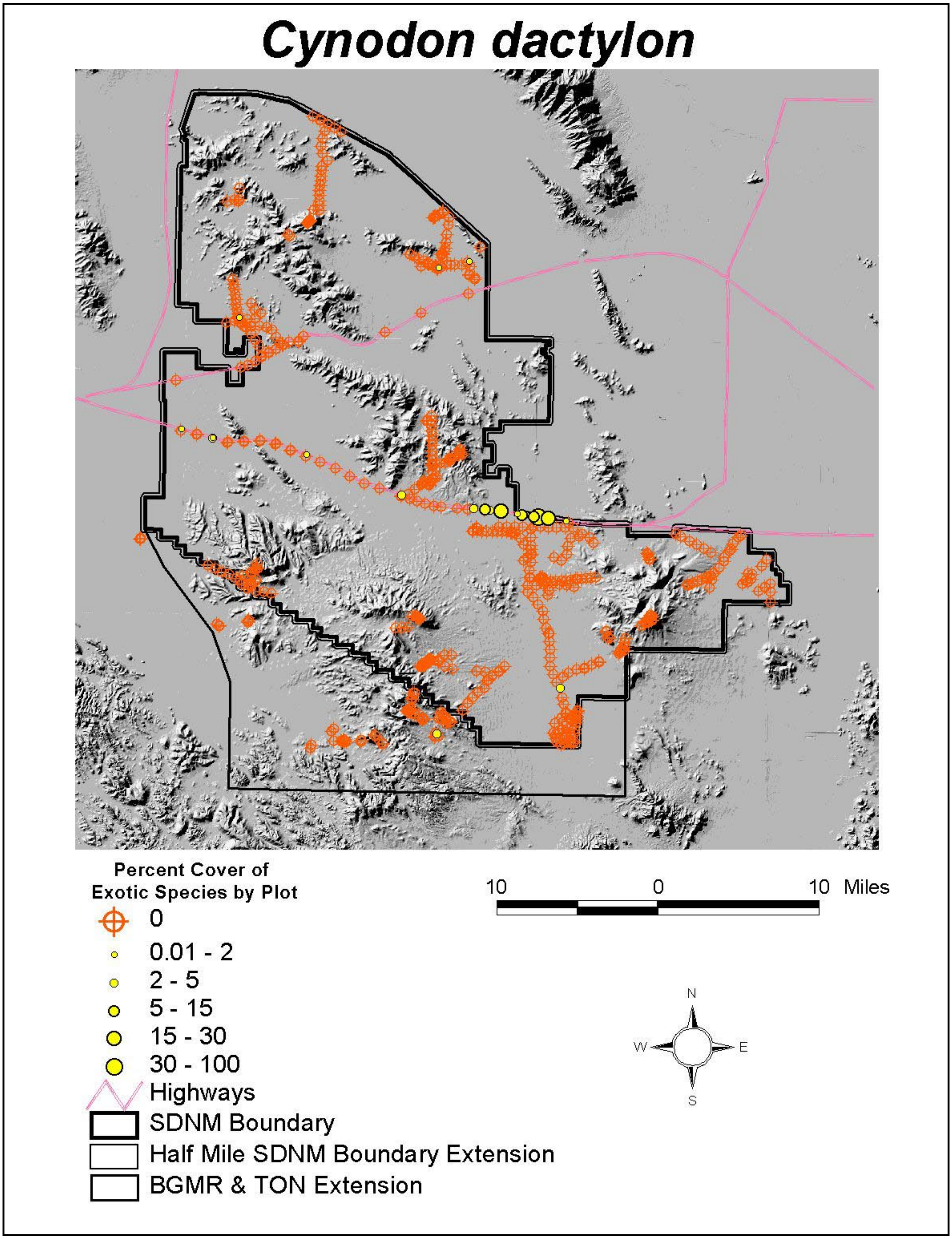
Bromus carinatus percent cover by plot.



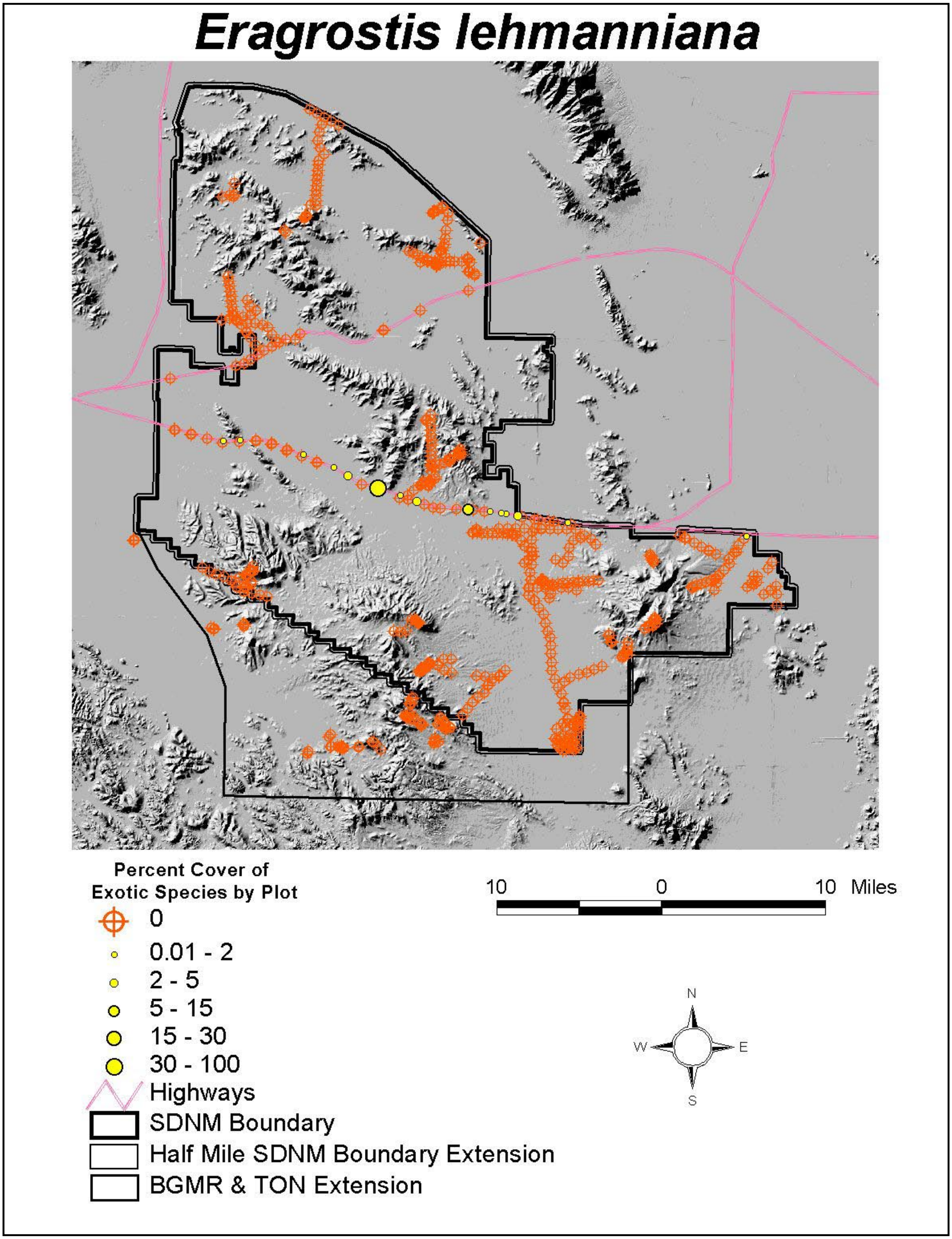
Chenopodium murale percent cover by plot.



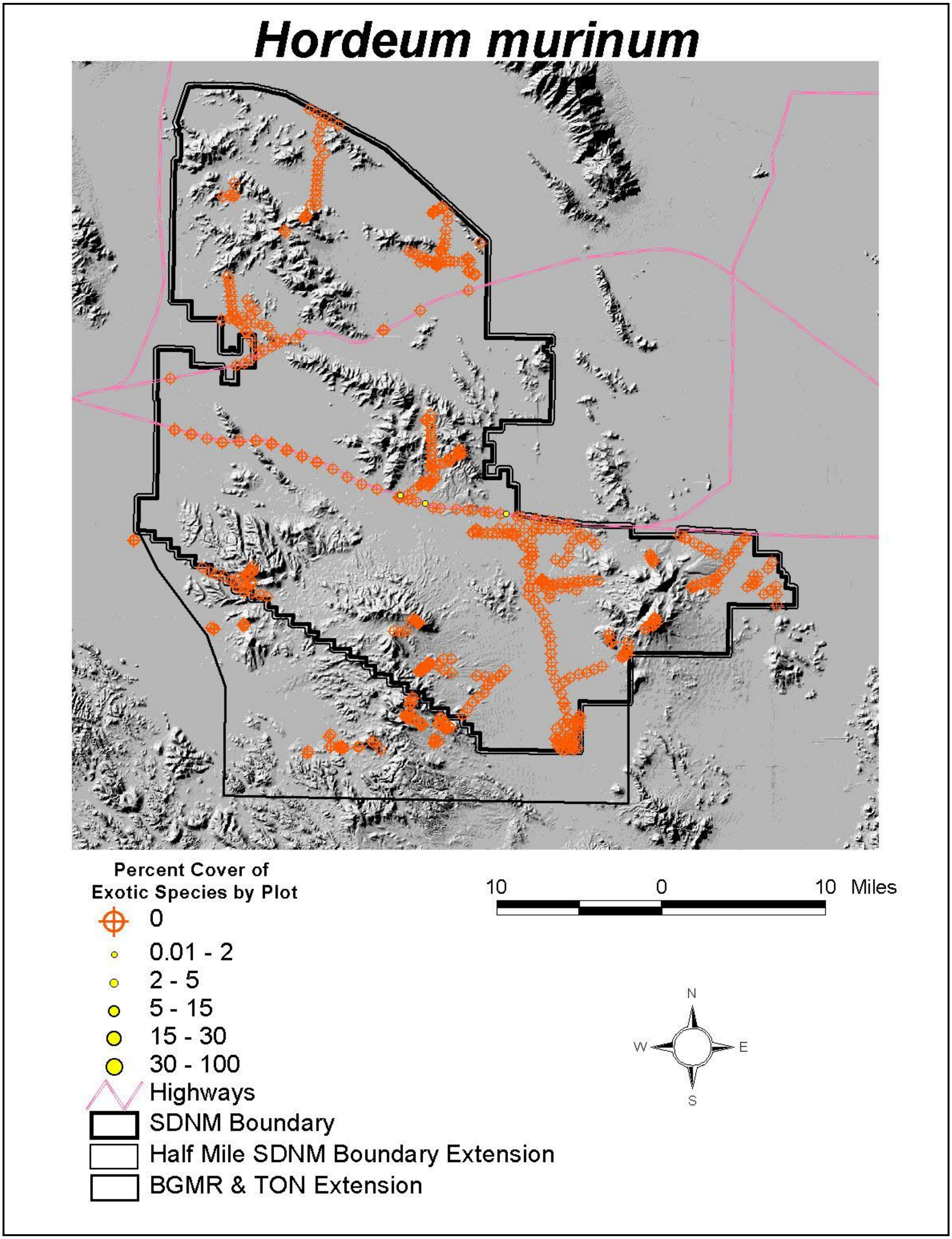
Conyza canadensis percent cover by plot.



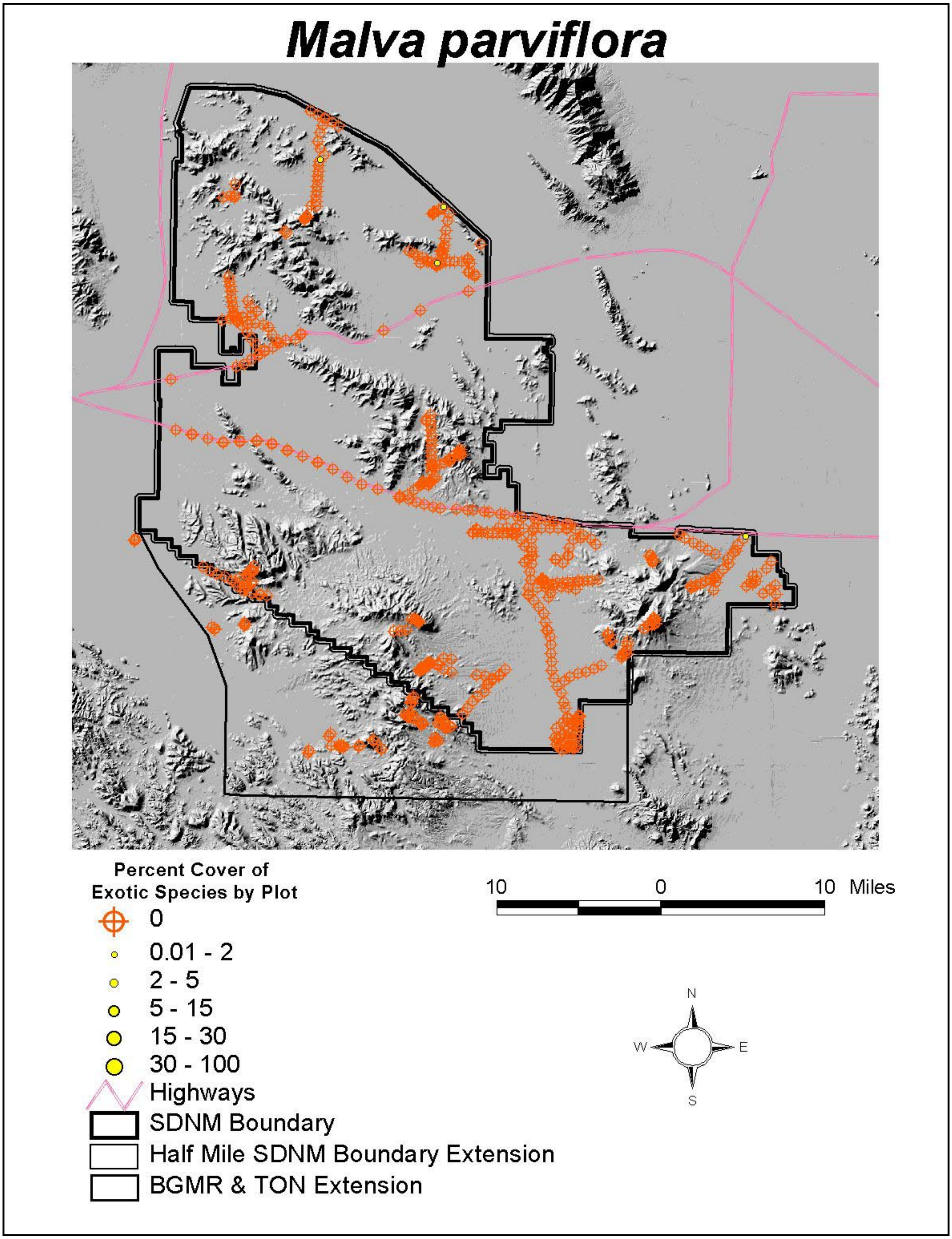
Cynodon dactylon percent cover by plot.



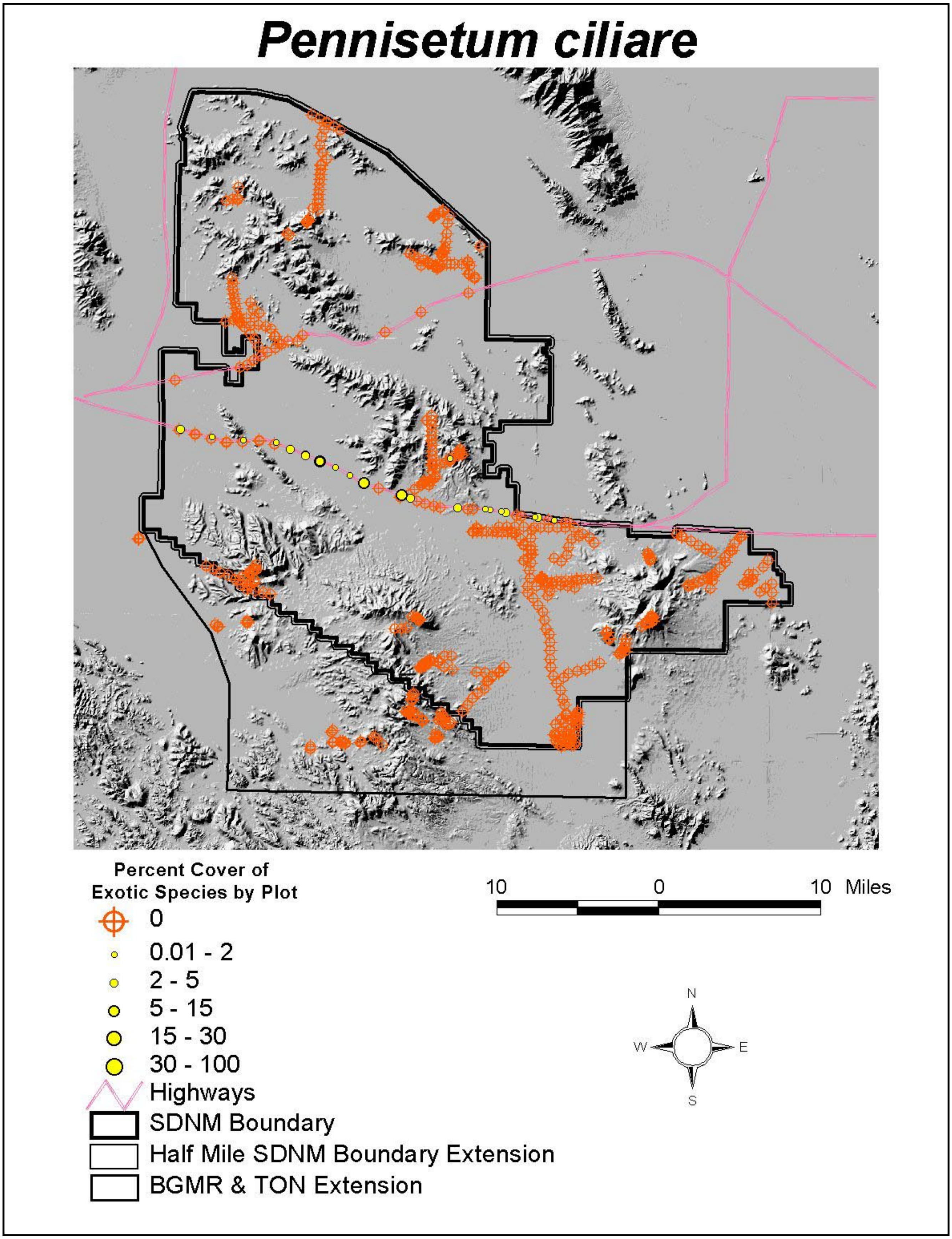
Eragrostis lehmanniana percent cover by plot.



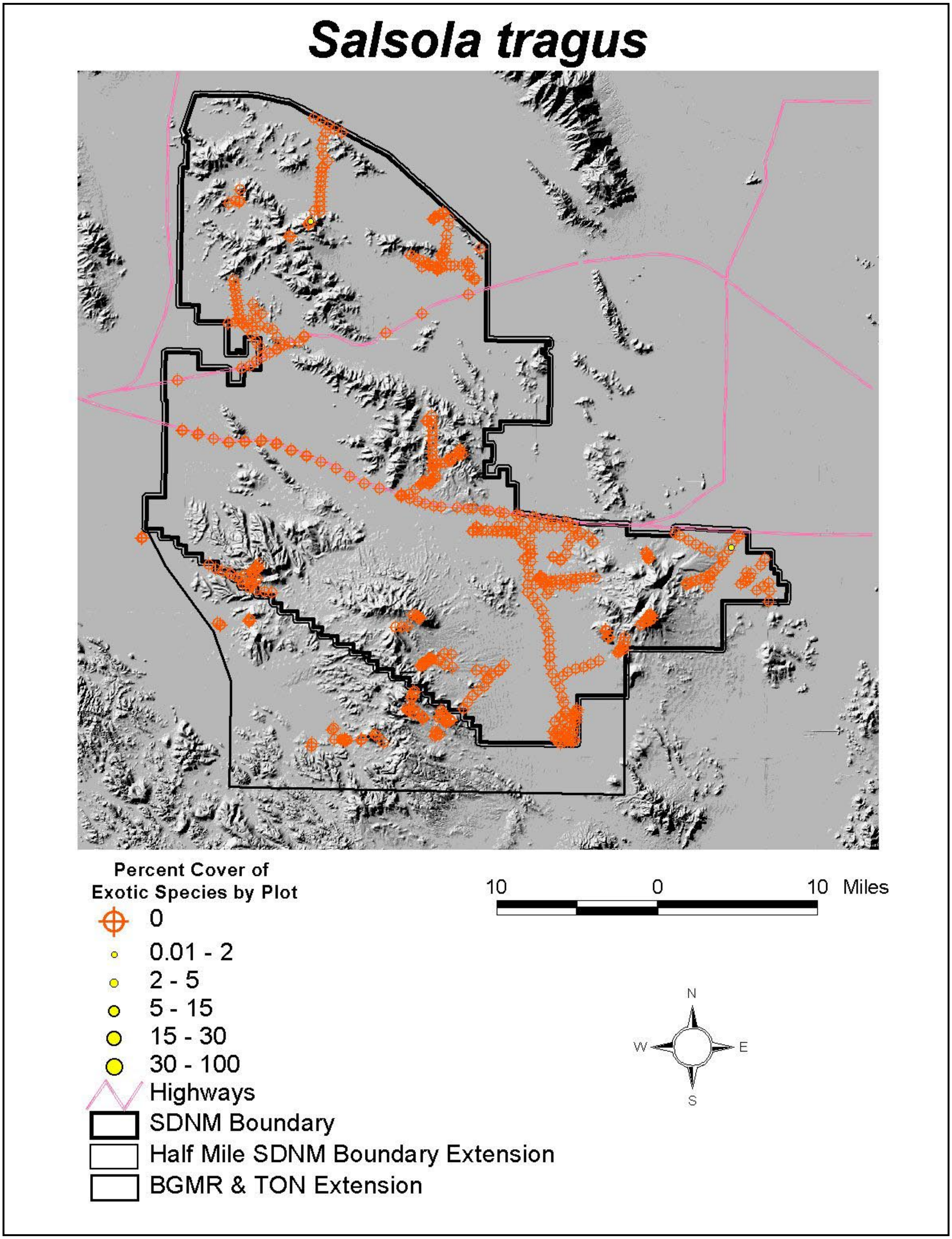
Hordeum murinum percent cover by plot.



Malva parviflora percent cover by plot.



Pennisetum ciliare percent cover by plot.



Salsola tragus percent cover by plot.

APPENDIX F

Summary of Condition Classes and Related Statistics by Natural Community

Natural Community CB

Condition Class 1

Summary for Condition Class = 1 (18 detail records)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	405.67	301.61	83.00	28.94	16.78	3.33	48.28	26.28	37.67	0.56	0.22
Min	7	12	0	0	4	1	9.75	4	4	0	0
Max	2402	1731	206	300	53	8	113.75	77.75	85	3	1

Condition Class 2

Summary for Condition Class = 2 (66 detail records)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	1875.71	760.41	11.02	4.79	11.42	1.44	31.34	12.14	29.32	0.26	0.56
Min	25	7	0	0	4	0	5	0	0	0	0
Max	12493	3689	114	200	29	3	81.75	57	90	3	15

Condition Class 3

Summary for Condition Class = 3 (3 detail records)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	11113.67	1454.67	0.00	0.00	20.67	1.33	63.25	4.08	6.75	1.67	1.83
Min	8310	482	0	0	18	1	53.5	1	5.25	0	0
Max	12573	2013	0	0	26	2	76.25	8	9	3	5

Summary for 'NaturalCommunity1' = CB (87 detail records)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	1890.11	689.43	25.53	9.62	12.85	1.83	35.95	14.78	30.27	0.37	0.53
Min	7	7	0	0	4	0	5	0	0	0	0
Max	12573	3689	206	300	53	8	113.75	77.75	90	3	15

Natural Community DG

Condition Class 1

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Summary for Condition Class = 1 (13 detail records)											
Avg	516.54	440.77	113.15	0.00	13.69	2.15	37.88	8.44	47.77	1.08	15.25
Min	304	63	80	0	5	1	10.25	1	25	1	1
Max	965	848	135	0	27	3	64.5	16.25	80	2	38.25
Summary for 'NaturalCommunity1' = DG (13 detail records)											
Avg	516.54	440.77	113.15	0.00	13.69	2.15	37.88	8.44	47.77	1.08	15.25
Min	304	63	80	0	5	1	10.25	1	25	1	1
Max	965	848	135	0	27	3	64.5	16.25	80	2	38.25

Natural Community M

Condition Class 1

Summary for Condition Class = 1 (10 detail records)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	792.80	367.10	68.40	0.00	15.10	3.10	100.85	34.70	20.13	0.60	4.98
Min	110	5	1	0	8	2	30.25	7.5	0	0	0
Max	1438	1012	300	0	28	5	184.25	78	66	3	47.5

Condition Class 2

Summary for Condition Class = 2 (3 detail records)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	1620.67	925.67	24.33	0.00	16.00	2.00	116.25	58.33	8.67	1.67	29.17
Min	1420	212	0	0	11	1	68.75	35	0	1	2.25
Max	1743	1335	51	0	26	3	183.25	70	16	2	80.25

Summary for 'NaturalCommunity1' = M (13 detail records)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	983.85	496.00	58.23	0.00	15.31	2.85	104.40	40.15	17.48	0.85	10.56
Min	110	5	0	0	8	1	30.25	7.5	0	0	0
Max	1743	1335	300	0	28	5	184.25	78	66	3	80.25

Natural Community MU

Condition Class 3

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Summary for Condition Class = 3 (36 detail records)											
Avg	3870.72	1670.83	0.00	0.00	35.53	1.19	79.67	1.62	4.15	3.25	14.70
Min	1476	306	0	0	17	0	24.75	0	0	1	0.25
Max	4967	3255	0	0	55	5	133.25	10	28	6	98.25
Summary for 'NaturalCommunity1' = MU (36 detail records)											
Avg	3870.72	1670.83	0.00	0.00	35.53	1.19	79.67	1.62	4.15	3.25	14.70
Min	1476	306	0	0	17	0	24.75	0	0	1	0.25
Max	4967	3255	0	0	55	5	133.25	10	28	6	98.25

Natural Community MXR

Condition Class 3

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Summary for Condition Class = 3 (16 detail records)											
Avg	4365.19	1319.38	0.06	0.13	49.25	2.31	76.63	4.84	13.98	3.13	6.58
Min	1727	5	0	0	17	0	29	0	0	0	0
Max	11695	6000	1	1	76	5	134	17.5	50	7	29.25
Summary for 'NaturalCommunity1' = MXR (16 detail records)											
Avg	4365.19	1319.38	0.06	0.13	49.25	2.31	76.63	4.84	13.98	3.13	6.58
Min	1727	5	0	0	17	0	29	0	0	0	0
Max	11695	6000	1	1	76	5	134	17.5	50	7	29.25

Natural Community PVMCB

Condition Class 1

Summary for Condition Class = 1 (1 detail record)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	61.00	2.00	200.00	0.00	8.00	3.00	11.25	61.00	20.00	0.00	0.00
Min	61	2	200	0	8	3	11.25	61	20	0	0
Max	61	2	200	0	8	3	11.25	61	20	0	0

Condition Class 2

Summary for Condition Class = 2 (20 detail records)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	1315.00	292.05	2.80	0.00	18.85	1.05	37.79	4.78	22.08	0.40	0.14
Min	107	48	0	0	8	1	14	0.25	1	0	0
Max	1997	1091	20	0	34	2	62.5	20	57	2	1

Condition Class 3

Summary for Condition Class = 3 (14 detail records)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	5217.00	1298.07	0.93	0.14	25.57	1.14	49.59	7.91	11.82	1.07	0.79
Min	2000	112	0	0	17	1	22	0.25	3	0	0
Max	10415	4292	4	1	35	3	77	30.5	40	4	3.5

Summary for 'NaturalCommunity1' = PVMCB (35 detail records)

Avg	2839.97	686.17	7.69	0.06	21.23	1.14	41.75	7.64	17.91	0.66	0.39
Min	61	2	0	0	8	1	11.25	0.25	1	0	0
Max	10415	4292	200	1	35	3	77	61	57	4	3.5

Natural Community PVMCR

Condition Class 3

	imprvdist	*roaddist*	*Livestock Index*	*Vehicle Index*	*Nativespecies*	*Exoticspecies*	*PercCovNatives*	*PercCovExotics*	*PercSandSoil*	*NativeGrasses*	*PercCovNatGrass*
Summary for Condition Class = 3 (64 detail records)											
Avg	*4706.34*	*1896.67*	*1.02*	*1.58*	*29.50*	*1.25*	*60.37*	*4.94*	*4.71*	*1.91*	*3.13*
Min	*1074*	*12*	*0*	*0*	*7*	*0*	*20*	*0*	*0*	*0*	*0*
Max	*11740*	*6000*	*50*	*101*	*54*	*4*	*141.75*	*42*	*31*	*4*	*37.5*
Summary for 'NaturalCommunity1' = PVMCR (64 detail records)											
Avg	*4706.34*	*1896.67*	*1.02*	*1.58*	*29.50*	*1.25*	*60.37*	*4.94*	*4.71*	*1.91*	*3.13*
Min	*1074*	*12*	*0*	*0*	*7*	*0*	*20*	*0*	*0*	*0*	*0*
Max	*11740*	*6000*	*50*	*101*	*54*	*4*	*141.75*	*42*	*31*	*4*	*37.5*

Natural Community RO

Condition Class 3

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Summary for Condition Class = 3 (7 detail records)											
Avg	3429.14	838.71	0.00	0.00	25.86	1.14	18.32	0.29	1.82	2.00	1.07
Min	1560	132	0	0	5	0	1.25	0	0	0	0
Max	4290	2424	0	0	75	2	36.25	0.5	6	8	3.5
Summary for 'NaturalCommunity1' = RO (7 detail records)											
Avg	3429.14	838.71	0.00	0.00	25.86	1.14	18.32	0.29	1.82	2.00	1.07
Min	1560	132	0	0	5	0	1.25	0	0	0	0
Max	4290	2424	0	0	75	2	36.25	0.5	6	8	3.5

Natural Community S

Condition Class 1

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Summary for Condition Class = 1 (3 detail records)											
Avg	*4805.67*	*1767.00*	*20.67*	*0.00*	*60.00*	*2.33*	*79.50*	*10.92*	*2.50*	*4.33*	*5.50*
Min	*3658*	*29*	*0*	*0*	*36*	*1*	*63.5*	*0.25*	*1.25*	*1*	*0.25*
Max	*5382*	*2640*	*60*	*0*	*87*	*3*	*90*	*27.25*	*3.25*	*8*	*10.25*
Summary for 'NaturalCommunity1' = S (3 detail records)											
Avg	*4805.67*	*1767.00*	*20.67*	*0.00*	*60.00*	*2.33*	*79.50*	*10.92*	*2.50*	*4.33*	*5.50*
Min	*3658*	*29*	*0*	*0*	*36*	*1*	*63.5*	*0.25*	*1.25*	*1*	*0.25*
Max	*5382*	*2640*	*60*	*0*	*87*	*3*	*90*	*27.25*	*3.25*	*8*	*10.25*

Natural Community BCF

Condition Class 1

Summary for Condition Class = 1 (1 detail record)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	1128.00	633.00	121.00	0.00	19.00	3.00	45.50	47.25	28.00	0.00	0.00
Min	1128	633	121	0	19	3	45.5	47.25	28	0	0
Max	1128	633	121	0	19	3	45.5	47.25	28	0	0

Condition Class 2

Summary for Condition Class = 2 (20 detail records)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	1133.80	556.60	65.70	0.50	20.25	1.95	42.19	22.34	32.98	0.75	0.48
Min	602	38	0	0	6	0	1.5	0	5	0	0
Max	3399	2039	202	6	35	3	107.25	68	86	2	3

Summary for 'NaturalCommunity1' = VBF (21 detail records)

Avg	1133.52	560.24	68.33	0.48	20.19	2.00	42.35	23.52	32.74	0.71	0.45
Min	602	38	0	0	6	0	1.5	0	5	0	0
Max	3399	2039	202	6	35	3	107.25	68	86	2	3

Natural Community VXR

Condition Class 1

Summary for Condition Class = 1 (10 detail records)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	1789.00	181.10	1.30	0.00	32.80	1.90	55.68	9.95	30.90	1.20	1.33
Min	15	60	0	0	23	1	33.25	2	10	0	0
Max	12400	865	5	0	53	4	89.75	24	65	4	8.25

Condition Class 2

Summary for Condition Class = 2 (14 detail records)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	2748.64	931.64	14.14	0.00	33.00	2.07	70.80	11.95	19.98	1.86	1.43
Min	604	40	0	0	17	1	42.75	0.25	3.25	0	0
Max	10243	4268	150	0	53	4	139.75	60.25	56	3	4

Condition Class 3

Summary for Condition Class = 3 (1 detail record)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	7884.00	1093.00	0.00	0.00	28.00	1.00	82.75	15.00	8.25	1.00	0.25
Min	7884	1093	0	0	28	1	82.75	15	8.25	1	0.25
Max	7884	1093	0	0	28	1	82.75	15	8.25	1	0.25

Summary for 'NaturalCommunity1' = VXR (25 detail records)

	imprvdist	roaddist	Livestock Index	Vehicle Index	Nativespecies	Exoticspecies	PercCovNatives	PercCovExotics	PercSandSoil	NativeGrasses	PercCovNatGrass
Avg	2570.20	637.88	8.44	0.00	32.72	1.96	65.23	11.27	23.88	1.56	1.34
Min	15	40	0	0	17	1	33.25	0.25	3.25	0	0
Max	12400	4268	150	0	53	4	139.75	60.25	65	4	8.25

APPENDIX G

Creosotebush-Bursage Desert Scrub Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group **1** *Number of Plots in Group:* **29**

Growth Form ***1. Trees***

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Olneya tesota	0.01	1
Parkinsonia florida	0.01	1
Parkinsonia microphylla	0.02	2
Prosopis velutina	0.86	9

Sum of Percent Cover by Growth Form **0.90**

Growth Form ***2. Shrubs***

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Acacia constricta	0.03	1
Acacia greggii	0.01	1
Ambrosia deltoidea	0.26	7
Ambrosia dumosa	0.21	8
Celtis pallida pallida	0.01	1
Encelia farinosa farinosa	0.01	1
Fagonia californica ssp longipes	0.02	2
Fouquieria splendens	0.14	2
Krameria grayi	0.17	2
Larrea divaricata tridentata	7.10	29
Senna covesii	0.01	1
Yucca baccata	0.01	1

Sum of Percent Cover by Growth Form **7.97**

Growth Form ***3. Cactus***

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Carnegiea gigantea	0.02	2
Cylindropuntia acanthocarpa	0.15	3
Cylindropuntia bigelovii	0.01	1
Cylindropuntia leptocaulis	0.03	1
Ferocactus	0.01	1
Mammillaria grahamii	0.01	1

Sum of Percent Cover by Growth Form **0.22**

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 1

Number of Plots in Group: 29

Growth Form *4. Herbs*

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	0.13	6
Amsinckia tessellata	0.01	1
Amsinkia	0.11	10
Astragalus nuttallianus	0.03	1
Bowlesia incana	0.01	1
Brassica tournefortii	0.01	1
Calycoseris wrightii	0.01	1
Camissonia	0.01	1
Camissonia chamaenerioides	0.01	1
Caulanthus lasiophyllus	0.05	3
Chaenactis stevioides	0.31	20
Chorizanthe brevicornus	0.06	7
Chorizanthe rigida	0.23	13
Cryptantha	0.01	1
Cryptantha barbigera	0.07	2
Cryptantha maritima	0.07	5
Cryptantha micrantha	0.01	1
Cryptantha pterocarya	0.02	2
Eriogonum deflexum	0.02	2
Eriogonum thomasii	0.79	2
Eriophyllum lanosum	0.07	8
Erodium cicutarium	0.54	14
Erodium texanum	0.28	12
Eucrypta micrantha	0.01	1
Euphorbia	0.01	1
Filago arizonica	0.01	1
Gilia stellata	0.01	1
Lappula occidentalis	0.01	1
Lepidium lasiocarpum	1.09	27
Lesquerella gordonii	1.85	21
Linanthus jonesii	0.01	1
Malva parviflora	0.01	1
Monoptilon bellioides	0.03	1
Oenothera	0.01	1
Oligomeris linifolia	0.03	4
Pectocarya	0.08	6
Pectocarya platycarpa	0.56	5
Pectocarya recurvata	0.07	1
Phacelia	0.10	1
Phacelia ambigua	0.10	1

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 1

Number of Plots in Group: **29**

Plagiobothrys	0.01	1
Plantago ovata	1.76	24
Sisymbrium irio	0.09	4
Sonchus	0.03	1
Sonchus oleraceus	0.01	1
Sphaeralcea coulteri	0.01	1
Veronica peregrina ssp xalapsis	0.03	1

Sum of Percent Cover by Growth Form 8.79

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Erioneuron pulchellum	0.10	1
Muhlenbergia porteri	0.03	1
Pleuraphis mutica	0.21	1
Schismus arabicus	1.38	24
Vulpia octoflora	0.04	2

Sum of Percent Cover by Growth Form 1.77

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 2

Number of Plots in Group: 14

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Prosopis velutina	0.02	1

Sum of Percent Cover by Growth Form 0.02

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia deltoidea	0.23	3
Larrea divaricata tridentata	6.79	14
Lycium andersonii	0.02	1

Sum of Percent Cover by Growth Form 7.04

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.04	2

Sum of Percent Cover by Growth Form 0.04

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	0.68	8
Astragalus	0.07	1
Caulanthus lasiophyllus	0.14	5
Chenopodium murale	0.14	1
Chorizanthe rigida	0.04	2
Cryptantha	0.05	3
Cryptantha maritima	0.02	1
Cryptantha micrantha	0.02	1
Eriastrum diffusum	0.02	1
Eriogonum trichopes	0.02	1
Eriophyllum lanosum	0.18	3
Erodium cicutarium	1.38	3
Erodium texanum	2.00	6
Filago depressa	0.02	1
Lepidium lasiocarpum	12.36	14
Lesquerella gordonii	0.55	8
Linanthus bigelovii	0.02	1
Malva parviflora	0.07	1

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 2 *Number of Plots in Group:* 14

Monolepis nuttalliana	0.14	1
Pectocarya	3.64	8
Pectocarya platycarpa	1.52	5
Plagiobothrys	0.14	1
Plantago ovata	18.29	14

Sum of Percent Cover by Growth Form 41.50

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Schismus arabicus	25.64	14
Vulpia octoflora	0.07	1

Sum of Percent Cover by Growth Form 25.71

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 3

Number of Plots in Group: 6

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Phoradendron californicum	0.50	1
Prosopis velutina	7.00	4

Sum of Percent Cover by Growth Form 7.50

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia deltoidea	0.83	1
Ambrosia dumosa	0.04	1
Larrea divaricata tridentata	25.50	6

Sum of Percent Cover by Growth Form 26.38

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Cylindropuntia leptocaulis	0.04	1
Grusonia parishii	0.04	1

Sum of Percent Cover by Growth Form 0.08

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	0.17	1
Amsinkia	0.58	4
Camissonia chamaenerioides	0.17	1
Caulanthus lasiophyllus	1.67	1
Chaenactis stevioides	0.17	4
Chorizanthe brevicornus	0.04	1
Chorizanthe rigida	0.04	1
Cryptantha	0.17	1
Cryptantha maritima	0.17	1
Cryptantha pterocarya	0.17	1
Descurania pinnata	0.04	1
Draba cuneifolia	0.04	1
Eriophyllum lanosum	0.04	1
Erodium cicutarium	5.21	6
Erodium texanum	0.08	2
Filago	0.33	1

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 3 *Number of Plots in Group:* 6

Filago arizonica	0.04	1
Lappula occidentalis	0.04	1
Lepidium lasiocarpum	0.54	3
Lesquerella gordonii	3.67	5
Malva parviflora	0.04	1
Orthocarpus purpurascens	0.04	1
Pectocarya	0.50	1
Pectocarya recurvata	1.67	1
Plantago	0.04	1
Plantago ovata	2.67	2
Sphaeralcea ambigua	0.17	1
unknown herb 1	0.04	1

Sum of Percent Cover by Growth Form 18.54

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Pleuraphis mutica	3.83	2
Poa bigelovii	0.04	1
Schismus arabicus	5.50	6

Sum of Percent Cover by Growth Form 9.38

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 23 — Number of Plots in Group: 1

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	1.00	1
Parkinsonia florida	2.00	1
Prosopis velutina	13.00	1

Sum of Percent Cover by Growth Form 16.00

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia deltoidea	0.25	1

Sum of Percent Cover by Growth Form 0.25

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinkia	5.00	1
Brassica tournefortii	0.25	1
Camissonia chamaenerioides	0.25	1
Daucus pusillus	0.25	1
Erodium cicutarium	0.25	1
Evax multicaulis	0.25	1
Herniaria cinerea	0.25	1
Lepidium lasiocarpum	60.00	1
Lesquerella gordonii	2.00	1
Malocothrix	0.25	1
Pectocarya	2.00	1
Sisymbrium irio	10.00	1
Sphaeralcea	5.00	1
Teucrium cubense ssp depressum	3.00	1
Verbena bracteata	4.00	1

Sum of Percent Cover by Growth Form 92.75

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Poa bigelovii	1.00	1
Schismus arabicus	5.00	1

Sum of Percent Cover by Growth Form 6.00

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group **24** *Number of Plots in Group:* **16**

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	1.27	3
Parkinsonia florida	0.38	2
Parkinsonia microphylla	0.20	3
Phoradendron californicum	0.03	2
Prosopis velutina	2.00	6

Sum of Percent Cover by Growth Form 3.88

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Abutilon incanum	0.02	1
Acacia constricta	0.09	3
Ambrosia deltoidea	2.14	11
Ambrosia dumosa	0.06	1
Baccharis sarothroides	0.19	1
Ditaxis lanceolata	0.08	2
Encelia farinosa farinosa	0.19	2
Fouquieria splendens	0.27	3
Krameria grayi	0.28	5
Larrea divaricata tridentata	5.50	16
Lycium	0.02	1
Lycium andersonii	0.02	1
Physalis crassifolia	0.02	1
Senna covesii	0.03	2
Tamarix ramosissima	0.06	1
Ziziphus obtusifolia canescens	0.02	1

Sum of Percent Cover by Growth Form 8.97

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.08	5
Cylindropuntia acanthocarpa	0.22	8
Cylindropuntia bigelovii	0.25	2
Cylindropuntia fulgida	0.02	1
Echinocereus	0.02	1
Echinocereus engelmannii	0.02	1
Ferocactus emoryi	0.02	1

Sum of Percent Cover by Growth Form 0.61

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 24

Number of Plots in Group: 16

Growth Form *4. Herbs*

Scientific Name	Average % Cover by Species	# of plots containing
Amaranthus albus	0.02	1
Ambrosia ambrosioides	1.06	2
Amsinckia intermedia	1.09	15
Amsinckia tessellata	0.06	1
Astragalus nuttallianus	0.02	1
Brassica tournefortii	0.34	4
Camissonia	0.08	5
Caulanthus lasiophyllus	0.64	11
Chaenactis	0.02	1
Chaenactis carphoclinia	0.27	2
Chaenactis stevioides	0.34	4
Chenopodium	0.02	1
Chenopodium murale	0.03	2
Chenopodium neomexicana	0.02	1
Chenopodium pratericola	0.02	1
Chorizanthe brevicornus	0.69	11
Chorizanthe rigida	0.27	8
Conyza canadensis	0.06	1
Cryptantha	0.03	2
Cryptantha barbigera	0.34	3
Cryptantha maritima	0.70	9
Cryptantha micrantha	0.06	1
Cryptantha pterocarya	0.44	5
Dalea mollissima	0.02	1
Datura discolor	0.06	1
Daucus pusillus	0.06	4
Descurania pinnata	0.05	3
Ditaxis neomexicana	0.08	2
Draba cuneifolia	0.06	4
Eriastrum diffusum	0.02	1
Eriogonum deflexum	0.34	3
Eriophyllum lanosum	0.45	7
Erodium cicutarium	1.13	3

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 24 *Number of Plots in Group:* 16

Erodium texanum	0.05	3
Euphorbia	0.02	1
Euphorbia albomarginata	0.02	1
Euphorbia polycarpa	0.31	2
Filago	0.05	3
Filago arizonica	0.03	2
Gilia	0.03	2
Lepidium lasiocarpum	3.22	15
Lesquerella gordonii	0.45	13
Linanthus jonesii	0.05	3
Loeflingia squarrosa ssp. Cactorum	0.14	2
Lotus salsuginosus	0.02	1
Lupinus	0.02	1
Lupinus sparsiflorus	0.03	2
Monoptilon bellioides	0.44	1
Nama hispidum	0.02	1
Nemacladus glanduliferous var. orienta	0.02	1
Nicotiana obtusifolia	0.31	2
Oenothera primaveris	0.02	1
Pectocarya	4.39	9
Pectocarya platycarpa	0.09	3
Pectocarya recurvata	1.06	2
Perityle emoryii	0.02	1
Phacelia	0.19	5
Plantago ovata	3.58	10
Rafinesquia neomexicana	0.03	2
Salsola tragus	0.02	1
Salvia columbariae	0.02	1
Silene	0.02	1
Sisymbrium irio	2.44	4
Sonchus	0.06	1
Spermolepis echinata	0.02	1
Sphaeralcea ambigua	0.03	2
Sphaeralcea coulteri	0.95	3
Stylocline micropoides	0.02	1
unknown herb 1	0.02	1
Veronica peregrina ssp xalapsis	0.02	1

Sum of Percent Cover by Growth Form 27.05

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 24 — Number of Plots in Group: 16

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Aristida	0.02	1
Bromus carinatus	0.02	1
Cynodon dactylon	0.02	1
Poa bigelovii	0.13	5
Schismus arabicus	12.56	16
Vulpia octoflora	0.19	6

Sum of Percent Cover by Growth Form 12.92

Growth Form 6. Vines

Scientific Name	Average % Cover by Species	# of plots containing
Janusia gracile	0.02	1

Sum of Percent Cover by Growth Form 0.02

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 32

Number of Plots in Group: 11

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	0.02	1
Parkinsonia florida	0.02	1
Parkinsonia microphylla	0.18	1
Prosopis velutina	0.09	1

Sum of Percent Cover by Growth Form 0.32

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Acacia constricta	0.02	1
Ambrosia deltoidea	1.20	8
Ambrosia dumosa	0.09	1
Ditaxis lanceolata	0.02	1
Fouquieria splendens	0.02	1
Krameria grayi	0.14	3
Larrea divaricata tridentata	6.27	11
Lycium andersonii	0.02	1

Sum of Percent Cover by Growth Form 7.80

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.09	4
Cylindropuntia acanthocarpa	0.11	5
Cylindropuntia fulgida	0.18	1
Ferocactus	0.02	1
Ferocactus cylindraceus	0.02	1
Ferocactus wislizeni	0.05	2
Mammillaria	0.02	1
Mammillaria grahamii	0.02	1

Sum of Percent Cover by Growth Form 0.52

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	0.23	7
Amsinckia tessellata	0.02	1
Astragalus	0.02	1

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 32 *Number of Plots in Group:* 11

Astragalus nuttallianus	0.20	2
Brassica tournefortii	0.05	2
Camissonia chamaenerioides	0.07	3
Caulanthus lasiophyllus	0.52	7
Chaenactis stevioides	0.55	3
Chenopodium	0.02	1
Chorizanthe brevicornus	0.39	8
Chorizanthe rigida	0.36	7
Cryptantha maritima	0.20	6
Cryptantha pterocarya	0.11	2
Descurania pinnata	0.02	1
Eriogonum	0.11	2
Eriophyllum lanosum	0.48	7
Erodium texanum	0.07	3
Euphorbia polycarpa	0.09	1
Filago	0.02	1
Lepidium lasiocarpum	21.45	11
Lesquerella gordonii	1.43	9
Linanthus jonesii	0.02	1
Lotus salsuginosus	0.02	1
Lupinus sparsiflorus	0.11	5
Monoptilon bellioides	0.02	1
Pectocarya	0.93	3
Pectocarya platycarpa	0.30	3
Pectocarya recurvata	0.45	1
Phacelia	0.07	3
Plantago ovata	6.09	11
Sphaeralcea coulteri	0.02	1

Sum of Percent Cover by Growth Form 34.48

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Schismus arabicus	10.45	11

Sum of Percent Cover by Growth Form 10.45

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 37 *Number of Plots in Group:* 4

Growth Form 1. Trees

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Olneya tesota	0.56	2
Parkinsonia florida	11.25	3
Prosopis velutina	1.50	2

Sum of Percent Cover by Growth Form 13.31

Growth Form 2. Shrubs

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Acacia greggii	0.31	2
Ambrosia deltoidea	1.31	3
Boerhavia wrightii	0.06	1
Encelia farinosa farinosa	0.06	1
Hymenoclea salsola	0.06	1
Larrea divaricata tridentata	10.25	4
Lycium	0.25	1
Lycium andersonii	0.06	1

Sum of Percent Cover by Growth Form 12.38

Growth Form 3. Cactus

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Cylindropuntia fulgida	0.25	1
Ferocactus	0.06	1
Opuntia	0.06	1

Sum of Percent Cover by Growth Form 0.38

Growth Form 4. Herbs

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Amsinckia intermedia	1.31	4
Brassica tournefortii	0.31	2
Caulanthus lasiophyllus	0.81	2
Chaenactis stevioides	0.06	1
Chenopodium murale	0.25	1
Chenopodium neomexicana	0.06	1
Chorizanthe rigida	0.06	1
Cryptantha maritima	0.25	1
Cryptantha pterocarya	0.81	2

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 37 *Number of Plots in Group:* 4

Descurania pinnata	0.25	1
Ditaxis neomexicana	0.25	1
Eriogonum deflexum	0.25	1
Eriophyllum lanosum	0.13	2
Erodium cicutarium	5.31	3
Eucrypta micrantha	0.25	1
Gilia	0.06	1
Lepidium lasiocarpum	9.00	3
Lesquerella gordonii	1.50	2
Malva parviflora	0.25	1
Nicotiana obtusifolia	0.25	1
Pectocarya	4.00	2
Pectocarya recurvata	2.25	2
Plantago ovata	3.00	3
Sisymbrium irio	3.75	3
Sphaeralcea ambigua	0.06	1
Sphaeralcea coulteri	0.06	1

Sum of Percent Cover by Growth Form 34.56

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Eragrostis lehmanniana	0.25	1
Muhlenbergia porteri	0.06	1
Poa bigelovii	0.06	1
Schismus arabicus	37.50	4

Sum of Percent Cover by Growth Form 37.88

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 40 — *Number of Plots in Group:* 3

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Parkinsonia microphylla	0.08	1

Sum of Percent Cover by Growth Form 0.08

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia deltoidea	1.42	3
Krameria grayi	0.08	1
Larrea divaricata tridentata	6.33	3
Lycium	0.33	1

Sum of Percent Cover by Growth Form 8.17

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.08	1
Ferocactus wislizeni	0.08	1

Sum of Percent Cover by Growth Form 0.17

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	0.50	3
Astragalus	0.08	1
Caulanthus lasiophyllus	0.42	2
Chorizanthe brevicornus	0.33	1
Chorizanthe rigida	0.08	1
Erodium cicutarium	0.08	1
Euphorbia	1.08	2
Lepidium lasiocarpum	10.33	3
Lesquerella gordonii	0.08	1
Pectocarya platycarpa	25.00	3
Plantago ovata	8.00	3

Sum of Percent Cover by Growth Form 46.00

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Erioneuron pulchellum	0.08	1
Schismus arabicus	20.00	3

Sum of Percent Cover by Growth Form 20.08

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 54 *Number of Plots in Group:* 1

Growth Form *2. Shrubs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Larrea divaricata tridentata	8.00	1

Sum of Percent Cover by Growth Form 8.00

Growth Form *3. Cactus*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Cylindropuntia fulgida	9.00	1

Sum of Percent Cover by Growth Form 9.00

Growth Form *4. Herbs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Amsinckia intermedia	1.00	1
Astragalus nuttallianus	0.25	1
Caulanthus lasiophyllus	1.00	1
Chaenactis stevioides	1.00	1
Chorizanthe brevicornus	0.25	1
Cryptantha barbigera	0.25	1
Cryptantha maritima	7.00	1
Eriastrum diffusum	1.00	1
Eriophyllum lanosum	1.00	1
Erodium texanum	0.25	1
Lepidium lasiocarpum	0.25	1
Lupinus sparsiflorus	0.25	1
Pectocarya recurvata	45.00	1
Phacelia	0.25	1
Sisymbrium irio	0.25	1

Sum of Percent Cover by Growth Form 59.00

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Pleuraphis rigida	0.25	1
Schismus arabicus	3.00	1
Vulpia octoflora	0.25	1

Sum of Percent Cover by Growth Form 3.50

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 56 — *Number of Plots in Group:* 2

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Phoradendron californicum	0.13	1
Prosopis velutina	4.00	1

Sum of Percent Cover by Growth Form 4.13

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Acacia constricta	0.63	2
Acacia greggii	0.13	1
Celtis pallida pallida	0.13	1
Krameria erecta	0.50	1
Larrea divaricata tridentata	5.00	1
Lycium	0.13	1

Sum of Percent Cover by Growth Form 6.50

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.13	1
Cylindropuntia acanthocarpa	0.50	1
Cylindropuntia fulgida	1.00	1
Cylindropuntia leptocaulis	0.13	1

Sum of Percent Cover by Growth Form 1.75

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia ambrosioides	0.13	1
Ambrosia confertifolia	0.13	1
Amsinckia intermedia	1.13	2
Camissonia californica	0.13	1
Castilleja exserta ssp. Exserta	0.13	1
Caulanthus lasiophyllus	0.25	2
Chaenactis stevioides	0.13	1
Chenopodium pratericola	0.13	1
Chorizanthe brevicornus	0.13	1
Chorizanthe rigida	0.13	1
Cirsium neomexicana	0.13	1

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 56 *Number of Plots in Group:* 2

Conyza coulteri	0.13	1
Cryptantha maritima	0.13	1
Cryptantha micrantha	0.13	1
Cryptantha pterocarya	0.25	2
Daucus pusillus	0.13	1
Descurania pinnata	0.13	1
Draba cuneifolia	0.25	2
Eriastrum diffusum	0.13	1
Eriogonum abertianum	0.13	1
Eriogonum deflexum	0.13	1
Eriophyllum lanosum	0.13	1
Erodium cicutarium	50.00	2
Eschscholzia mexicana	0.13	1
Eucrypta chrysanthemifolia	0.13	1
Gilia	0.13	1
Herniaria cinerea	0.13	1
Lappula occidentalis	0.13	1
Lepidium lasiocarpum	0.25	2
Lesquerella gordonii	0.25	2
Lupinus	0.13	1
Lupinus sparsiflorus	0.13	1
Machaeranthera tagetina	0.13	1
Mentzelia affinis	0.13	1
Nama hispidum	0.13	1
Nicotiana obtusifolia	0.13	1
Pectocarya recurvata	2.63	2
Penstemon parryi	0.13	1
Phacelia ambigua	0.13	1
Phacelia coerulea	0.13	1
Plantago patagonica	0.13	1
Silene antirrhina	0.13	1
Sisymbrium irio	7.50	1
Sonchus	0.13	1
Sphaeralcea laxa	0.13	1
Teucrium cubense ssp depressum	0.13	1
unknown herb 1	0.13	1
unknown herb 2	0.13	1
Uropappus lindleyi	0.13	1
Verbena bracteata	0.13	1

Sum of Percent Cover by Growth Form 67.63

Community Statistics by Cluster Group

Natural Community *Creosotebush-Bursage Desert Scrub*

Group 56 *Number of Plots in Group:* 2

Growth Form *5. Grasses and Sedges*

Scientific Name	Average % Cover by Species	# of plots containing
Bromus	0.13	1
Bromus rubens	0.13	1
Cynodon dactylon	2.00	1
Heteropogon contortus	0.13	1
Muhlenbergia porteri	0.50	1
Phalaris minor	4.00	1
Pleuraphis mutica	0.50	1
Schismus arabicus	0.13	1
Vulpia octoflora	0.50	1

Sum of Percent Cover by Growth Form 8.00

APPENDIX H

Paloverde - Mixed Cacti – Mixed Scrub on Bajadas
Community Statistics by Cluster Group

Natural Community **PVMCB**

Group 0 - outlier *Number of Plots in Group:* 1

Growth Form *1. Trees*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Parkinsonia florida	0.25	1
Phoradendron californicum	0.25	1
Prosopis velutina	4.00	1

Sum of Percent Cover by Growth Form 4.50

Growth Form *2. Shrubs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Larrea divaricata tridentata	0.25	1

Sum of Percent Cover by Growth Form 0.25

Growth Form *4. Herbs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Erodium cicutarium	4.00	1
Lepidium lasiocarpum	0.25	1
Lesquerella gordonii	0.25	1
Pectocarya	5.00	1
Plagiobothrys	1.00	1
Sisymbrium irio	2.00	1

Sum of Percent Cover by Growth Form 12.50

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Schismus arabicus	55.00	1

Sum of Percent Cover by Growth Form 55.00

Community Statistics by Cluster Group

Natural Community PVMCB

Group 1

Number of Plots in Group: 3

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Parkinsonia microphylla	1.75	3

Sum of Percent Cover by Growth Form 1.75

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia deltoidea	2.00	3
Ditaxis lanceolata	0.17	2
Fouquieria splendens	0.33	1
Krameria grayi	0.83	3
Larrea divaricata tridentata	4.67	3

Sum of Percent Cover by Growth Form 8.00

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.50	3
Cylindropuntia acanthocarpa	0.75	3
Cylindropuntia bigelovii	0.08	1
Cylindropuntia fulgida	0.17	2
Cylindropuntia leptocaulis	0.08	1
Echinocereus	0.08	1
Ferocactus emoryi	0.08	1
Mammillaria grahamii	0.17	2
Opuntia	3.33	1

Sum of Percent Cover by Growth Form 5.25

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	0.42	2
Camissonia	0.08	1
Caulanthus lasiophyllus	0.75	3
Chaenactis stevioides	0.08	1
Chorizanthe brevicornus	5.08	3
Chorizanthe rigida	0.08	1
Cryptantha maritima	1.00	2
Cryptantha pterocarya	0.17	2

Community Statistics by Cluster Group

Natural Community PVMCB

Group 1

Number of Plots in Group: 3

Descurania pinnata	0.08	1
Draba cuneifolia	0.08	1
Eriastrum diffusum	0.17	2
Eriophyllum lanosum	0.17	2
Erodium texanum	0.08	1
Euphorbia polycarpa	0.67	2
Filago	0.42	2
Lepidium lasiocarpum	4.00	3
Lesquerella gordonii	1.67	1
Pectocarya	20.00	3
Plantago ovata	5.00	2
Stylocline micropoides	0.08	1

Sum of Percent Cover by Growth Form 40.08

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Aristida	0.33	1
Schismus arabicus	1.67	3
Vulpia octoflora	0.67	2

Sum of Percent Cover by Growth Form 2.67

Community Statistics by Cluster Group

Natural Community PVMCB

Group 2 *Number of Plots in Group:* 3

Growth Form 2. Shrubs

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Ambrosia deltoidea	1.67	3
Ambrosia dumosa	0.42	2
Krameria grayi	0.08	1
Larrea divaricata tridentata	19.00	3

Sum of Percent Cover by Growth Form 21.17

Growth Form 4. Herbs

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Amsinckia intermedia	0.67	1
Amsinkia	0.08	1
Camissonia	0.08	1
Camissonia chamaenerioides	0.08	1
Caulanthus lasiophyllus	0.42	2
Chaenactis stevioides	0.67	2
Chorizanthe brevicornus	0.50	3
Chorizanthe rigida	1.00	3
Cryptantha pterocarya	0.08	1
Descurania pinnata	0.08	1
Eriastrum diffusum	0.08	1
Eriogonum deflexum	0.08	1
Eriophyllum lanosum	0.08	1
Euphorbia polycarpa	0.08	1
Lepidium lasiocarpum	4.67	2
Lesquerella gordonii	1.33	3
Lupinus sparsiflorus	0.08	1
Mentzelia	0.08	1
Pectocarya	1.08	2
Plantago ovata	1.67	3
Stylocline micropoides	0.08	1

Sum of Percent Cover by Growth Form 13.00

Growth Form 5. Grasses and Sedges

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Schismus arabicus	2.42	3

Sum of Percent Cover by Growth Form 2.42

Community Statistics by Cluster Group

Natural Community PVMCB

Group 3

Number of Plots in Group: 7

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	2.57	3
Parkinsonia microphylla	1.18	5
Phoradendron californicum	0.07	2
Prosopis velutina	0.75	2

Sum of Percent Cover by Growth Form 4.57

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Acacia constricta	0.57	2
Ambrosia deltoidea	2.04	7
Ambrosia dumosa	0.32	2
Ditaxis lanceolata	0.04	1
Encelia farinosa farinosa	0.04	1
Fouquieria splendens	0.18	2
Hymenoclea salsola	0.04	1
Krameria erecta	0.29	1
Krameria grayi	0.89	3
Larrea divaricata tridentata	5.71	7
Lycium	0.46	3
Lycium andersonii	0.04	1
Trixis californica	0.14	1

Sum of Percent Cover by Growth Form 10.75

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.36	3
Cylindropuntia acanthocarpa	0.36	4
Cylindropuntia fulgida	0.14	1
Cylindropuntia leptocaulis	0.04	1
Mammillaria grahamii	0.04	1
Opuntia engelmannii	0.04	1
Peniocereus greggii	0.04	1

Sum of Percent Cover by Growth Form 1.00

Community Statistics by Cluster Group

Natural Community PVMCB

Group 3

Number of Plots in Group: 7

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia tessellata	0.29	1
Amsinkia	0.07	2
Camissonia chamaenerioides	0.04	1
Caulanthus lasiophyllus	0.21	3
Chaenactis carphoclinia	0.04	1
Chaenactis stevioides	0.21	3
Chorizanthe brevicornus	0.61	3
Chorizanthe rigida	0.57	6
Cryptantha	0.61	2
Cryptantha maritima	0.29	1
Cryptantha pterocarya	0.29	2
Eriastrum diffusum	0.04	1
Eriophyllum lanosum	0.50	3
Eucrypta micrantha	0.04	1
Euphorbia	0.04	1
Filago arizonica	0.04	1
Lepidium lasiocarpum	2.61	7
Lesquerella gordonii	0.75	4
Linanthus jonesii	0.04	1
Oligomeris linifolia	0.04	1
Parietaria floridana	0.04	1
Pectocarya	1.57	4
Pectocarya platycarpa	0.32	2
Pectocarya recurvata	0.04	1
Phacelia	0.18	2
Phacelia ambigua	0.14	1
Plantago ovata	0.96	6
Stylocline micropoides	0.04	1

Sum of Percent Cover by Growth Form 10.57

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Aristida purpurea	0.04	1
Poa bigelovii	0.14	1
Schismus arabicus	3.00	7
Vulpia octoflora	0.29	1

Sum of Percent Cover by Growth Form 3.46

Community Statistics by Cluster Group

Natural Community PVMCB

Group 7

Number of Plots in Group: 1

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Parkinsonia florida	14.00	1

Sum of Percent Cover by Growth Form 14.00

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Acacia greggii	2.00	1
Ambrosia deltoidea	5.00	1
Hymenoclea salsola	14.00	1
Larrea divaricata tridentata	2.00	1
Lycium macrodon	3.00	1
Lycium parishii	1.00	1

Sum of Percent Cover by Growth Form 27.00

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	1.00	1
Cylindropuntia acanthocarpa	0.25	1

Sum of Percent Cover by Growth Form 1.25

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinkia	0.25	1
Camissonia	0.25	1
Chorizanthe rigida	0.25	1
Cryptantha maritima	3.00	1
Cryptantha pterocarya	0.25	1
Ditaxis neomexicana	0.25	1
Draba cuneifolia	1.00	1
Eriastrum diffusum	0.25	1
Euphorbia pediculifera	0.25	1
Filago arizonica	0.25	1
Lepidium lasiocarpum	2.00	1
Linanthus jonesii	0.25	1
Nama hispidum	0.25	1
Pectocarya recurvata	2.00	1
Stylocline micropoides	0.25	1

Sum of Percent Cover by Growth Form 10.75

Community Statistics by Cluster Group

Natural Community PVMCB

Group 7 *Number of Plots in Group:* 1

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Schismus arabicus	20.00	1

Sum of Percent Cover by Growth Form 20.00

Community Statistics by Cluster Group

Natural Community PVMCB

Group 8

Number of Plots in Group: 4

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	0.56	2
Parkinsonia florida	0.25	1
Parkinsonia microphylla	1.63	3
Phoradendron californicum	0.06	1

Sum of Percent Cover by Growth Form 2.50

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia deltoidea	8.00	4
Ambrosia dumosa	0.31	2
Fouquieria splendens	0.31	2
Hymenoclea salsola	0.75	1
Larrea divaricata tridentata	8.75	4
Lycium parishii	0.25	1

Sum of Percent Cover by Growth Form 18.38

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.88	3
Cylindropuntia acanthocarpa	0.38	3
Cylindropuntia fulgida	0.56	2
Ferocactus emoryi	0.25	1
Mammillaria grahamii	0.06	1
Mammillaria tetrancistra	0.06	1

Sum of Percent Cover by Growth Form 2.19

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	0.13	2
Amsinckia tessellata	0.25	1
Amsinkia	0.06	1
Camissonia	0.13	2
Camissonia chamaenerioides	0.06	1
Caulanthus lasiophyllus	0.50	2
Chorizanthe brevicornus	0.44	4

Community Statistics by Cluster Group

Natural Community PVMCB

Group 8 *Number of Plots in Group:* 4

Chorizanthe rigida	0.06	1
Cryptantha barbigera	0.25	1
Cryptantha maritima	7.25	4
Cryptantha pterocarya	0.19	3
Descurania pinnata	0.38	3
Ditaxis neomexicana	0.25	1
Draba cuneifolia	0.06	1
Eriastrum diffusum	0.06	1
Eriophyllum lanosum	0.19	3
Euphorbia polycarpa	0.06	1
Filago	0.06	1
Filago arizonica	0.25	1
Lepidium lasiocarpum	0.56	3
Loeflingia squarrosa ssp. Cactorum	0.13	2
Orobanche cooperi	0.06	1
Pectocarya	2.50	1
Pectocarya platycarpa	0.25	1
Pectocarya recurvata	3.25	3
Stylocline micropoides	0.06	1

Sum of Percent Cover by Growth Form 17.44

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Aristida	0.06	1
Erioneuron pulchellum	0.06	1
Schismus arabicus	10.00	4
Vulpia octoflora	0.13	2

Sum of Percent Cover by Growth Form 10.25

Community Statistics by Cluster Group

Natural Community PVMCB

Group 12 — Number of Plots in Group: 7

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	1.57	4
Parkinsonia microphylla	10.14	7
Phoradendron californicum	0.04	1

Sum of Percent Cover by Growth Form 11.75

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Acacia constricta	0.29	2
Ambrosia deltoidea	10.14	7
Ambrosia dumosa	0.61	2
Ayenia filiformis	0.04	1
Calliandra eriophylla	0.04	1
Ditaxis lanceolata	0.07	2
Encelia farinosa farinosa	0.07	2
Ephedra aspera	0.14	1
Fagonia californica ssp longipes	0.14	1
Fouquieria splendens	1.50	7
Jatropha cardiophylla	0.14	1
Krameria grayi	2.18	7
Larrea divaricata tridentata	1.82	7
Lycium	0.25	4
Lycium andersonii	0.04	1
Lycium berlandieri	0.04	1
Trixis californica	0.18	2

Sum of Percent Cover by Growth Form 17.68

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.46	7
Cylindropuntia	0.14	1
Cylindropuntia acanthocarpa	0.89	5
Cylindropuntia bigelovii	0.04	1
Cylindropuntia fulgida	0.04	1
Echinocereus	0.04	1
Echinocereus engelmannii	0.14	4

Community Statistics by Cluster Group

Natural Community PVMCB

Group 12 — Number of Plots in Group: 7

Ferocactus	0.04	1
Ferocactus emoryi	0.11	3
Mammillaria	0.04	1
Mammillaria grahamii	0.11	3

Sum of Percent Cover by Growth Form 2.04

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	0.18	2
Amsinckia tessellata	0.14	1
Calycoseris wrightii	0.04	1
Camissonia chamaenerioides	0.14	1
Caulanthus lasiophyllus	0.43	3
Chaenactis stevioides	0.32	2
Chorizanthe brevicornus	2.11	7
Chorizanthe rigida	0.54	5
Cryptantha maritima	2.04	4
Cryptantha pterocarya	1.07	7
Daucus pusillus	0.04	1
Descurania pinnata	0.07	2
Draba cuneifolia	0.18	2
Eriogonum	0.18	2
Eriogonum inflatum	0.04	1
Eriogonum thomasii	0.04	1
Eriophyllum lanosum	0.25	4
Eucrypta micrantha	0.04	1
Euphorbia	0.04	1
Euphorbia polycarpa	0.18	2
Filago arizonica	0.04	1
Gilia	0.14	1
Lappula occidentalis	0.29	1
Lepidium lasiocarpum	4.21	7
Lesquerella gordonii	1.75	5
Lotus	0.04	1
Marina parryi	0.04	1
Mentzelia	0.04	1
Mentzelia involucrata	0.14	1
Pectocarya	0.04	1

Community Statistics by Cluster Group

Natural Community PVMCB

Group 12 — Number of Plots in Group: 7

Pectocarya platycarpa	0.50	4
Pectocarya recurvata	2.86	3
Phacelia	0.04	1
Phacelia ambigua	0.75	4
Plantago ovata	0.82	7
Rafinesquia neomexicana	0.04	1
Senecio	0.04	1
Sphaeralcea	0.04	1
Stylocline micropoides	0.04	1

Sum of Percent Cover by Growth Form 19.86

Growth Form 5. Grasses and Sedges

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Aristida	0.04	1
Erioneuron pulchellum	0.07	2
Poa bigelovii	0.07	2
Schismus arabicus	1.89	7
Vulpia octoflora	0.07	2

Sum of Percent Cover by Growth Form 2.14

Growth Form 6. Vines

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Janusia gracile	0.04	1

Sum of Percent Cover by Growth Form 0.04

Community Statistics by Cluster Group

Natural Community **PVMCB**

Group 14 *Number of Plots in Group:* 5

Growth Form *1. Trees*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Parkinsonia florida	0.40	1
Parkinsonia microphylla	1.10	3

Sum of Percent Cover by Growth Form 1.50

Growth Form *2. Shrubs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Acacia constricta	0.40	1
Ambrosia deltoidea	2.00	5
Ditaxis lanceolata	0.05	1
Fouquieria splendens	0.45	3
Hymenoclea salsola	0.40	1
Krameria grayi	0.80	3
Larrea divaricata tridentata	4.40	5
Lycium	0.05	1

Sum of Percent Cover by Growth Form 8.55

Growth Form *3. Cactus*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Carnegiea gigantea	0.15	3
Cylindropuntia acanthocarpa	3.45	5
Cylindropuntia fulgida	0.20	1
Cylindropuntia leptocaulis	0.45	2
Echinocereus engelmannii	0.05	1

Sum of Percent Cover by Growth Form 4.30

Growth Form *4. Herbs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Amsinckia intermedia	0.45	3
Camissonia	0.05	1
Camissonia californica	0.25	2
Caulanthus lasiophyllus	1.05	5
Chaenactis stevioides	1.10	4
Chorizanthe brevicornus	0.25	2
Chorizanthe rigida	0.10	2
Cryptantha barbigera	1.50	3

Community Statistics by Cluster Group

Natural Community PVMCB

Group 14 Number of Plots in Group: 5

Cryptantha maritima	1.25	3
Cryptantha micrantha	0.05	1
Cryptantha pterocarya	0.45	3
Daucus pusillus	0.05	1
Descurania pinnata	0.15	3
Eriastrum diffusum	0.05	1
Eriogonum thomasii	0.10	2
Eriophyllum lanosum	0.05	1
Erodium texanum	0.05	1
Eucrypta micrantha	0.05	1
Euphorbia polycarpa	0.05	1
Filago	0.20	1
Gilia	0.05	1
Lepidium lasiocarpum	13.00	5
Lesquerella gordonii	1.05	3
Linanthus jonesii	0.05	1
Lupinus	0.05	1
Lupinus sparsiflorus	0.05	1
Mentzelia	0.05	1
Nama hispidum	0.05	1
Nicotiana obtusifolia	0.05	1
Orobanche cooperi	0.05	1
Pectocarya	1.05	2
Pectocarya platycarpa	1.85	3
Pectocarya recurvata	0.20	1
Phacelia	0.40	2
Phacelia ambigua	0.20	1
Plantago ovata	1.45	5
Rafinesquia neomexicana	0.05	1
Sisymbrium irio	0.05	1
Thysanocarpis curvipes	0.05	1

Sum of Percent Cover by Growth Form 27.00

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Aristida adsensionis	0.05	1
Erioneuron pulchellum	0.20	1
Muhlenbergia porteri	0.05	1
Schismus arabicus	6.20	5
Vulpia octoflora	0.65	3

Sum of Percent Cover by Growth Form 7.15

Community Statistics by Cluster Group

Natural Community PVMCB

Group 14

Number of Plots in Group: 5

Growth Form *6. Vines*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Janusia gracile	0.20	1

Sum of Percent Cover by Growth Form 0.20

Community Statistics by Cluster Group

Natural Community PVMCB

Group 16

Number of Plots in Group: 1

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Parkinsonia microphylla	0.25	1

Sum of Percent Cover by Growth Form 0.25

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Acacia constricta	0.25	1
Ambrosia deltoidea	1.00	1
Encelia farinosa farinosa	0.25	1
Fouquieria splendens	0.25	1
Krameria grayi	2.00	1
Larrea divaricata tridentata	2.00	1

Sum of Percent Cover by Growth Form 5.75

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.25	1
Cylindropuntia acanthocarpa	1.00	1

Sum of Percent Cover by Growth Form 1.25

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	0.25	1
Camissonia	0.25	1
Camissonia californica	0.25	1
Caulanthus lasiophyllus	0.25	1
Chaenactis stevioides	0.25	1
Chorizanthe brevicornus	0.25	1
Chorizanthe rigida	0.25	1
Cryptantha barbigera	0.25	1
Eriogonum inflatum	0.25	1
Eriogonum thomasii	25.00	1
Lepidium lasiocarpum	3.00	1
Lesquerella gordonii	1.00	1
Pectocarya	0.25	1
Phacelia ambigua	1.00	1
Plantago ovata	2.00	1

Sum of Percent Cover by Growth Form 34.50

Community Statistics by Cluster Group

Natural Community **PVMCB**

Group **16**

Number of Plots in Group: **1**

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Schismus arabicus	7.00	1

Sum of Percent Cover by Growth Form **7.00**

Community Statistics by Cluster Group

Natural Community PVMCB

Group 22 — Number of Plots in Group: 1

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	30.00	1
Parkinsonia microphylla	2.00	1
Prosopis velutina	1.00	1

Sum of Percent Cover by Growth Form 33.00

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia deltoidea	5.00	1
Larrea divaricata tridentata	2.00	1
Lycium	1.00	1

Sum of Percent Cover by Growth Form 8.00

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Mammillaria grahamii	0.25	1

Sum of Percent Cover by Growth Form 0.25

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinkia	1.00	1
Caulanthus lasiophyllus	0.25	1
Chorizanthe brevicornus	1.00	1
Cryptantha pterocarya	1.00	1
Lepidium lasiocarpum	3.00	1
Pectocarya	3.00	1
Plantago ovata	1.00	1

Sum of Percent Cover by Growth Form 10.25

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Schismus arabicus	1.00	1

Sum of Percent Cover by Growth Form 1.00

Community Statistics by Cluster Group

Natural Community PVMCB

Group 24 *Number of Plots in Group:* 2

Growth Form 1. Trees

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Parkinsonia microphylla	4.00	2

Sum of Percent Cover by Growth Form 4.00

Growth Form 2. Shrubs

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Acacia constricta	0.13	1
Ambrosia deltoidea	7.50	2
Encelia farinosa farinosa	0.13	1
Larrea divaricata tridentata	3.00	2

Sum of Percent Cover by Growth Form 10.75

Growth Form 3. Cactus

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Carnegiea gigantea	0.63	2
Cylindropuntia acanthocarpa	0.63	2
Cylindropuntia bigelovii	0.13	1
Cylindropuntia fulgida	0.13	1
Cylindropuntia leptocaulis	0.13	1
Echinocereus engelmannii	0.13	1
Opuntia	0.13	1

Sum of Percent Cover by Growth Form 1.88

Growth Form 4. Herbs

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Allium macropetalon	0.13	1
Amsinckia intermedia	0.63	2
Astragalus	0.50	1
Calycoseris wrightii	0.13	1
Camissonia chamaenerioides	1.50	1
Caulanthus lasiophyllus	1.63	2
Chorizanthe brevicornus	2.13	2
Chorizanthe rigida	0.13	1
Cryptantha	1.00	1
Cryptantha barbigera	0.13	1
Cryptantha maritima	2.63	2

Community Statistics by Cluster Group

Natural Community PVMCB

Group 24 Number of Plots in Group: 2

Cryptantha pterocarya	0.63	2
Descurania pinnata	1.50	1
Eriophyllum lanosum	0.50	1
Erodium cicutarium	0.13	1
Eschscholzia mexicana	0.50	1
Eucrypta micrantha	0.13	1
Euphorbia	0.50	1
Lepidium lasiocarpum	4.50	2
Lesquerella gordonii	1.50	2
Lotus	0.13	1
Lotus salsuginosus	0.50	1
Lupinus sparsiflorus	0.13	1
Monoptilon bellioides	0.13	1
Pectocarya recurvata	13.50	2
Phacelia	0.13	1
Phacelia ambigua	0.13	1
Plantago ovata	1.00	1
Sisymbrium irio	0.13	1

Sum of Percent Cover by Growth Form 36.13

Growth Form *5. Grasses and Sedges*

Scientific Name	Average % Cover by Species	# of plots containing
Schismus arabicus	30.00	2

Sum of Percent Cover by Growth Form 30.00

APPENDIX I

Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes Community Statistics by Cluster Group

Group 1

Number of Plots in Group: 10

Growth Form *1. Trees*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Olneya tesota	0.43	2
Parkinsonia microphylla	7.50	10

Sum of Percent Cover by Growth Form 7.93

Growth Form *2. Shrubs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Acacia constricta	0.50	2
Adenophyllum porophylloides	0.03	1
Agave deserti simplex	0.03	1
Ambrosia deltoidea	2.40	6
Ayenia microphylla	0.05	2
Brickellia coulteri	0.03	1
Calliandra eriophylla	0.10	1
Carlowrightii arizonica	0.03	1
Celtis pallida pallida	0.03	1
Ditaxis lanceolata	0.30	6
Encelia farinosa farinosa	7.60	10
Ephedra aspera	0.23	3
Eriogonum fasiculatum	0.10	1
Eriogonum wrightii	0.03	1
Fagonia californica ssp longipes	0.20	5
Fouquieria splendens	1.25	8
Gallium stellatum	0.03	1
Hibiscus denudatus	0.43	2
Hyptis emoryi	0.73	3
Jatropha cardiophylla	0.05	2
Krameria grayi	0.78	8
Larrea divaricata tridentata	1.33	6
Lycium	0.83	5
Lycium berlandieri	0.63	3
Lycium exsertum	0.10	1
Machaeranthera pinnatifida gooddingii	0.05	2
Menodora scabra	0.30	1
Mirabilis laevis v villosa	0.13	2
Tiquilia canescens	0.03	1
Trixis californica	0.20	5
Viguiera parishii	0.13	2

Sum of Percent Cover by Growth Form 18.58

Community Statistics by Cluster Group

Natural Community PVMCR

Group 1 *Number of Plots in Group:* 10

Growth Form *3. Cactus*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Carnegiea gigantea	0.40	9
Cylindropuntia	0.03	1
Cylindropuntia acanthocarpa	0.85	8
Cylindropuntia bigelovii	0.53	4
Echinocereus	0.03	1
Echinocereus engelmannii	0.10	4
Ferocactus cylindraceus	0.03	1
Ferocactus emoryi	0.03	1
Mammillaria	0.03	1
Mammillaria grahamii	0.13	5

Sum of Percent Cover by Growth Form 2.13

Growth Form *4. Herbs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Acleisanthes longiflora	0.03	1
Allionia incarnata	0.10	1
Amsinckia intermedia	0.08	3
Amsinckia tessellata	0.10	1
Amsinkia	0.10	1
Antirrhinum cyathiferum	0.03	1
Astragalus	0.03	1
Bowlesia incana	0.03	1
Calandrinia ciliata	0.03	1
Calycoseris wrightii	0.03	1
Camissonia	0.18	4
Camissonia californica	0.03	1
Camissonia chamaenerioides	0.15	3
Caulanthus lasiophyllus	0.18	4
Chaenactis stevioides	0.03	1
Chenopodium neomexicana	0.53	2
Chorizanthe brevicornus	0.15	6
Crassula connata	0.03	1
Cryptantha barbigera	0.13	2

Community Statistics by Cluster Group

Natural Community PVMCR

Group 1 *Number of Plots in Group:* 10

Cryptantha maritima	0.83	6
Cryptantha micrantha	0.03	1
Cryptantha pterocarya	1.15	6
Daucus pusillus	0.05	2
Descurania pinnata	0.83	7
Ditaxis adenophora	0.03	1
Draba cuneifolia	0.10	4
Eriogonum abertianum	0.05	2
Eriogonum deflexum	0.03	1
Eriogonum inflatum	0.23	3
Eriophyllum lanosum	0.05	2
Eucrypta chrysanthemifolia	0.03	1
Eucrypta micrantha	0.30	2
Euphorbia	0.23	2
Euphorbia albomarginata	0.03	1
Euphorbia arizonica	0.03	1
Euphorbia polycarpa	0.23	2
Filago	0.08	3
Gilia	0.08	3
Gilia flavocincta	0.03	1
Gilia stellata	0.35	3
Lepidium lasiocarpum	1.73	8
Lesquerella gordonii	0.10	1
Linanthus bigelovii	0.03	1
Linanthus jonesii	0.20	2
Lupinus sparsiflorus	0.03	1
Marina parryi	0.05	2
Mentzelia involucrata	0.13	2
Monoptilon bellioides	0.03	1
Nemacladus glanduliferous var. orienta	0.03	1
Parietaria floridana	0.03	1
Pectocarya	0.03	1
Pectocarya platycarpa	0.03	1
Pectocarya recurvata	0.18	4
Perityle emoryii	0.05	2
Phacelia	0.75	6
Phacelia ambigua	0.20	2
Phacelia coerulea	0.30	1
Plantago ovata	0.33	3

Community Statistics by Cluster Group

Natural Community PVMCR

Group 1

Number of Plots in Group: 10

Senecio lemmonii	0.03	1
Silene antirrhina	0.03	1
Sphaeralcea	0.40	1
Sphaeralcea ambigua	0.05	2
Stephanomeria pauciflora	0.03	1
Streptanthus carinatus	0.13	2
Stylocline micropoides	0.13	2
Thysanocarpis curvipes	0.15	3

Sum of Percent Cover by Growth Form 11.70

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Aristida	0.20	2
Aristida purpurea	0.03	1
Bromus rubens	0.10	1
Muhlenbergia porteri	0.20	2
Pleuraphis mutica	0.03	1
Pleuraphis rigida	0.15	3
Poa bigelovii	0.05	2
Schismus arabicus	1.55	8
Tridens muticus	0.53	3
unknown grass 1	0.03	1
Vulpia octoflora	0.43	3

Sum of Percent Cover by Growth Form 3.28

Growth Form 6. Vines

Scientific Name	Average % Cover by Species	# of plots containing
Janusia gracile	0.90	4
Matelea parvifolia	0.03	1
Sarcostemma cynanchoides	0.03	1

Sum of Percent Cover by Growth Form 0.95

Growth Form 7. Ferns and Club Mosses

Scientific Name	Average % Cover by Species	# of plots containing
Astrolepis cochisensis	0.08	3
Astrolepis sinuata sinuata	0.03	1
Notholaena standleyi	0.18	4
Selaginella arizonica	1.70	4

Sum of Percent Cover by Growth Form 1.98

Community Statistics by Cluster Group

Natural Community PVMCR

Group 4 *Number of Plots in Group:* 5

Growth Form *1. Trees*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Olneya tesota	0.40	1
Parkinsonia microphylla	21.60	5

Sum of Percent Cover by Growth Form 22.00

Growth Form *2. Shrubs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Ambrosia deltoidea	8.25	5
Ayenia microphylla	0.05	1
Brickellia coulteri	0.05	1
Calliandra eriophylla	0.60	1
Ditaxis lanceolata	0.05	1
Encelia farinosa farinosa	0.90	4
Ephedra aspera	0.05	1
Eriogonum fasiculatum	0.80	1
Fagonia californica ssp longipes	0.85	3
Fouquieria splendens	1.45	5
Gallium stellatum	0.05	1
Hyptis emoryi	0.20	1
Krameria grayi	1.20	2
Larrea divaricata tridentata	1.05	4
Lycium	1.85	4
Lycium berlandieri	0.05	1

Sum of Percent Cover by Growth Form 17.45

Growth Form *3. Cactus*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Carnegiea gigantea	0.25	2
Cylindropuntia acanthocarpa	1.00	4
Echinocereus engelmannii	0.05	1
Mammillaria grahamii	0.10	2

Sum of Percent Cover by Growth Form 1.40

Growth Form *4. Herbs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Amsinckia intermedia	0.05	1

Community Statistics by Cluster Group

Natural Community PVMCR

Group 4 *Number of Plots in Group:* 5

Amsinkia	0.45	2
Camissonia chamaenerioides	0.05	1
Caulanthus lasiophyllus	0.25	2
Chaenactis stevioides	0.20	1
Chenopodium	1.00	1
Chorizanthe brevicornus	0.35	4
Cryptantha barbigera	0.15	3
Cryptantha maritima	0.55	5
Cryptantha pterocarya	1.25	4
Daucus pusillus	0.05	1
Descurania pinnata	0.25	2
Draba cuneifolia	0.10	2
Eriastrum diffusum	0.05	1
Eriogonum inflatum	0.05	1
Erodium cicutarium	0.05	1
Eucrypta micrantha	0.25	2
Euphorbia	0.05	1
Gilia	0.20	1
Gilia stellata	0.20	1
Lepidium lasiocarpum	3.25	4
Lesquerella gordonii	0.25	2
Linanthus jonesii	0.05	1
Lupinus sparsiflorus	0.05	1
Pectocarya	1.20	1
Perityle emoryii	0.40	1
Phacelia ambigua	0.85	3
Plantago ovata	2.70	4
Sphaeralcea ambigua	0.20	1
unknown herb 1	0.20	1

Sum of Percent Cover by Growth Form 14.70

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Aristida	0.20	1
Aristida adsensionis	0.05	1
Aristida purpurea	0.10	2
Muhlenbergia	0.05	1
Muhlenbergia microsperma	0.05	1

Community Statistics by Cluster Group

Natural Community PVMCR

Group 4 — Number of Plots in Group: 5

Schismus arabicus	2.10	5
Vulpia octoflora	0.40	1

Sum of Percent Cover by Growth Form 2.95

Growth Form 6. Vines

Scientific Name	Average % Cover by Species	# of plots containing
Janusia gracile	0.05	1

Sum of Percent Cover by Growth Form 0.05

Community Statistics by Cluster Group

Natural Community PVMCR

Group 5

Number of Plots in Group: 12

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	0.02	1
Parkinsonia microphylla	6.35	12

Sum of Percent Cover by Growth Form 6.38

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Acacia constricta	0.44	4
Acacia greggii	0.44	4
Adenophyllum porophylloides	0.13	3
Agave deserti simplex	0.23	4
Aloysia wrightii	0.02	1
Ambrosia deltoidea	3.19	6
Brickellia coulteri	0.08	1
Celtis pallida pallida	0.10	2
Ditaxis lanceolata	0.17	5
Encelia farinosa farinosa	2.71	9
Ephedra aspera	1.17	9
Eriogonum fasiculatum	1.94	7
Eriogonum wrightii	0.58	2
Fouquieria splendens	1.71	10
Gallium stellatum	0.81	5
Hyptis emoryi	0.27	3
Jatropha cardiophylla	0.08	1
Krameria grayi	0.94	7
Larrea divaricata tridentata	0.96	6
Lycium	0.83	8
Lycium andersonii	0.02	1
Lycium berlandieri	0.13	3
Menodora scabra	0.29	5
Mirabilis laevis v villosa	0.13	3
Porophyllum gracile	0.04	2
Sebastiania bilocularis	0.33	1
Simmondsia chinensis	0.08	1
Trixis californica	0.15	4
Viguiera parishii	1.79	6

Sum of Percent Cover by Growth Form 19.75

Community Statistics by Cluster Group

Natural Community PVMCR

Group 5 *Number of Plots in Group:* 12

Growth Form *3. Cactus*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Carnegiea gigantea	0.23	8
Cylindropuntia acanthocarpa	1.04	11
Cylindropuntia bigelovii	0.50	2
Echinocereus	0.06	3
Echinocereus engelmannii	0.04	2
Ferocactus emoryi	0.02	1
Mammillaria grahamii	0.08	4
Opuntia phaeacantha	0.02	1

Sum of Percent Cover by Growth Form 2.00

Growth Form *4. Herbs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Acleisanthes longiflora	0.04	2
Amsinckia intermedia	0.73	8
Amsinckia tessellata	0.08	1
Amsinkia	0.02	1
Astragalus	0.02	1
Astragalus nuttallianus	0.02	1
Bowlesia incana	0.02	1
Calandrinia ciliata	0.04	2
Camissonia	0.06	3
Camissonia chamaenerioides	0.15	4
Caulanthus lasiophyllus	0.60	5
Chaenactis stevioides	0.02	1
Chorizanthe brevicornus	0.25	6
Cryptantha	0.02	1
Cryptantha barbigera	0.92	2
Cryptantha maritima	0.29	3
Cryptantha pterocarya	3.96	11
Daucus pusillus	0.19	2
Descurania pinnata	0.23	4
Draba cuneifolia	0.06	3
Eriastrum diffusum	0.25	6
Eriogonum abertianum	0.02	1

Community Statistics by Cluster Group

Natural Community PVMCR

Group 5

Number of Plots in Group: 12

Eriogonum deflexum	0.02	1
Eriogonum inflatum	0.10	2
Eriophyllum lanosum	0.04	2
Erodium cicutarium	0.10	2
Eschscholzia mexicana	0.10	2
Eucrypta micrantha	0.27	7
Euphorbia	0.08	1
Euphorbia pediculifera	0.02	1
Euphorbia polycarpa	0.02	1
Filago	0.08	1
Filago arizonica	0.19	3
Gilia	0.15	4
Gilia flavocincta	0.04	2
Gilia stellata	0.17	5
Lepidium lasiocarpum	3.38	10
Lesquerella gordonii	0.50	1
Linanthus bigelovii	0.02	1
Linanthus jonesii	0.42	3
Lotus salsuginosus	0.02	1
Lupinus Arizonicus	0.02	1
Lupinus sparsiflorus	0.04	2
Marina parryi	0.10	2
Nicotiana obtusifolia	0.02	1
Pectocarya	0.04	2
Pectocarya platycarpa	0.17	1
Pectocarya recurvata	1.38	7
Perityle emoryii	0.10	2
Phacelia	1.75	4
Phacelia ambigua	0.02	1
Phacelia coerulea	2.42	3
Phacelia distans	0.33	1
Pholistoma auritum var arizonicum	0.08	1
Plantago ovata	0.17	2
Plantago patagonica	0.44	2
Rafinesquia neomexicana	0.25	2
Salsola tragus	0.02	1
Senecio lemmonii	0.25	2
Sisymbrium irio	0.08	1
Sphaeralcea ambigua	0.54	5

Community Statistics by Cluster Group

Natural Community PVMCR

Group 5 *Number of Plots in Group:* 12

Sphaeralcea coulteri	0.04	2
Stephanomeria pauciflora	0.35	3
Stylocline micropoides	0.25	3
Thysanocarpis curvipes	0.40	7
Uropappus lindleyi	0.02	1

Sum of Percent Cover by Growth Form 23.02

Growth Form 5. Grasses and Sedges

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Aristida	0.04	2
Aristida adsensionis	0.02	1
Aristida purpurea	0.25	1
Bromus rubens	0.13	3
Muhlenbergia microsperma	0.17	2
Muhlenbergia porteri	0.33	2
Poa bigelovii	0.19	6
Schismus arabicus	1.31	9
Vulpia octoflora	1.77	10

Sum of Percent Cover by Growth Form 4.21

Growth Form 6. Vines

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Janusia gracile	2.04	9

Sum of Percent Cover by Growth Form 2.04

Growth Form 7. Ferns and Club Mosses

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Astrolepis cochisensis	0.04	2
Cheilanthes parryi	0.02	1
Notholaena standleyi	0.04	2
Pellaea truncata	0.02	1
Selaginella arizonica	23.33	12

Sum of Percent Cover by Growth Form 23.46

Community Statistics by Cluster Group

Natural Community PVMCR

Group 6 — Number of Plots in Group: 5

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	0.80	1
Parkinsonia florida	0.20	1
Parkinsonia microphylla	1.80	3

Sum of Percent Cover by Growth Form 2.80

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Agave deserti simplex	0.05	1
Ambrosia deltoidea	6.00	4
Brickellia coulteri	0.60	1
Ditaxis lanceolata	0.10	2
Encelia farinosa farinosa	2.80	5
Ephedra aspera	0.20	1
Fagonia californica ssp longipes	0.65	3
Fouquieria splendens	1.60	3
Hyptis emoryi	1.80	2
Krameria grayi	0.65	3
Larrea divaricata tridentata	0.65	3
Lycium	0.45	3
Machaeranthera pinnatifida gooddingii	0.25	2

Sum of Percent Cover by Growth Form 15.80

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.20	4
Cylindropuntia acanthocarpa	0.50	4
Cylindropuntia bigelovii	6.00	2
Cylindropuntia fulgida	0.05	1
Echinocereus	0.05	1
Echinocereus engelmannii	0.05	1
Ferocactus	0.05	1
Ferocactus cylindraceus	0.05	1
Ferocactus emoryi	0.05	1
Mammillaria	0.05	1
Mammillaria grahamii	0.05	1
Opuntia	0.05	1

Sum of Percent Cover by Growth Form 7.15

Community Statistics by Cluster Group

Natural Community PVMCR

Group 6 **Number of Plots in Group:** 5

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia tessellata	0.20	1
Amsinkia	0.20	1
Camissonia	0.10	2
Camissonia boothii ssp condensata	0.05	1
Camissonia chamaenerioides	0.05	1
Caulanthus lasiophyllus	0.05	1
Chaenactis carphoclinia	0.60	1
Chorizanthe brevicornus	0.30	3
Chorizanthe rigida	0.05	1
Cryptantha barbigera	4.60	2
Cryptantha maritima	1.65	2
Cryptantha micrantha	0.05	1
Cryptantha pterocarya	0.25	2
Descurania pinnata	0.70	4
Ditaxis neomexicana	0.05	1
Eriogonum deflexum	0.05	1
Eucrypta micrantha	0.40	1
Euphorbia	0.20	1
Euphorbia arizonica	0.05	1
Euphorbia capitellata	0.05	1
Euphorbia polycarpa	0.25	2
Gilia	0.45	2
Lepidium lasiocarpum	2.80	4
Nicotiana obtusifolia	0.05	1
Pectocarya recurvata	0.20	1
Perityle emoryii	1.45	3
Phacelia	0.60	2
Phacelia ambigua	1.05	3
Phacelia coerulea	0.80	1
Plantago	0.05	1
Plantago ovata	1.00	1
Silene	0.05	1
Sphaeralcea ambigua	0.60	2
unknown herb 1	0.05	1
Sum of Percent Cover by Growth Form	19.05	

Community Statistics by Cluster Group

Natural Community PVMCR

Group 6 *Number of Plots in Group:* 5

Growth Form 5. Grasses and Sedges

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Erioneuron pulchellum	0.25	2
Muhlenbergia porteri	0.05	1
Pleuraphis mutica	0.05	1
Schismus arabicus	0.55	5
Tridens muticus	0.05	1
unknown grass 1	0.05	1
Vulpia octoflora	0.05	1

Sum of Percent Cover by Growth Form 1.05

Growth Form 6. Vines

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Janusia gracile	0.05	1

Sum of Percent Cover by Growth Form 0.05

Growth Form 7. Ferns and Club Mosses

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Notholaena standleyi	0.15	3

Sum of Percent Cover by Growth Form 0.15

Community Statistics by Cluster Group

Natural Community PVMCR

Group 7

Number of Plots in Group: 5

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Parkinsonia microphylla	3.05	5

Sum of Percent Cover by Growth Form 3.05

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia deltoidea	0.80	3
Ditaxis lanceolata	0.05	1
Encelia farinosa farinosa	3.60	5
Fagonia californica ssp longipes	0.05	1
Fouquieria splendens	0.30	3
Hyptis emoryi	0.40	2
Larrea divaricata tridentata	1.05	4
Lycium	0.50	3
Lycium andersonii	0.05	1
Machaeranthera pinnatifida gooddingii	0.05	1

Sum of Percent Cover by Growth Form 6.85

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.40	5
Cylindropuntia acanthocarpa	0.70	4
Echinocereus engelmannii	0.05	1
Ferocactus	0.10	2
Ferocactus emoryi	0.05	1
Mammillaria grahamii	0.05	1

Sum of Percent Cover by Growth Form 1.35

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	0.05	1
Amsinkia	0.05	1
Astragalus nuttallianus	0.05	1
Camissonia	0.10	2
Camissonia californica	0.05	1
Camissonia chamaenerioides	0.05	1

Community Statistics by Cluster Group

Natural Community PVMCR

Group 7

Number of Plots in Group: 5

Caulanthus lasiophyllus	0.10	2
Chaenactis stevioides	0.05	1
Chorizanthe brevicornus	0.15	3
Cryptantha barbigera	0.85	2
Cryptantha maritima	0.30	3
Cryptantha pterocarya	0.05	1
Descurania pinnata	0.05	1
Eriogonum inflatum	0.20	1
Eriophyllum lanosum	0.05	1
Eucrypta micrantha	0.10	2
Filago arizonica	0.05	1
Gilia	0.05	1
Gilia stellata	0.05	1
Lepidium lasiocarpum	1.05	2
Lesquerella gordonii	0.05	1
Lesquerella tenella	0.05	1
Lotus salsuginosus	0.05	1
Lupinus sparsiflorus	0.05	1
Mentzelia involucrata	0.05	1
Pectocarya	0.05	1
Pectocarya platycarpa	0.05	1
Pectocarya recurvata	0.05	1
Perityle emoryii	11.80	5
Phacelia	1.40	2
Phacelia ambigua	0.45	2
Phacelia coerulea	1.60	2
Sonchus	0.05	1
Sphaeralcea	0.05	1
Sphaeralcea ambigua	0.10	2
unknown herb 1	0.05	1

Sum of Percent Cover by Growth Form 19.35

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Aristida	0.15	3
Muhlenbergia porteri	0.40	2
Schismus arabicus	1.70	4
Vulpia octoflora	0.05	1

Sum of Percent Cover by Growth Form 2.30

Community Statistics by Cluster Group

Natural Community PVMCR

Group 7

Number of Plots in Group: 5

Growth Form *7. Ferns and Club Mosses*

Scientific Name	Average % Cover by Species	# of plots containing
Notholaena standleyi	0.10	2

Sum of Percent Cover by Growth Form 0.10

Community Statistics by Cluster Group

Natural Community PVMCR

Group 8

Number of Plots in Group: 4

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	0.50	1
Parkinsonia microphylla	5.00	4
Phoradendron californicum	0.06	1

Sum of Percent Cover by Growth Form 5.56

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Agave deserti simplex	0.31	2
Ambrosia deltoidea	2.31	4
Condalia warnockii	0.25	1
Ditaxis lanceolata	0.13	2
Encelia farinosa farinosa	2.00	2
Ephedra aspera	0.75	2
Fouquieria splendens	1.50	4
Gallium stellatum	0.06	1
Hyptis emoryi	0.75	1
Krameria grayi	0.56	3
Larrea divaricata tridentata	0.13	2
Lycium	0.19	3
Machaeranthera pinnatifida gooddingii	0.06	1
Menodora scabra	0.06	1
Trixis californica	0.31	2
Viguiera parishii	0.75	1

Sum of Percent Cover by Growth Form 10.13

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.13	2
Cylindropuntia acanthocarpa	0.81	3
Cylindropuntia leptocaulis	0.06	1
Echinocereus engelmannii	0.13	2
Ferocactus	0.06	1
Ferocactus emoryi	0.06	1
Opuntia	1.00	3

Sum of Percent Cover by Growth Form 2.25

Community Statistics by Cluster Group

Natural Community PVMCR

Group 8

Number of Plots in Group: 4

Growth Form *4. Herbs*

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	2.25	3
Amsinkia	0.06	1
Androsace occidentalis	0.75	1
Astragalus nuttallianus	0.06	1
Calycoseris wrightii	0.06	1
Camissonia	0.38	3
Caulanthus lasiophyllus	1.94	4
Chaenactis stevioides	0.06	1
Chenopodium neomexicana	0.31	2
Chorizanthe brevicornus	0.19	3
Cryptantha barbigera	2.00	1
Cryptantha maritima	0.25	1
Cryptantha pterocarya	15.50	4
Daucus pusillus	0.31	2
Delphinium scaposum	0.13	2
Descurania pinnata	0.19	3
Draba cuneifolia	0.06	1
Dudleya arizonica	0.06	1
Eriastrum diffusum	0.06	1
Eriophyllum lanosum	0.06	1
Erodium cicutarium	0.50	1
Eucrypta micrantha	2.75	2
Gilia	1.31	3
Lappula occidentalis	0.06	1
Lepidium lasiocarpum	5.25	4
Lesquerella gordonii	1.31	2
Linanthus jonesii	0.63	3
Pectocarya	13.00	3
Perityle emoryii	0.50	1
Phacelia ambigua	0.25	1
Phacelia distans	3.00	2
Plantago	1.00	1
Plantago ovata	1.56	2
Rafinesquia neomexicana	0.25	1

Community Statistics by Cluster Group

Natural Community PVMCR

Group 8 — Number of Plots in Group: 4

Senecio	0.06	1
Sphaeralcea ambigua	0.31	2
Sphaeralcea coulteri	0.06	1
Stylocline micropoides	0.38	3
Thysanocarpis curvipes	1.25	1

Sum of Percent Cover by Growth Form 58.13

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Aristida	0.06	1
Muhlenbergia	0.75	1
Muhlenbergia porteri	0.63	3
Poa bigelovii	0.19	3
Schismus arabicus	0.88	3
Vulpia octoflora	1.31	4

Sum of Percent Cover by Growth Form 3.81

Growth Form 6. Vines

Scientific Name	Average % Cover by Species	# of plots containing
Janusia gracile	1.75	3

Sum of Percent Cover by Growth Form 1.75

Growth Form 7. Ferns and Club Mosses

Scientific Name	Average % Cover by Species	# of plots containing
Notholaena standleyi	0.13	2
Selaginella arizonica	0.06	1

Sum of Percent Cover by Growth Form 0.19

Community Statistics by Cluster Group

Natural Community PVMCR

Group 15

Number of Plots in Group: 4

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	0.75	1
Parkinsonia microphylla	3.00	3
Phoradendron californicum	0.06	1

Sum of Percent Cover by Growth Form 3.81

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Acacia constricta	0.06	1
Acacia greggii	0.06	1
Ambrosia deltoidea	7.56	4
Ditaxis lanceolata	0.06	1
Encelia farinosa farinosa	0.31	2
Fouquieria splendens	0.56	2
Krameria grayi	0.06	1
Larrea divaricata tridentata	4.00	4
Lycium	0.25	1
Lycium parishii	0.25	1

Sum of Percent Cover by Growth Form 13.19

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.38	3
Cylindropuntia acanthocarpa	1.06	3
Cylindropuntia fulgida	1.06	2
Cylindropuntia leptocaulis	0.25	1
Echinocereus engelmannii	0.06	1
Ferocactus emoryi	0.06	1
Opuntia phaeacantha	0.06	1

Sum of Percent Cover by Growth Form 2.94

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	2.25	2
Amsinckia tessellata	0.25	1
Astragalus nuttallianus	0.25	1

Community Statistics by Cluster Group

Natural Community PVMCR

Group 15 — *Number of Plots in Group:* 4

Caulanthus lasiophyllus	1.25	3
Chenopodium neomexicana	0.06	1
Chorizanthe brevicornus	0.88	3
Chorizanthe rigida	0.06	1
Cryptantha maritima	4.00	2
Cryptantha pterocarya	0.81	3
Descurania pinnata	0.25	1
Eriogonum thomasii	0.06	1
Eriophyllum lanosum	0.31	2
Erodium texanum	0.56	2
Eschscholzia mexicana	0.06	1
Euphorbia	0.25	1
Filago	0.06	1
Lepidium lasiocarpum	6.75	4
Lesquerella gordonii	2.00	2
Linanthus jonesii	0.06	1
Lotus	0.06	1
Pectocarya	0.50	1
Pectocarya recurvata	2.75	3
Phacelia	0.31	2
Plantago ovata	2.25	2
Silene antirrhina	0.06	1
Sisymbrium irio	1.75	1
Sphaeralcea coulteri	0.25	1

Sum of Percent Cover by Growth Form 28.13

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Aristida	0.06	1
Muhlenbergia porteri	0.50	1
Schismus arabicus	28.25	4
Vulpia octoflora	0.50	2

Sum of Percent Cover by Growth Form 29.31

Growth Form *6. Vines*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Janusia gracile	0.06	1

Sum of Percent Cover by Growth Form 0.06

Community Statistics by Cluster Group

Natural Community PVMCR

Group 27

Number of Plots in Group: 8

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	0.38	1
Parkinsonia florida	1.13	1
Parkinsonia microphylla	4.38	7
Phoradendron californicum	0.03	1

Sum of Percent Cover by Growth Form 5.91

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Abutilon	0.03	1
Acacia constricta	0.66	2
Acacia greggii	0.13	1
Agave deserti simplex	0.06	2
Ambrosia deltoidea	0.78	4
Ambrosia dumosa	0.13	1
Ayenia microphylla	0.03	1
Calliandra eriophylla	0.63	2
Celtis pallida pallida	0.03	1
Condalia warnockii	0.03	1
Crossosma bigelovii	0.16	2
Ditaxis lanceolata	0.06	2
Encelia farinosa farinosa	1.44	6
Ephedra aspera	0.28	3
Eriogonum fasiculatum	0.50	2
Fagonia californica ssp longipes	0.06	2
Fouquieria splendens	1.94	7
Gallium stellatum	0.38	2
Gymnosperma glutinosum	0.03	1
Hyptis emoryi	0.13	1
Jatropha cardiophylla	1.13	2
Koeberlinia spinosa	0.03	1
Krameria grayi	0.91	5
Larrea divaricata tridentata	1.81	7
Lycium	0.97	5
Lycium berlandieri	0.38	1
Mirabilis laevis v villosa	0.13	1
Porophyllum gracile	0.13	1

Community Statistics by Cluster Group

Natural Community PVMCR

Group 27 Number of Plots in Group: 8

Trixis californica	0.03	1
Viguiera parishii	0.63	2

Sum of Percent Cover by Growth Form 13.59

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.53	7
Cylindropuntia acanthocarpa	2.63	7
Cylindropuntia bigelovii	0.50	1
Echinocereus engelmannii	0.22	4
Ferocactus cylindraceus	0.06	2
Ferocactus emoryi	0.06	2
Mammillaria grahamii	0.06	2
Opuntia chlorotica	0.13	1
Opuntia engelmannii	0.13	1
Opuntia phaeacantha	0.25	1

Sum of Percent Cover by Growth Form 4.56

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	1.31	5
Bowlesia incana	0.03	1
Brassica tournefortii	0.03	1
Calandrinia ciliata	0.03	1
Calycoseris wrightii	0.13	1
Camissonia californica	0.22	4
Caulanthus lasiophyllus	1.81	7
Chaenactis stevioides	0.19	3
Chenopodium neomexicana	0.13	1
Chorizanthe brevicornus	0.31	4
Chorizanthe rigida	0.03	1
Cryptantha barbigera	1.00	3
Cryptantha maritima	0.38	1
Cryptantha pterocarya	5.03	7
Daucus pusillus	0.22	4
Descurania pinnata	0.09	3
Dichelostemma capitatum ssp. Pauciflor	0.06	2
Draba cuneifolia	0.09	3

Community Statistics by Cluster Group

Natural Community PVMCR

Group 27   *Number of Plots in Group:* 8

Eriastrum diffusum	0.03	1
Eriogonum	0.06	2
Eriophyllum lanosum	0.16	2
Erodium cicutarium	0.53	2
Erodium texanum	0.13	1
Eucrypta micrantha	1.13	4
Filago	0.06	2
Filago arizonica	0.03	1
Gilia	0.41	3
Gilia flavocincta	0.03	1
Gilia stellata	0.28	2
Lepidium lasiocarpum	16.13	8
Lesquerella gordonii	0.03	1
Linanthus jonesii	0.16	2
Lupinus	0.03	1
Lupinus sparsiflorus	0.19	3
Mentzelia	0.03	1
Parietaria floridana	0.03	1
Pectocarya	0.03	1
Pectocarya recurvata	3.66	3
Perityle emoryii	0.28	2
Phacelia	3.44	5
Phacelia ambigua	0.13	1
Phacelia coerulea	0.13	1
Plantago ovata	2.72	7
Plantago patagonica	0.03	1
Rafinesquia neomexicana	0.03	1
Senecio	0.03	1
Sonchus	0.03	1
Sphaeralcea ambigua	0.50	2
Stylocline micropoides	0.75	1
Thysanocarpis curvipes	0.66	4
Uropappus lindleyi	0.09	3

Sum of Percent Cover by Growth Form 43.03

Community Statistics by Cluster Group

Natural Community PVMCR

Group 27 — Number of Plots in Group: 8

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Aristida	0.25	2
Aristida purpurea	0.03	1
Erioneuron pulchellum	0.03	1
Muhlenbergia porteri	0.41	3
Poa bigelovii	0.06	2
Schismus arabicus	1.84	7
Tridens muticus	0.03	1
unknown grass 1	0.38	1
Vulpia octoflora	2.28	6

Sum of Percent Cover by Growth Form 5.31

Growth Form 6. Vines

Scientific Name	Average % Cover by Species	# of plots containing
Janusia gracile	1.53	4

Sum of Percent Cover by Growth Form 1.53

Growth Form 7. Ferns and Club Mosses

Scientific Name	Average % Cover by Species	# of plots containing
Astrolepis cochisensis	0.03	1
Cheilanthes parryi	0.03	1
Notholaena standleyi	0.03	1
Pellaea truncata	0.03	1
Selaginella arizonica	0.13	1

Sum of Percent Cover by Growth Form 0.25

Community Statistics by Cluster Group

Natural Community PVMCR

Group 36

Number of Plots in Group: 6

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	0.71	2
Parkinsonia microphylla	2.08	5

Sum of Percent Cover by Growth Form 2.79

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Abutilon incanum	0.04	1
Acacia constricta	0.21	2
Agave deserti simplex	0.17	1
Ambrosia deltoidea	4.38	5
Calliandra eriophylla	0.04	1
Ditaxis lanceolata	0.04	1
Encelia farinosa farinosa	0.33	1
Ephedra aspera	0.08	2
Fagonia californica ssp longipes	0.33	2
Fouquieria splendens	3.83	6
Jatropha cardiophylla	0.04	1
Krameria erecta	0.17	1
Krameria grayi	1.21	4
Larrea divaricata tridentata	3.38	4
Lycium	0.29	4

Sum of Percent Cover by Growth Form 14.54

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.71	5
Cylindropuntia acanthocarpa	2.33	5
Cylindropuntia fulgida	0.04	1
Cylindropuntia leptocaulis	0.54	3
Echinocereus engelmannii	0.25	6
Ferocactus cylindraceus	0.04	1
Ferocactus emoryi	0.08	2
Mammillaria grahamii	0.08	2
Mammillaria tetrancistra	0.04	1
Opuntia phaeacantha	0.54	2

Sum of Percent Cover by Growth Form 4.67

Community Statistics by Cluster Group

Natural Community PVMCR

Group 36 Number of Plots in Group: 6

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	0.08	2
Amsinkia	0.04	1
Astragalus nuttallianus	0.08	2
Calycoseris wrightii	0.04	1
Camissonia californica	0.04	1
Caulanthus lasiophyllus	1.38	4
Chaenactis stevioides	0.04	1
Chenopodium neomexicana	0.29	4
Chorizanthe brevicornus	0.38	3
Cryptantha barbigera	0.21	2
Cryptantha pterocarya	0.42	4
Daucus pusillus	0.58	4
Delphinium scaposum	0.04	1
Descurania pinnata	0.21	2
Dichelostemma capitatum ssp. Pauciflor	0.13	3
Ditaxis neomexicana	0.04	1
Draba cuneifolia	0.17	1
Eriogonum abertianum	0.08	2
Eriogonum deflexum	0.04	1
Eriogonum thomasii	0.21	2
Eriophyllum lanosum	0.25	3
Erodium cicutarium	1.21	4
Filago arizonica	0.17	1
Gilia	0.04	1
Lepidium lasiocarpum	14.04	6
Lesquerella gordonii	16.17	6
Lotus	0.38	3
Pectocarya platycarpa	0.33	2
Pectocarya recurvata	0.58	3
Phacelia ambigua	0.54	2
Phacelia coerulea	0.04	1
Plantago ovata	2.33	5
Rafinesquia neomexicana	0.04	1
Silene antirrhina	0.17	1
Stylocline micropoides	0.21	2
Sum of Percent Cover by Growth Form	41.00	

Community Statistics by Cluster Group

Natural Community PVMCR

Group 36 — Number of Plots in Group: 6

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Erioneuron pulchellum	1.04	4
Muhlenbergia porteri	1.83	4
Schismus arabicus	1.63	6
Trisetum interruptum	0.04	1
Vulpia octoflora	1.25	4

Sum of Percent Cover by Growth Form 5.79

Growth Form 6. Vines

Scientific Name	Average % Cover by Species	# of plots containing
Janusia gracile	0.04	1

Sum of Percent Cover by Growth Form 0.04

Community Statistics by Cluster Group

Natural Community PVMCR

Group 42

Number of Plots in Group: 5

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Parkinsonia microphylla	4.40	5

Sum of Percent Cover by Growth Form 4.40

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Acacia constricta	0.40	2
Agave deserti simplex	0.20	1
Ambrosia deltoidea	0.65	2
Ambrosia dumosa	0.60	1
Ayenia microphylla	0.20	1
Brickellia coulteri	0.05	1
Calliandra eriophylla	1.00	3
Condalia warnockii	0.05	1
Encelia farinosa farinosa	1.25	3
Ephedra aspera	1.25	4
Eriogonum fasiculatum	0.20	1
Fouquieria splendens	2.20	5
Gallium stellatum	0.05	1
Jatropha cardiophylla	0.60	2
Krameria erecta	0.80	1
Krameria grayi	1.20	4
Larrea divaricata tridentata	6.10	5
Lycium	0.10	2
Lycium berlandieri	0.40	1
Machaeranthera pinnatifida gooddingii	0.25	2
Menodora scabra	0.05	1
Mirabilis laevis v villosa	0.20	1
Porophyllum gracile	0.40	1
Senna covesii	0.05	1
Tiquilia canescens	0.20	1
Trixis californica	0.10	2
Viguiera parishii	0.60	2
Ziziphus obtusifolia canescens	0.20	1

Sum of Percent Cover by Growth Form 19.35

Community Statistics by Cluster Group

Natural Community PVMCR

Group **42** *Number of Plots in Group:* **5**

Growth Form *3. Cactus*

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.35	4
Cylindropuntia acanthocarpa	2.25	4
Cylindropuntia bigelovii	0.80	1
Cylindropuntia leptocaulis	0.10	2
Echinocereus engelmannii	0.50	4
Ferocactus	0.05	1
Mammillaria grahamii	0.15	3
Opuntia engelmannii	0.40	2
Opuntia phaeacantha	0.05	1

Sum of Percent Cover by Growth Form 4.65

Growth Form *4. Herbs*

Scientific Name	Average % Cover by Species	# of plots containing
Amsinckia intermedia	0.25	2
Androsace occidentalis	0.05	1
Astragalus	0.05	1
Camissonia californica	0.05	1
Caulanthus lasiophyllus	0.65	4
Chaenactis stevioides	0.05	1
Chenopodium neomexicana	0.05	1
Chorizanthe brevicornus	0.20	4
Cryptantha	0.20	1
Cryptantha barbigera	0.65	2
Cryptantha maritima	0.40	2
Cryptantha pterocarya	1.05	3
Daucus pusillus	0.85	4
Descurania pinnata	0.55	4
Dichelostemma capitatum ssp. Pauciflor	0.10	2
Ditaxis neomexicana	0.10	2
Draba cuneifolia	0.10	2
Eriastrum diffusum	0.05	1
Eriogonum abertianum	0.10	2
Eriogonum deflexum	0.05	1
Eriogonum inflatum	0.20	1
Eriogonum thomasii	0.05	1
Eriophyllum lanosum	0.35	4

Community Statistics by Cluster Group

Natural Community PVMCR

Group 42 Number of Plots in Group: 5

Erodium cicutarium	14.60	4
Erodium texanum	0.20	1
Eschscholzia mexicana	0.05	1
Eucrypta micrantha	0.85	3
Euphorbia	0.05	1
Filago	0.05	1
Gilia	0.10	2
Lepidium lasiocarpum	4.05	5
Lesquerella gordonii	2.45	4
Linanthus bigelovii	0.05	1
Linanthus jonesii	0.25	2
Linum perenne ssp lewisii	0.25	2
Lotus	0.05	1
Lotus salsuginosus	0.05	1
Lupinus sparsiflorus	0.05	1
Pectocarya recurvata	1.85	5
Phacelia	0.25	2
Phacelia ambigua	0.20	1
Phacelia coerulea	0.40	2
Plantago ovata	1.20	1
Plantago patagonica	0.25	2
Rafinesquia neomexicana	0.10	2
Senecio lemmonii	0.05	1
Silene antirrhina	0.05	1
Stephanomeria pauciflora	0.05	1
Stylocline micropoides	0.10	2
Thysanocarpis curvipes	0.05	1

Sum of Percent Cover by Growth Form 33.80

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Bromus rubens	0.20	1
Erioneuron pulchellum	0.60	1
Muhlenbergia porteri	9.60	4
Poa bigelovii	0.40	1
Schismus arabicus	4.30	4
Tridens muticus	3.00	1
unknown grass 1	0.10	2
Vulpia octoflora	0.75	5

Sum of Percent Cover by Growth Form 18.95

Community Statistics by Cluster Group

Natural Community PVMCR

Group 42 *Number of Plots in Group:* 5

Growth Form *6. Vines*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Janusia gracile	1.25	4

Sum of Percent Cover by Growth Form 1.25

Growth Form *7. Ferns and Club Mosses*

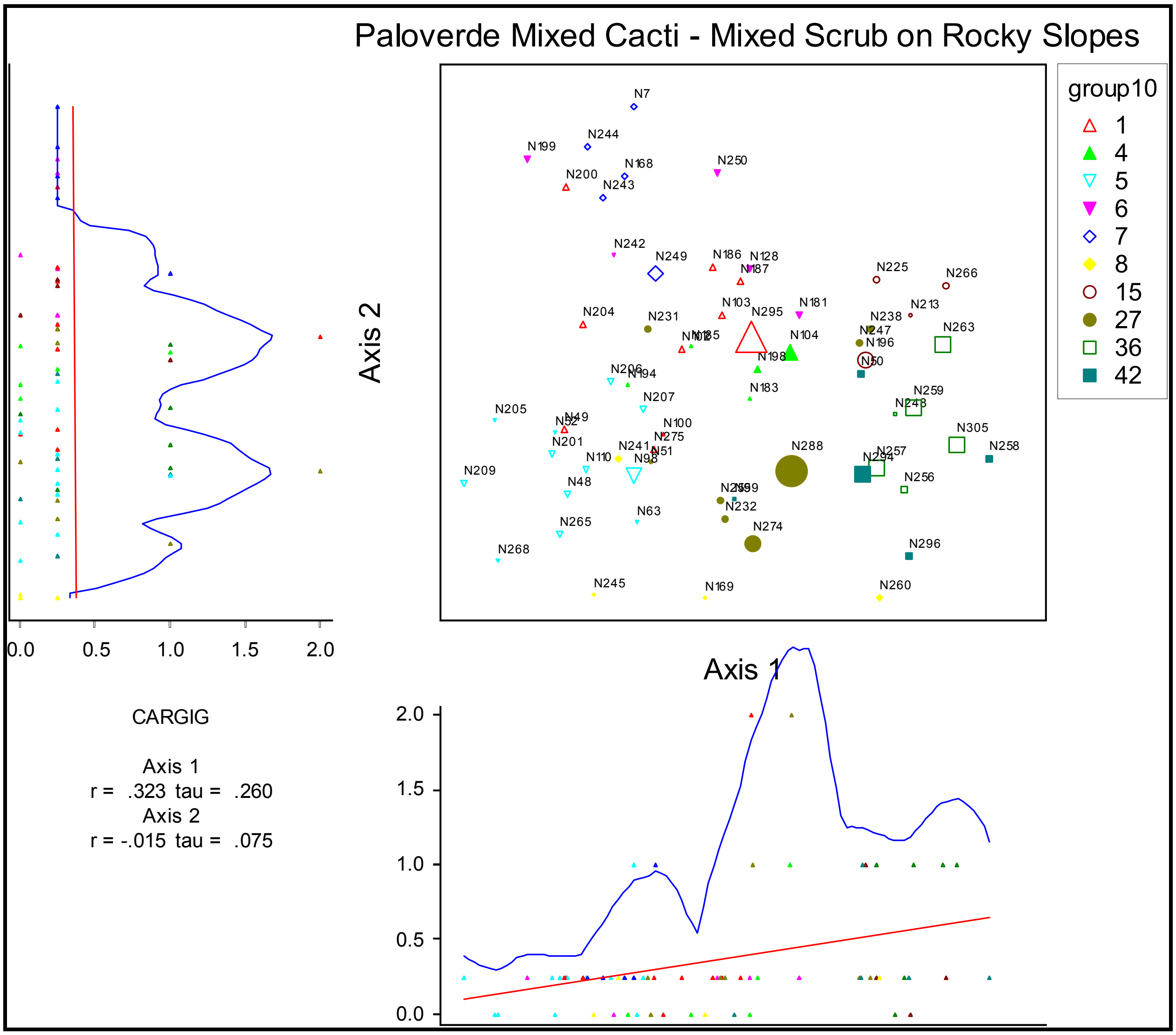
Scientific Name	*Average % Cover by Species*	*# of plots containing*
Astrolepis cochisensis	0.05	1
Selaginella arizonica	0.05	1

Sum of Percent Cover by Growth Form 0.10

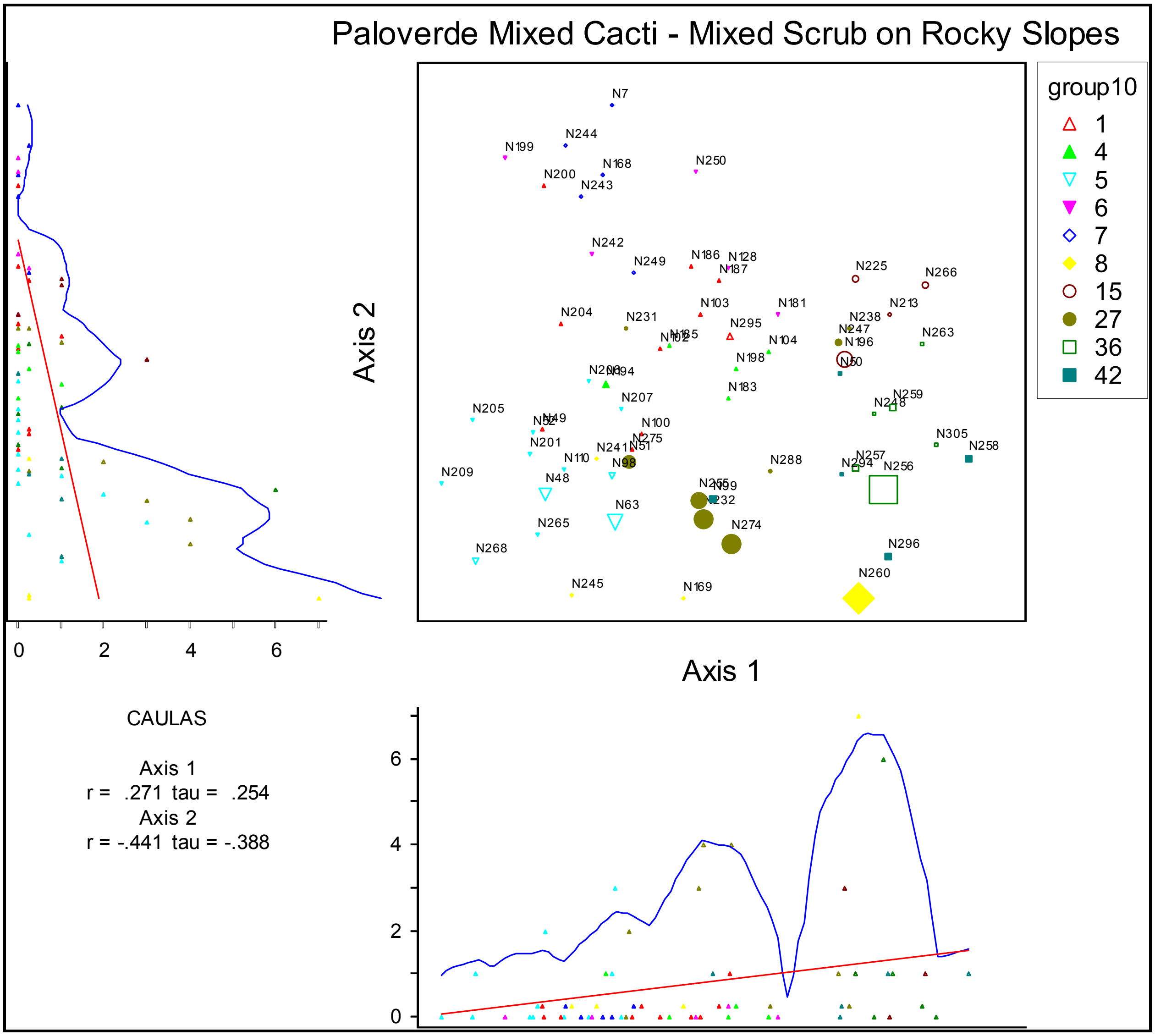
APPENDIX J

RELATIONSHIP OF MOST IMPORTANT SPECIES WITH DECORANA AXES

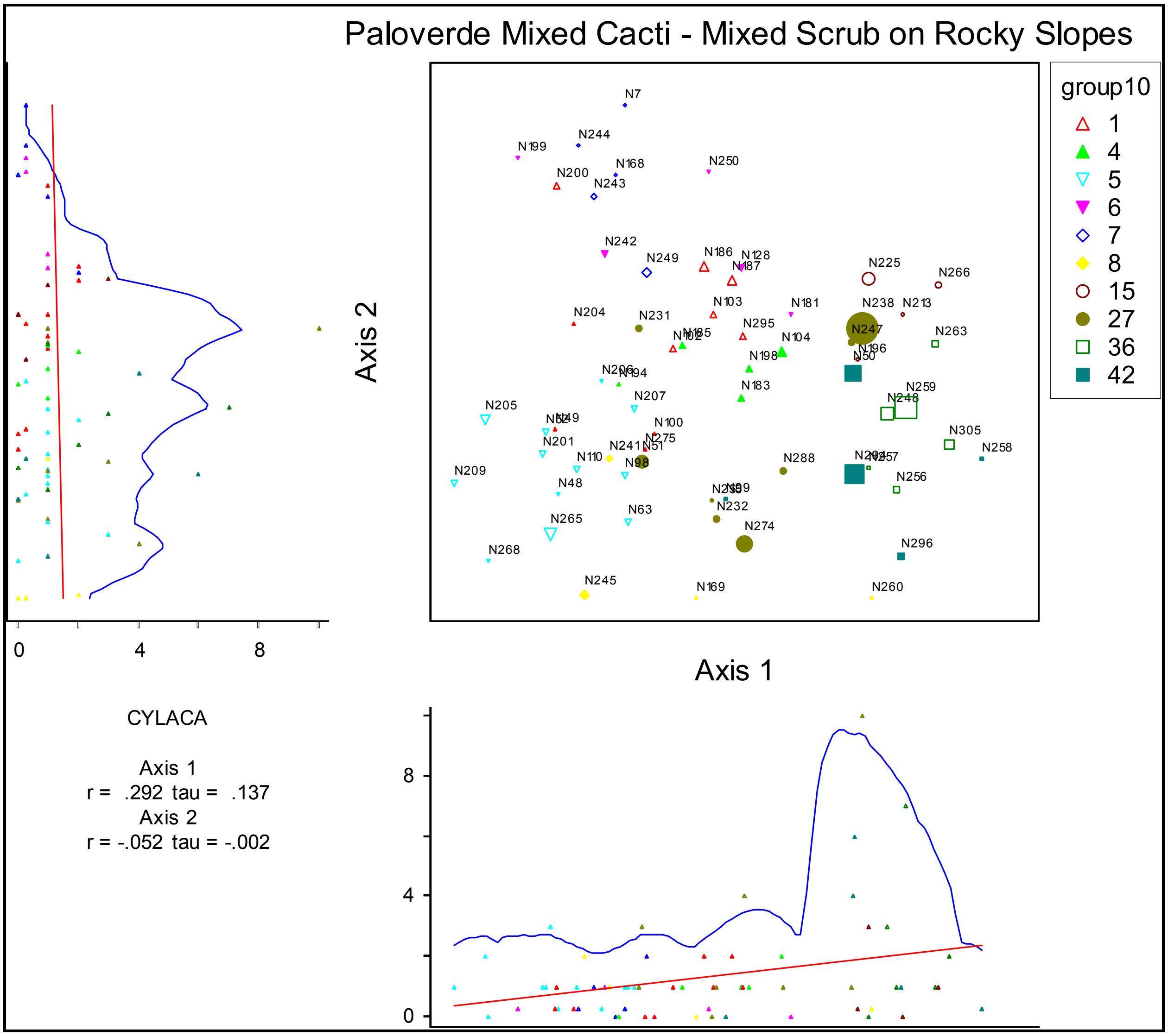
Paloverde - Mixed Cacti – Mixed Scrub on Rocky Slopes Community



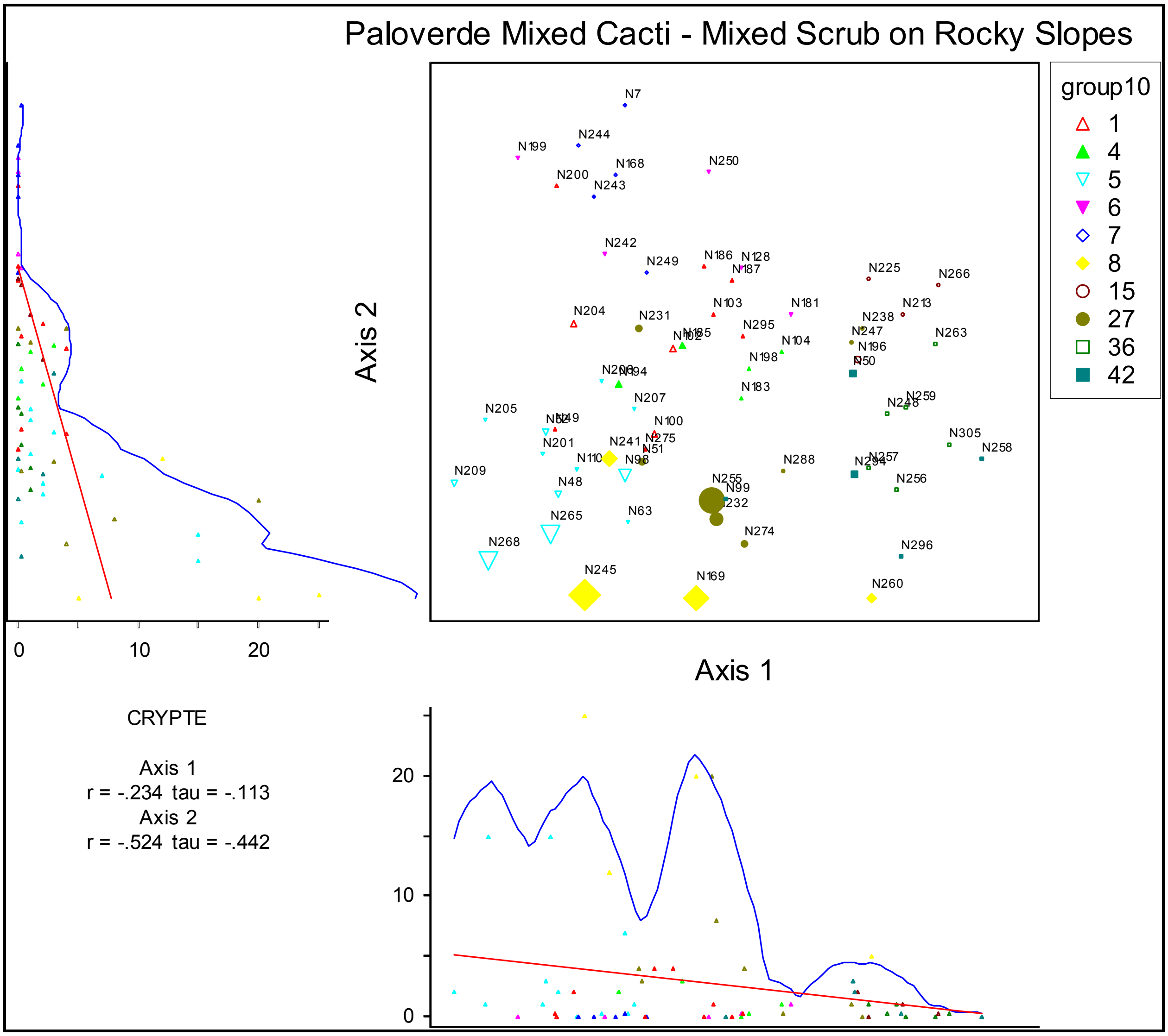
Carnegiea gigantea



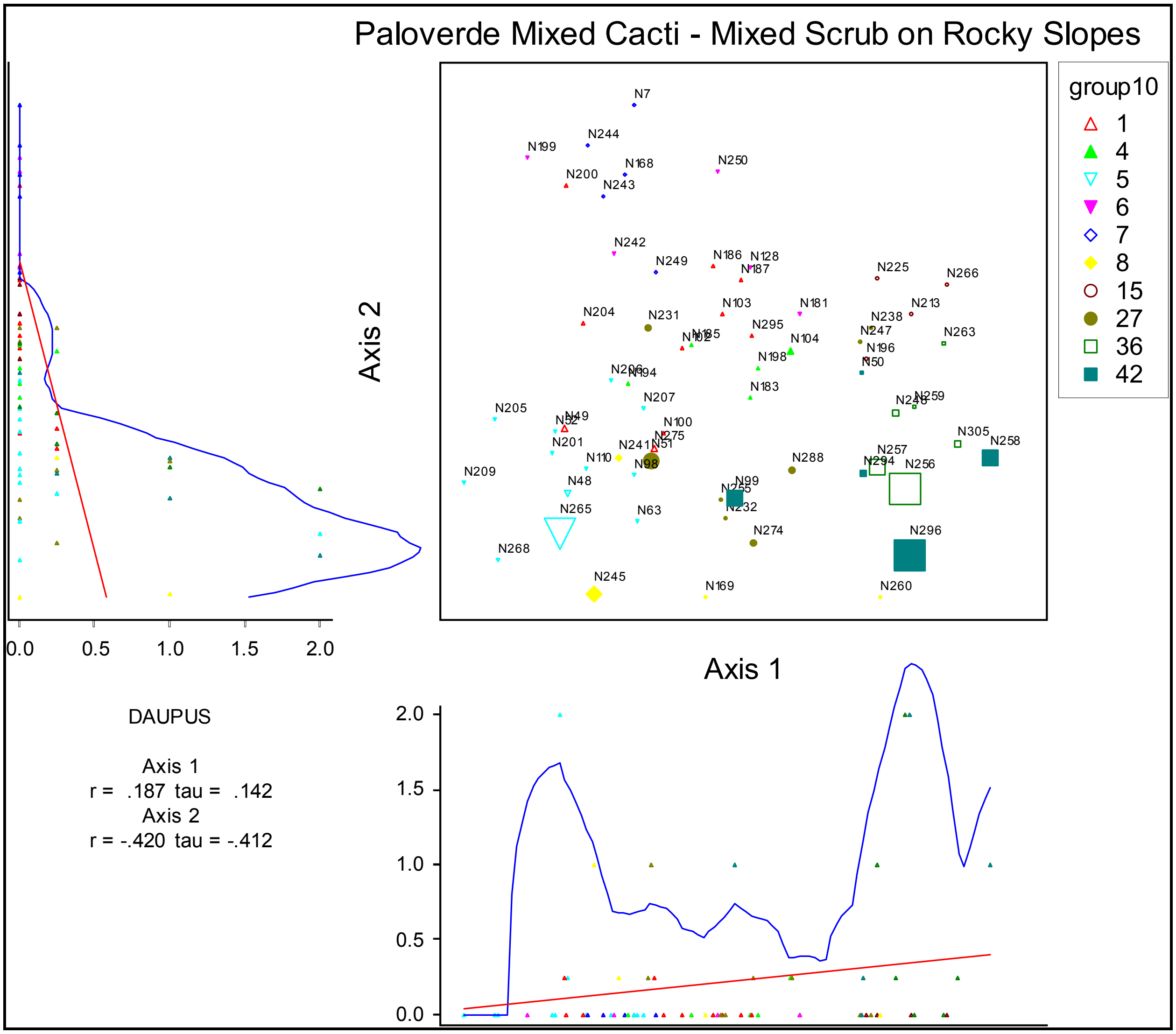
Caulanthus lasiophyllus



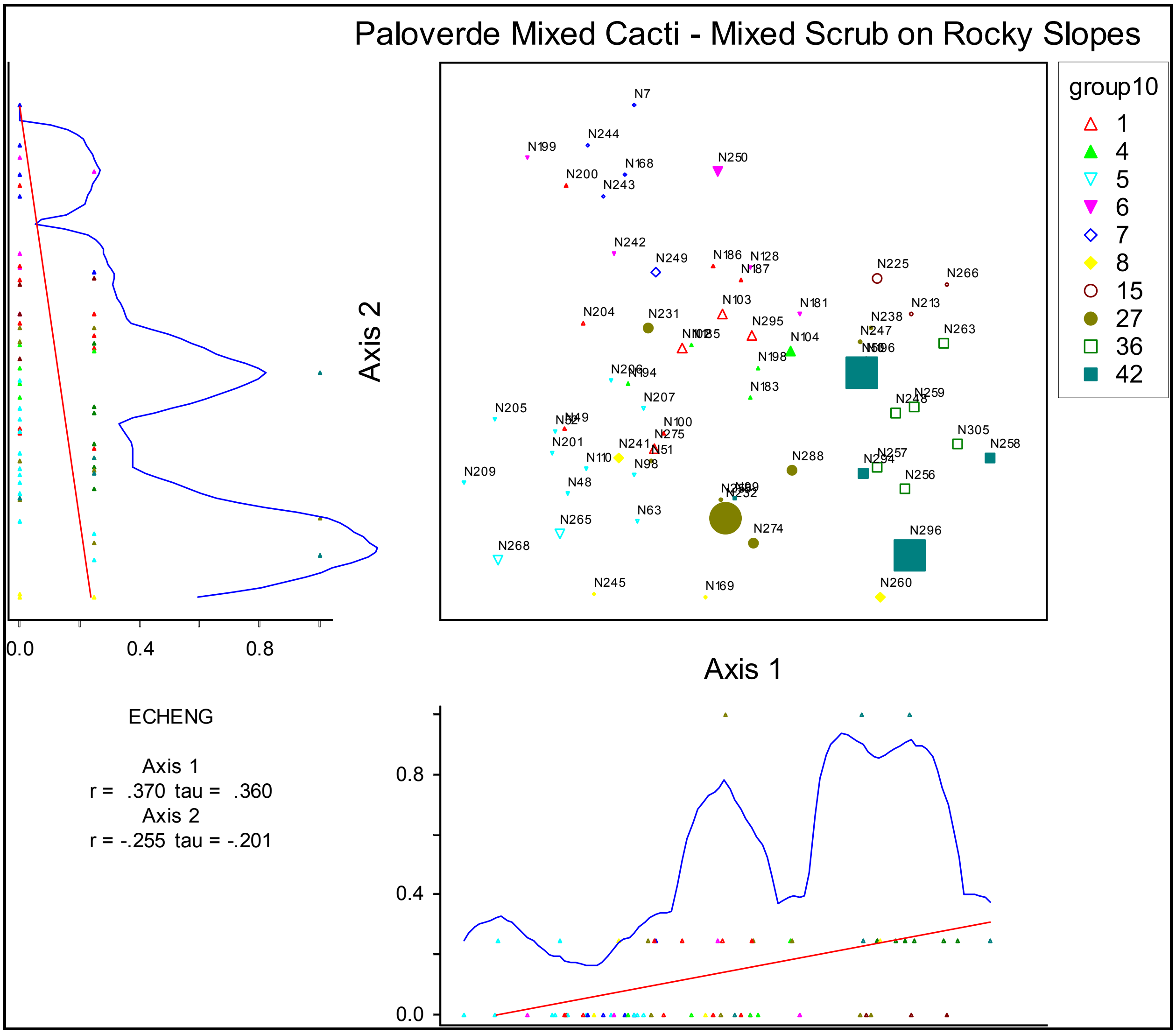
Cylindropuntia acanthocarpa



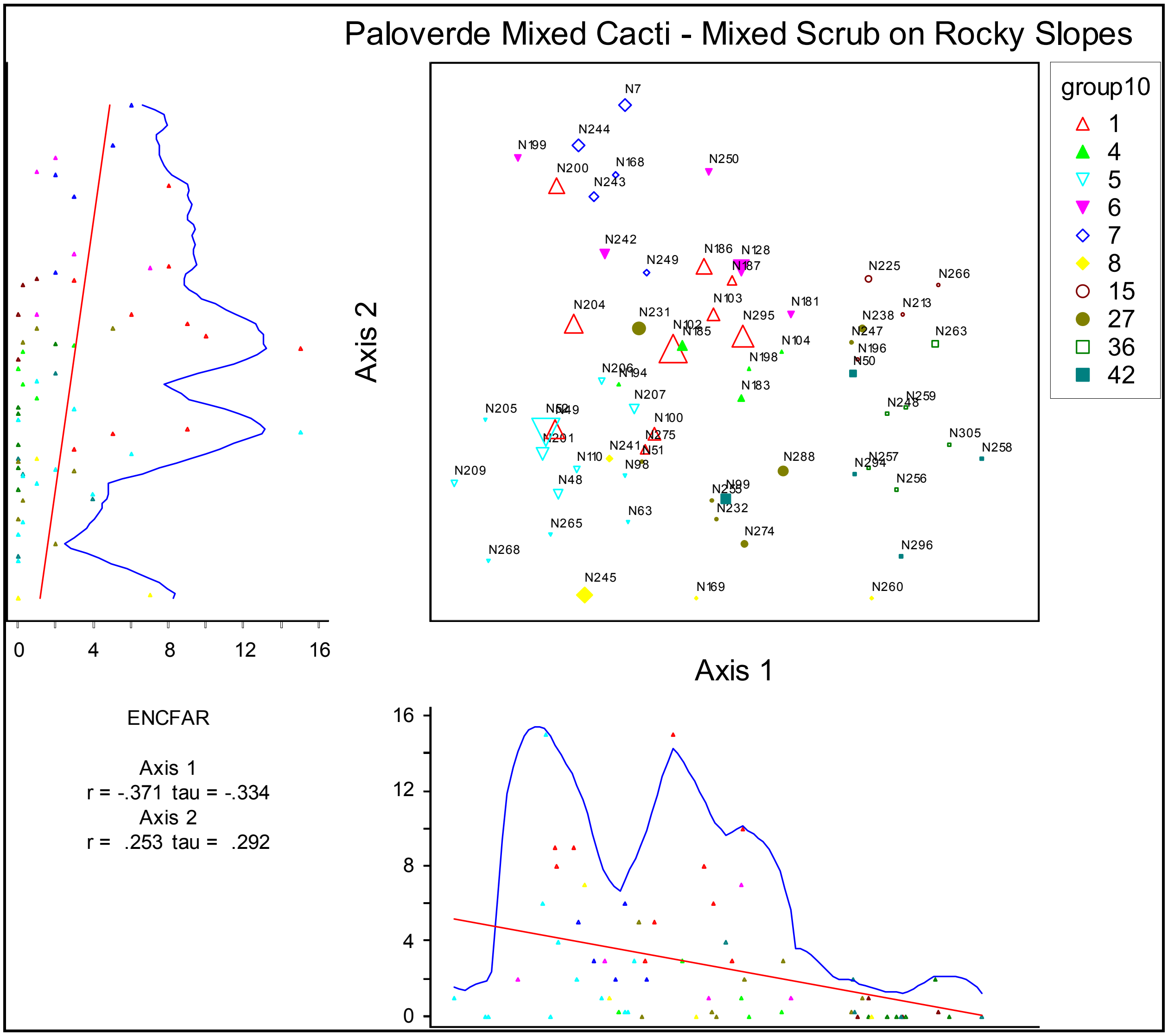
Cryptantha pterocarya



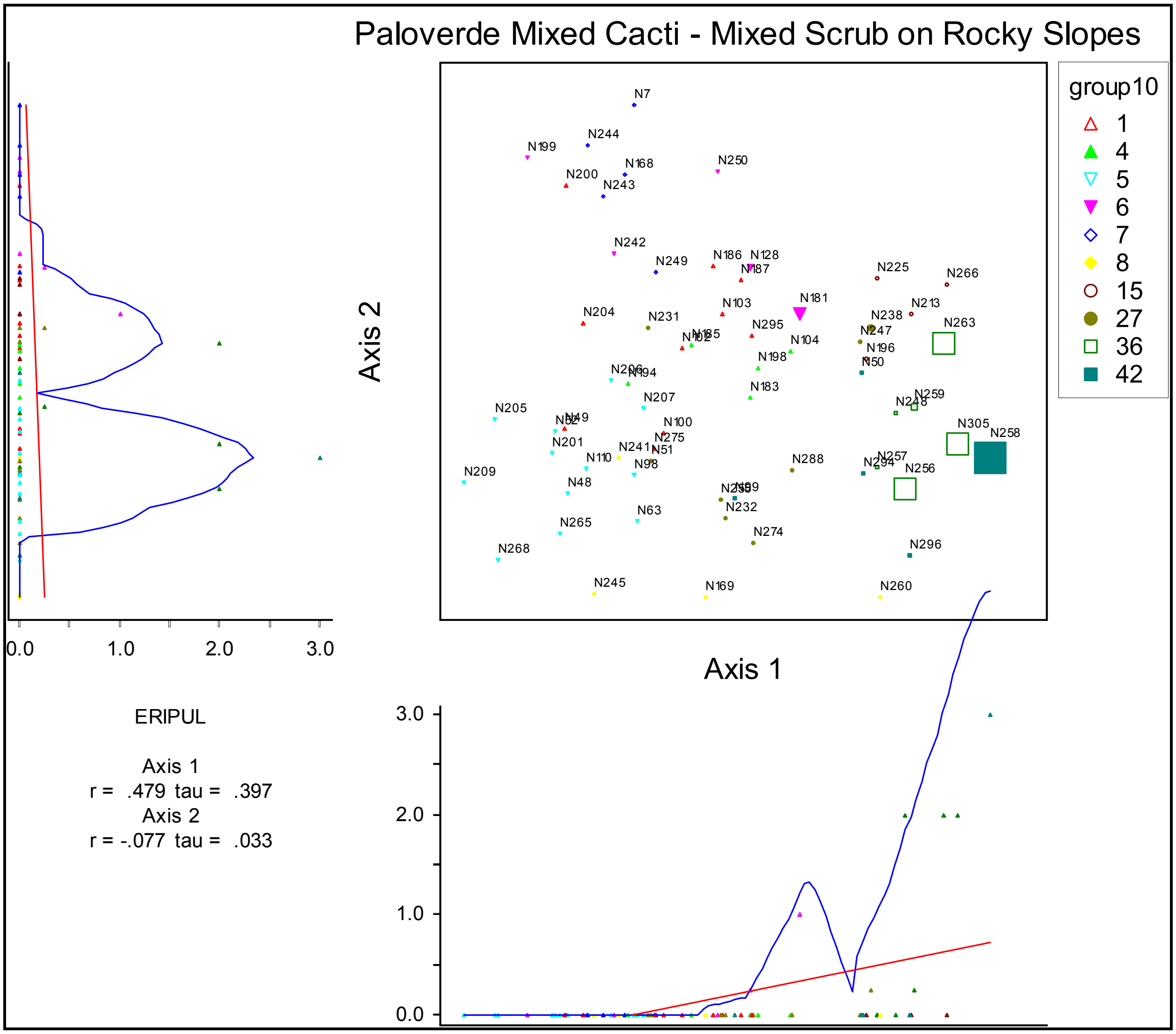
Daucus pusillus



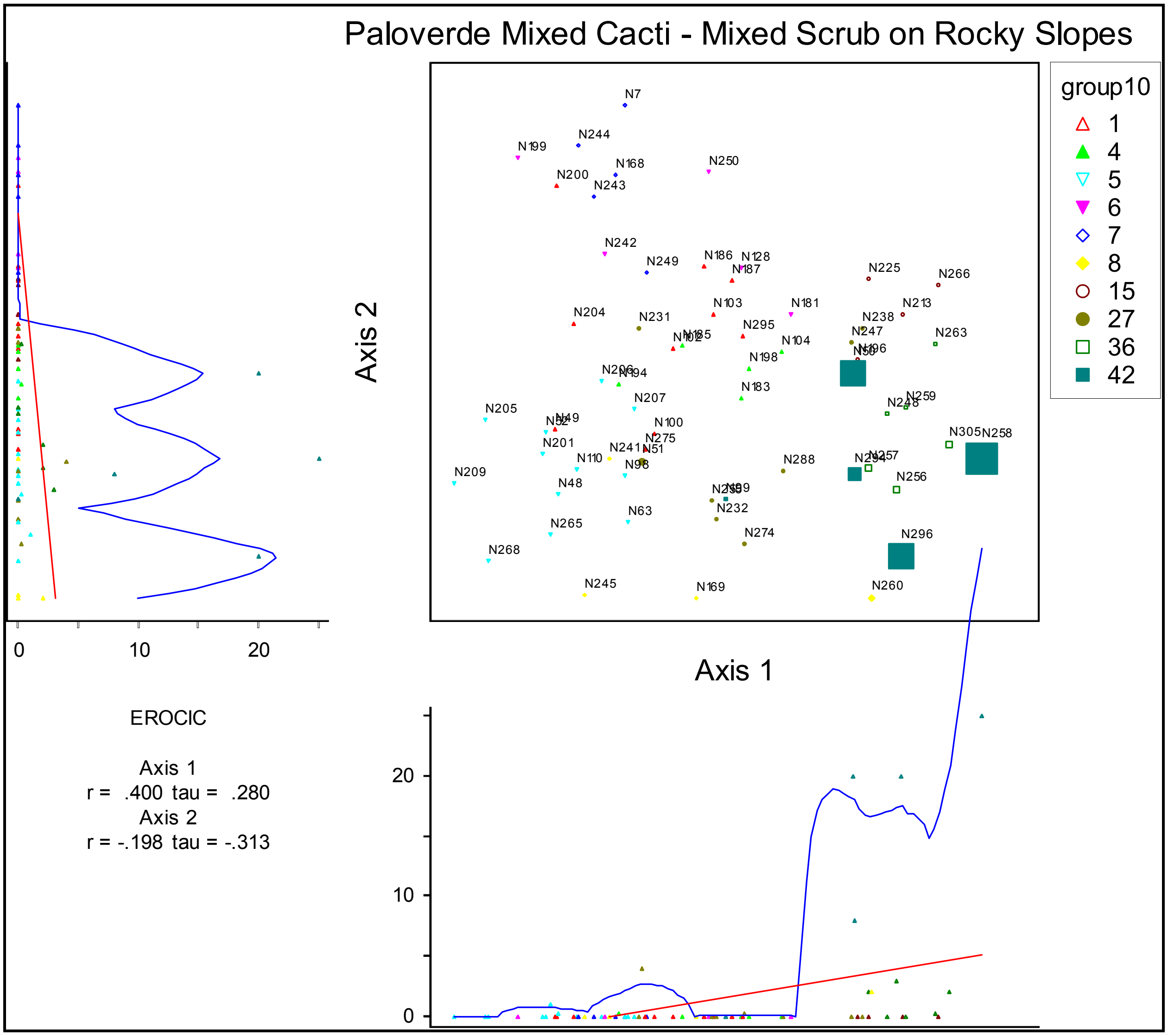
Echinocereus engelmannii



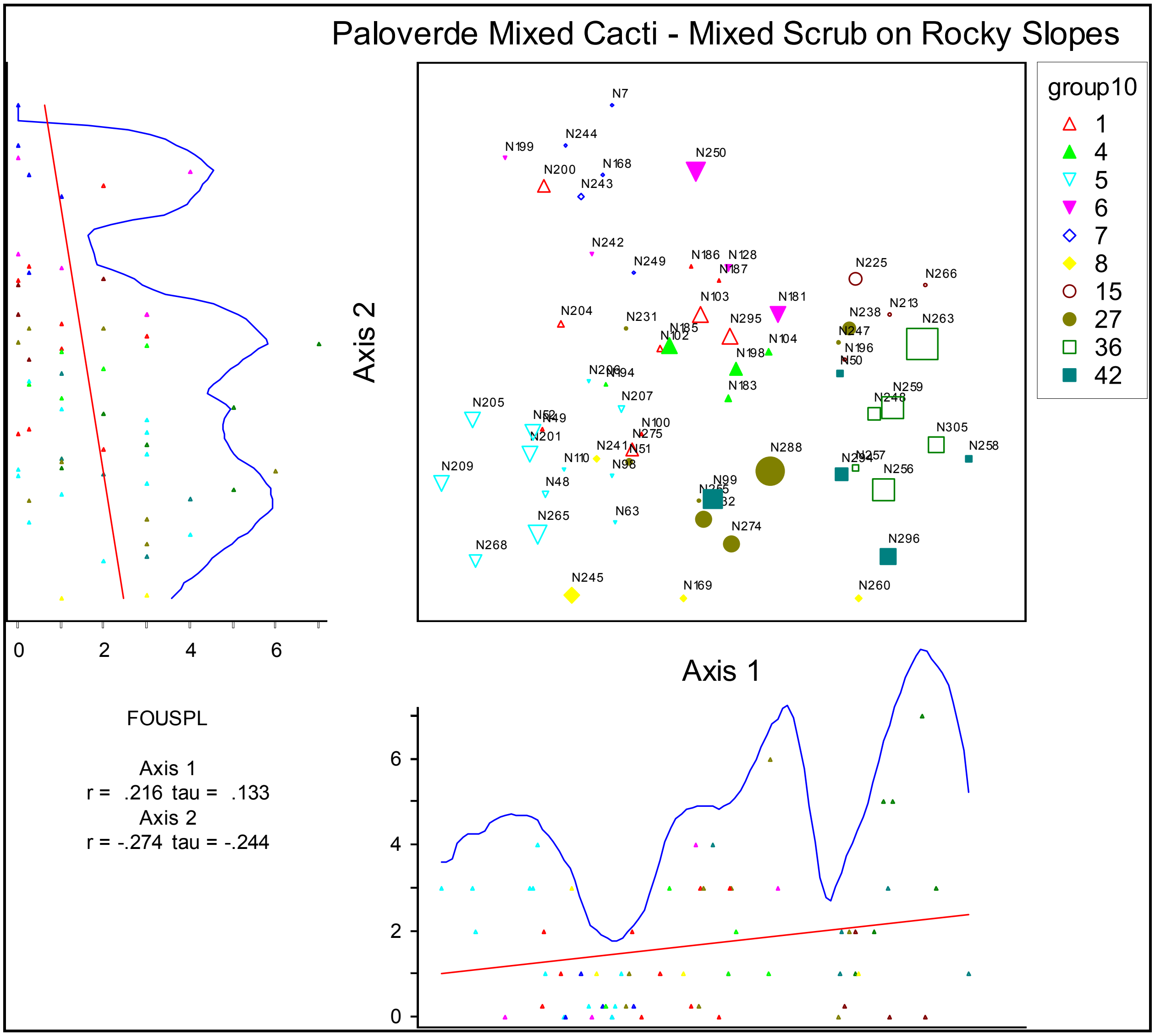
Encelia farinosa farinosa



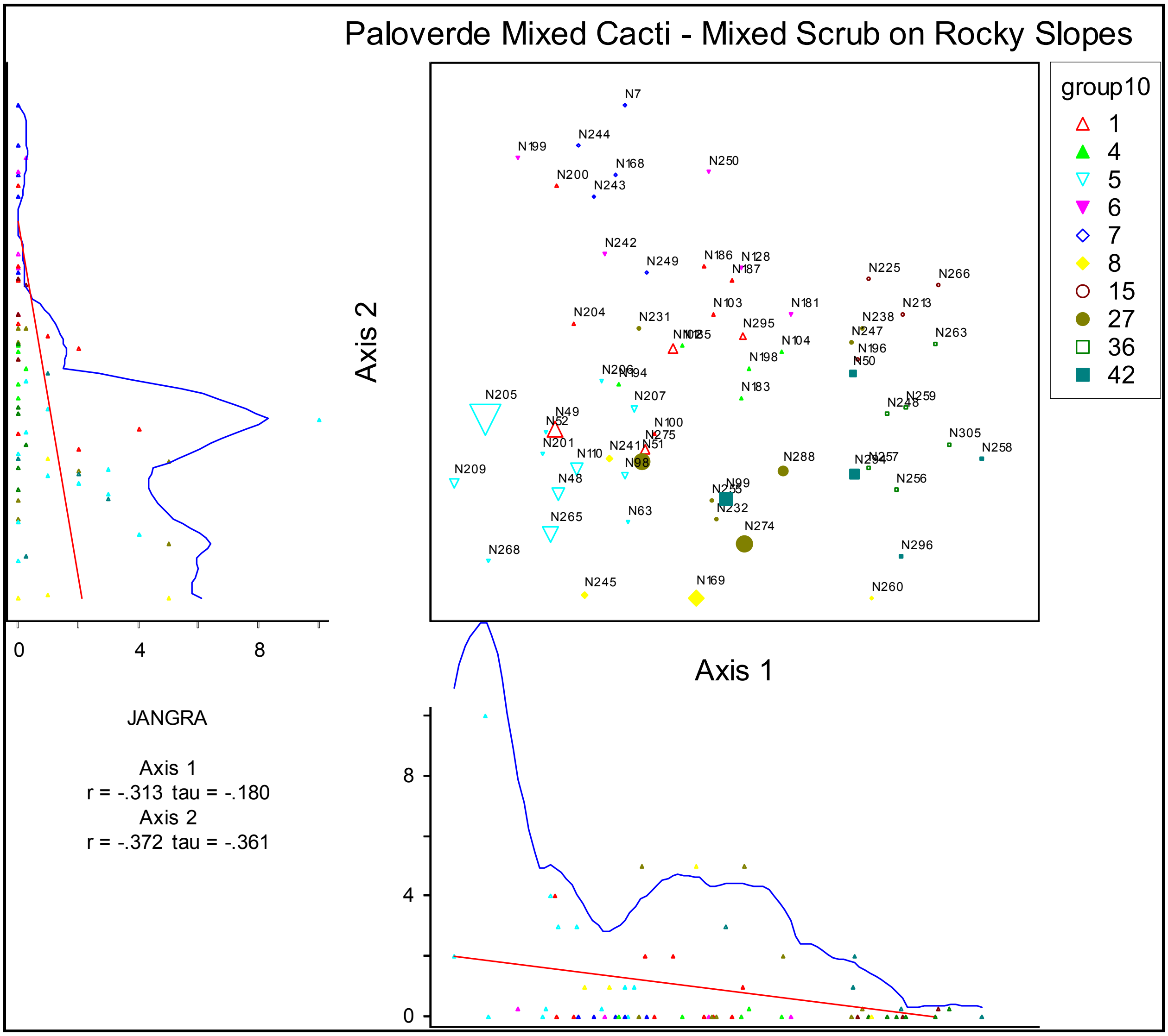
Erioneuron pulchellum



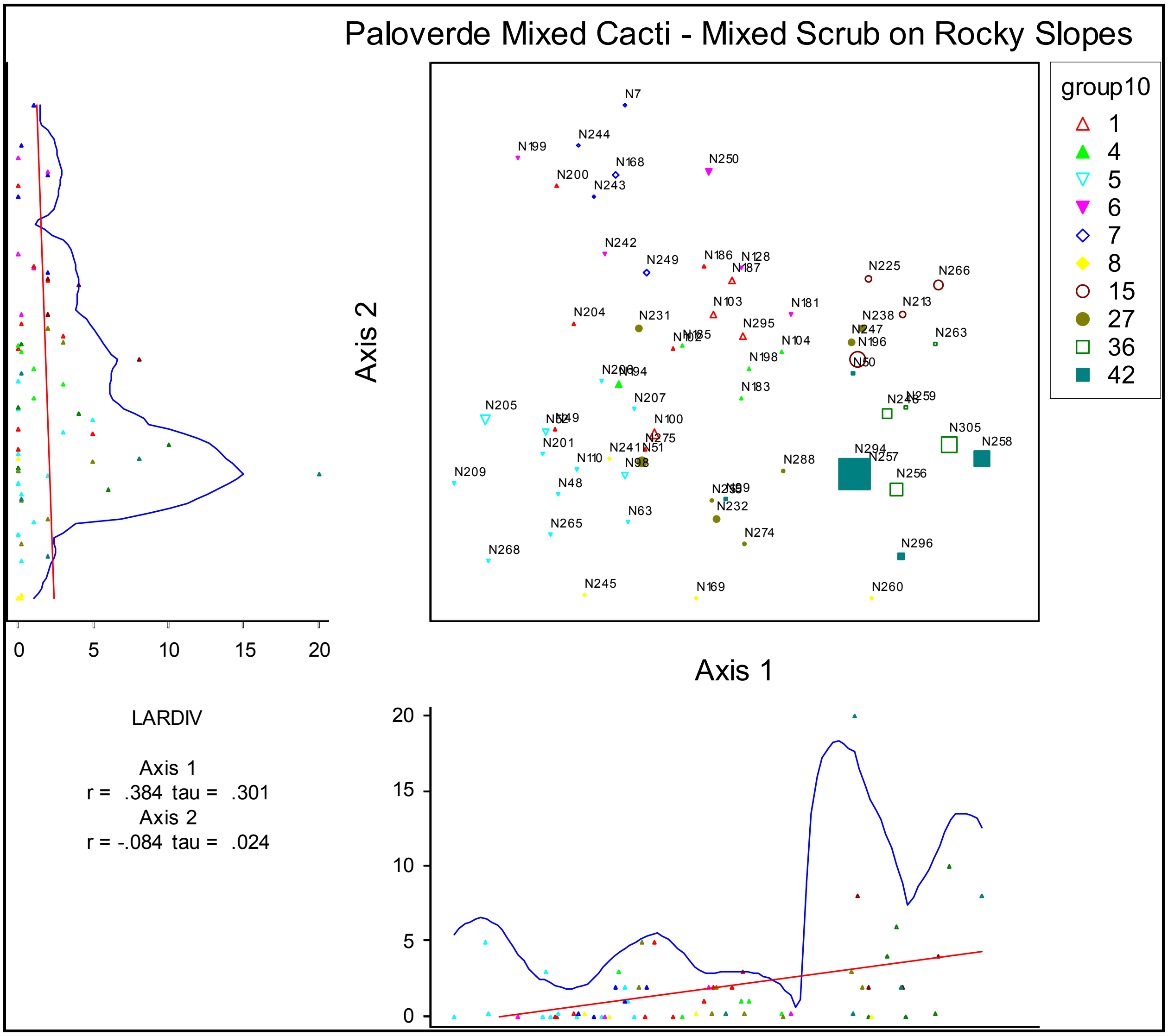
Erodium cicutarium



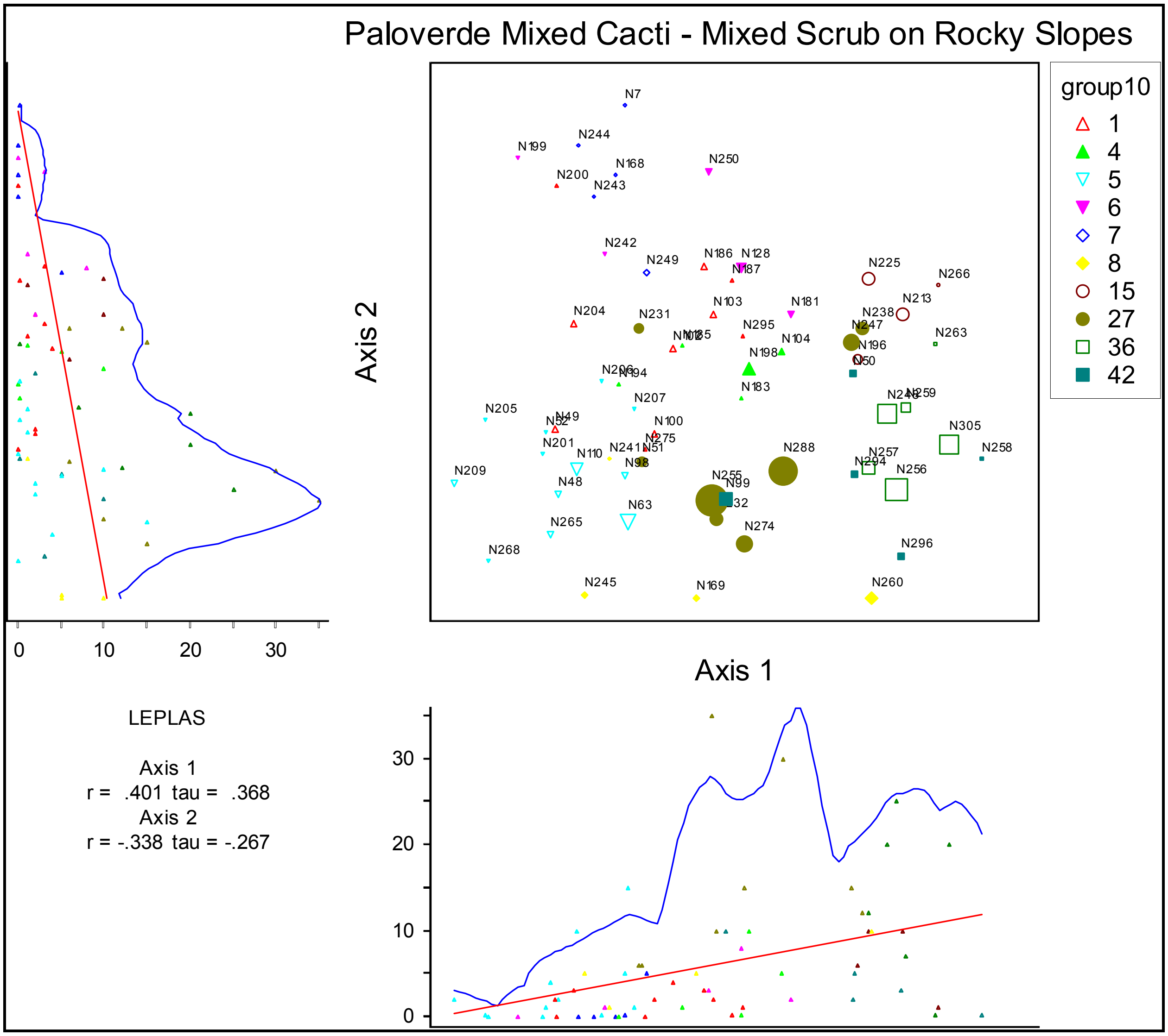
Fouquieria splendens



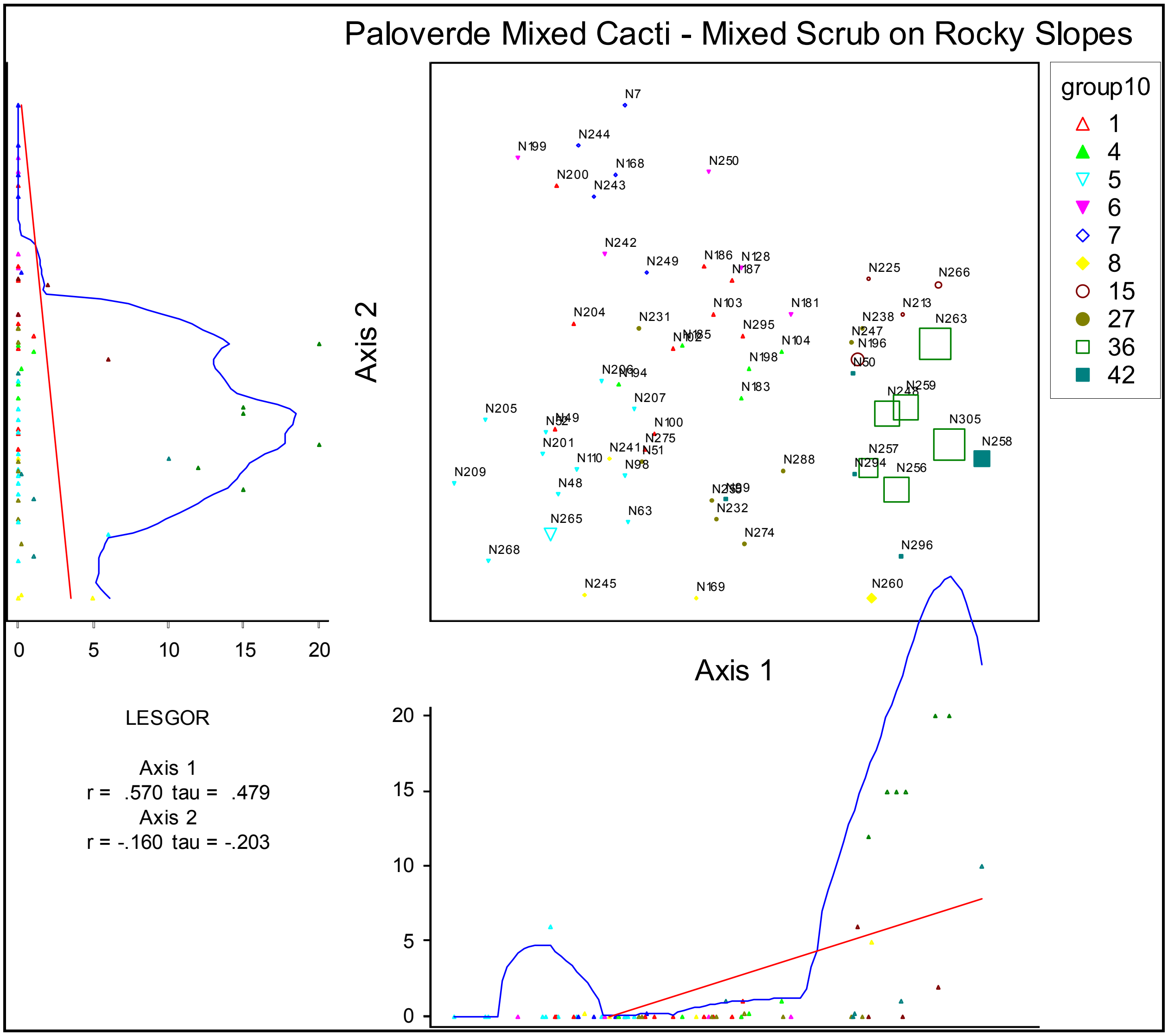
Janusia gracilis



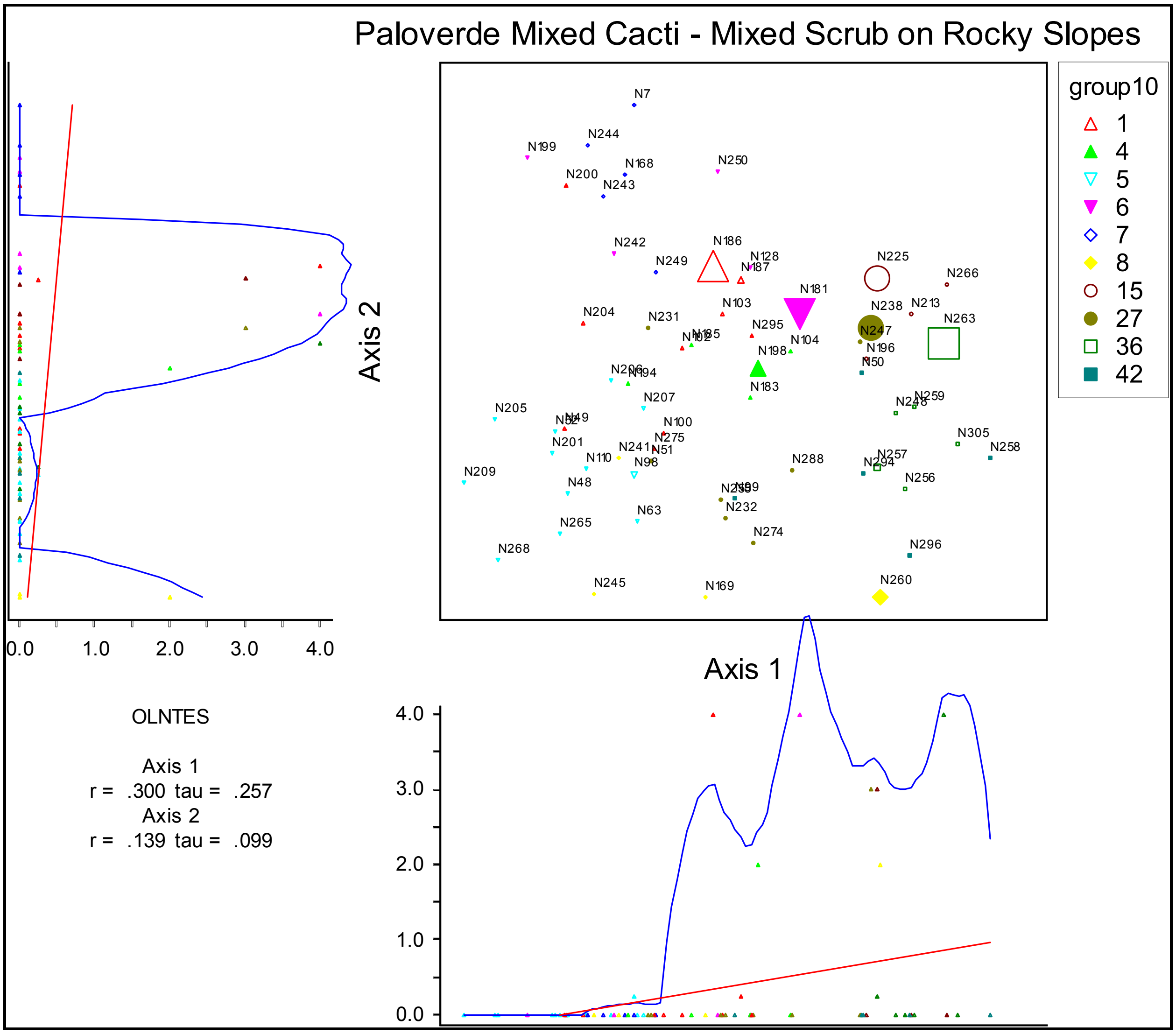
Larrea divaricata tridentata



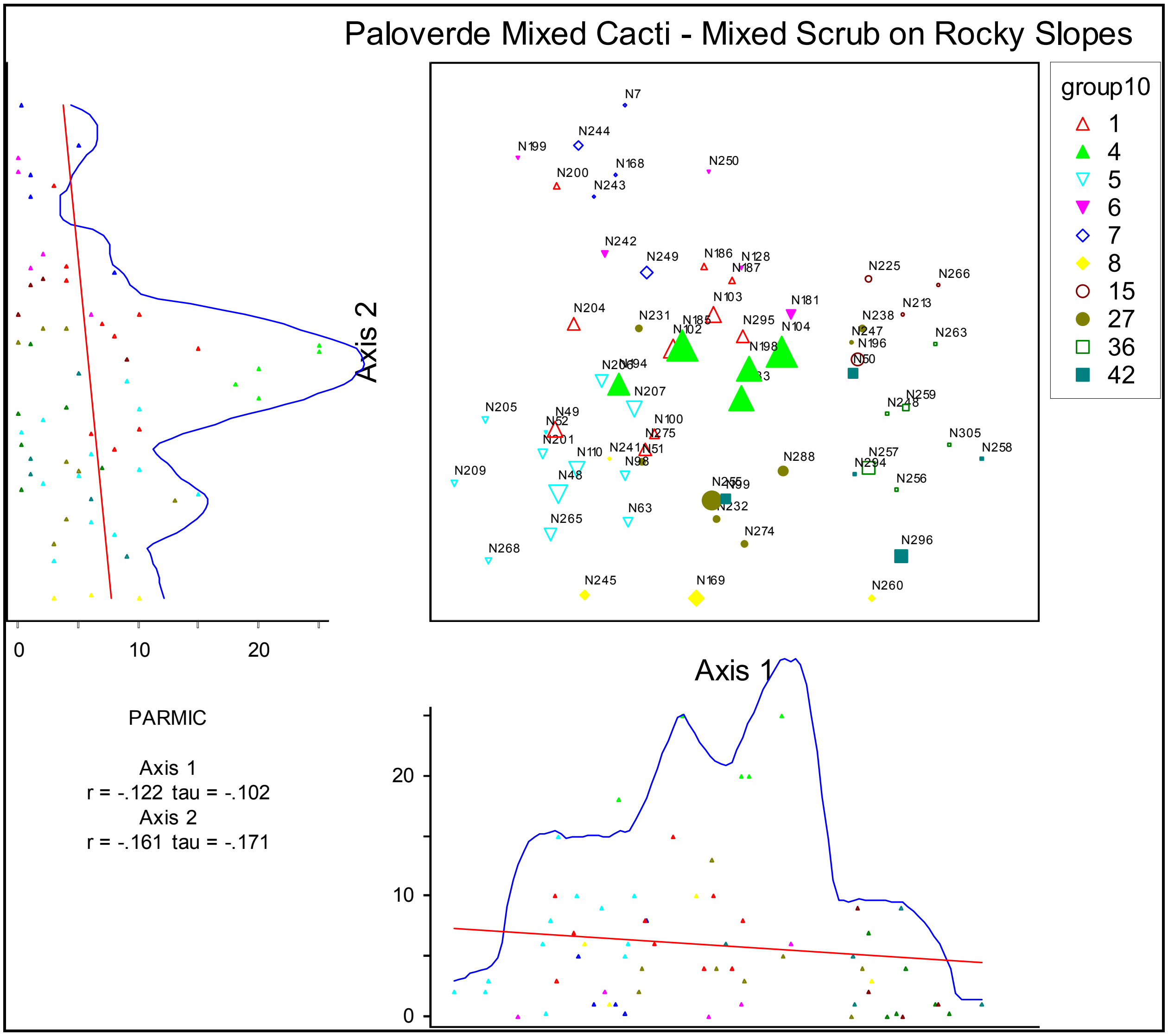
Lepidium lasiocarpum



Lesquerella gordonii

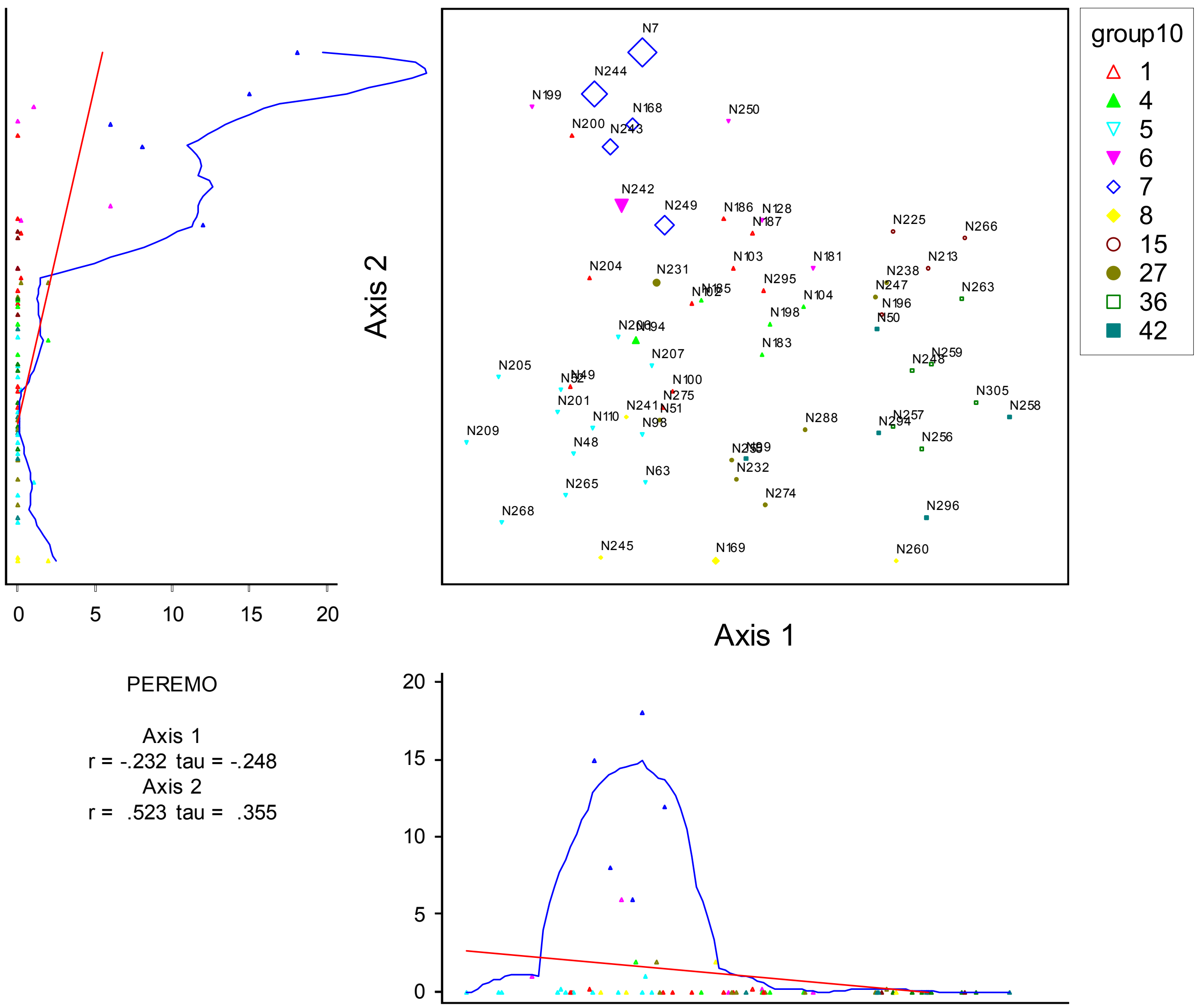


Olneya tesota



Parkinsonia microphylla

Paloverde Mixed Cacti - Mixed Scrub on Rocky Slopes



PEREMO

Axis 1
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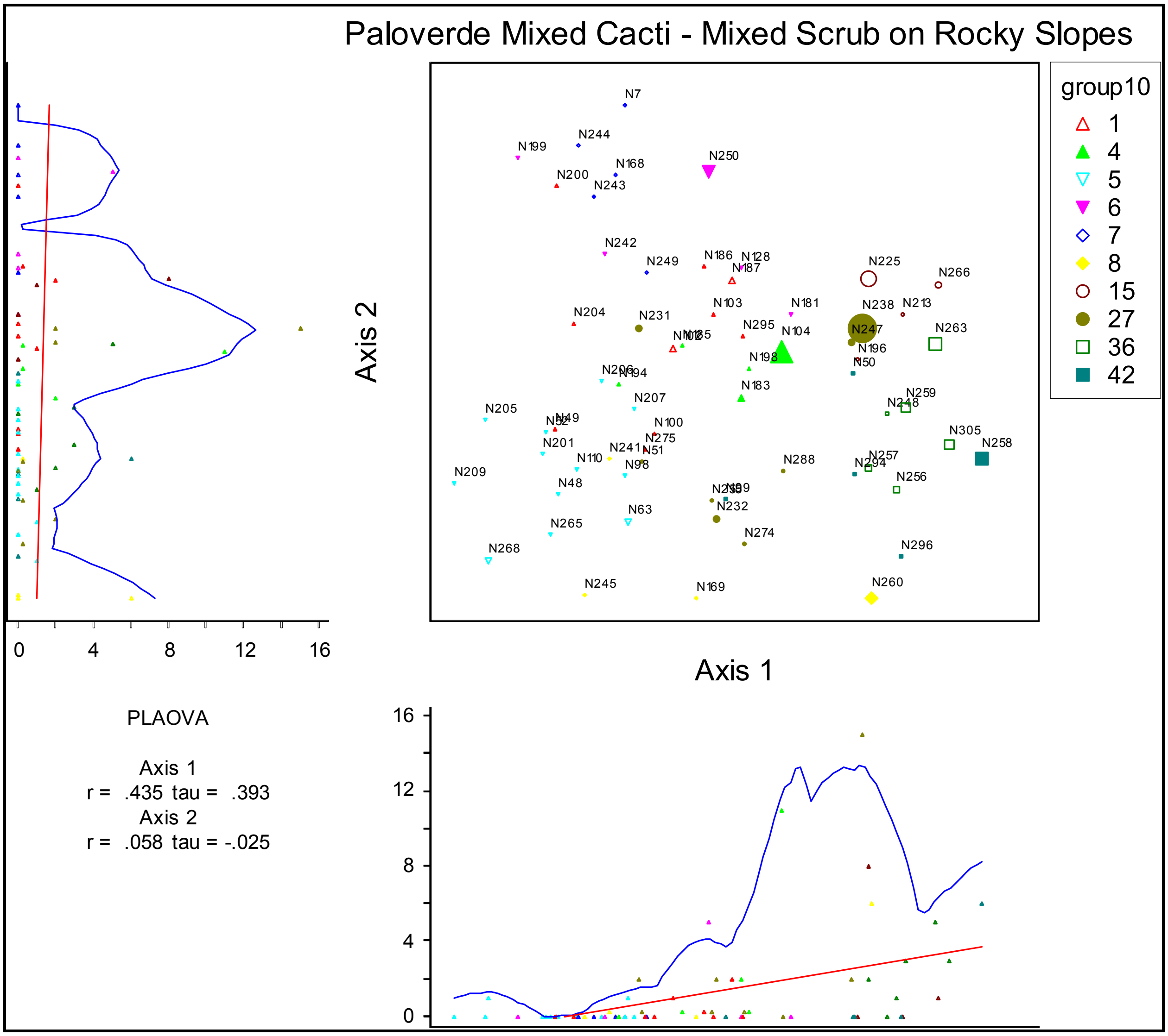
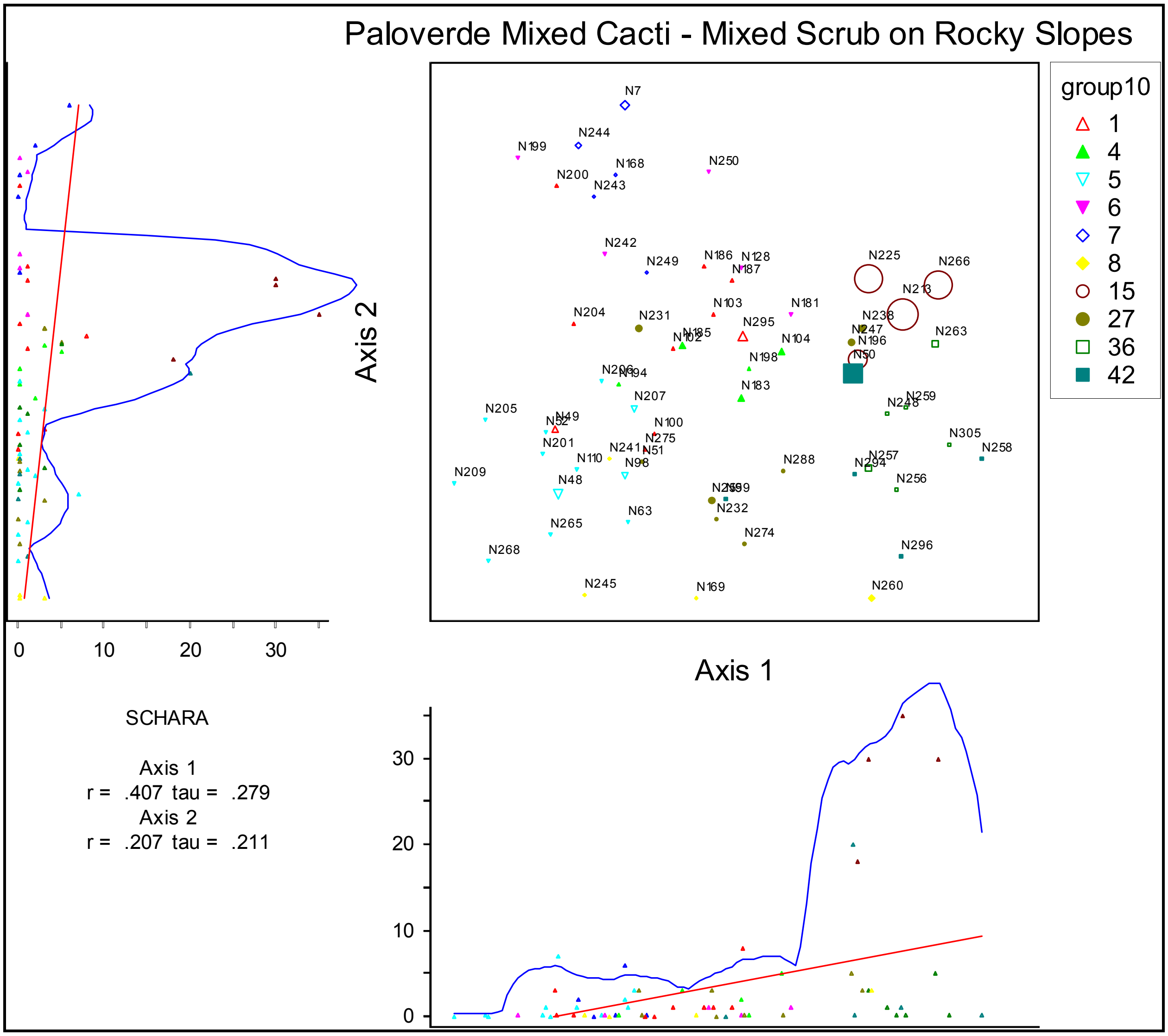
Axis 2
r = .523 tau = .355

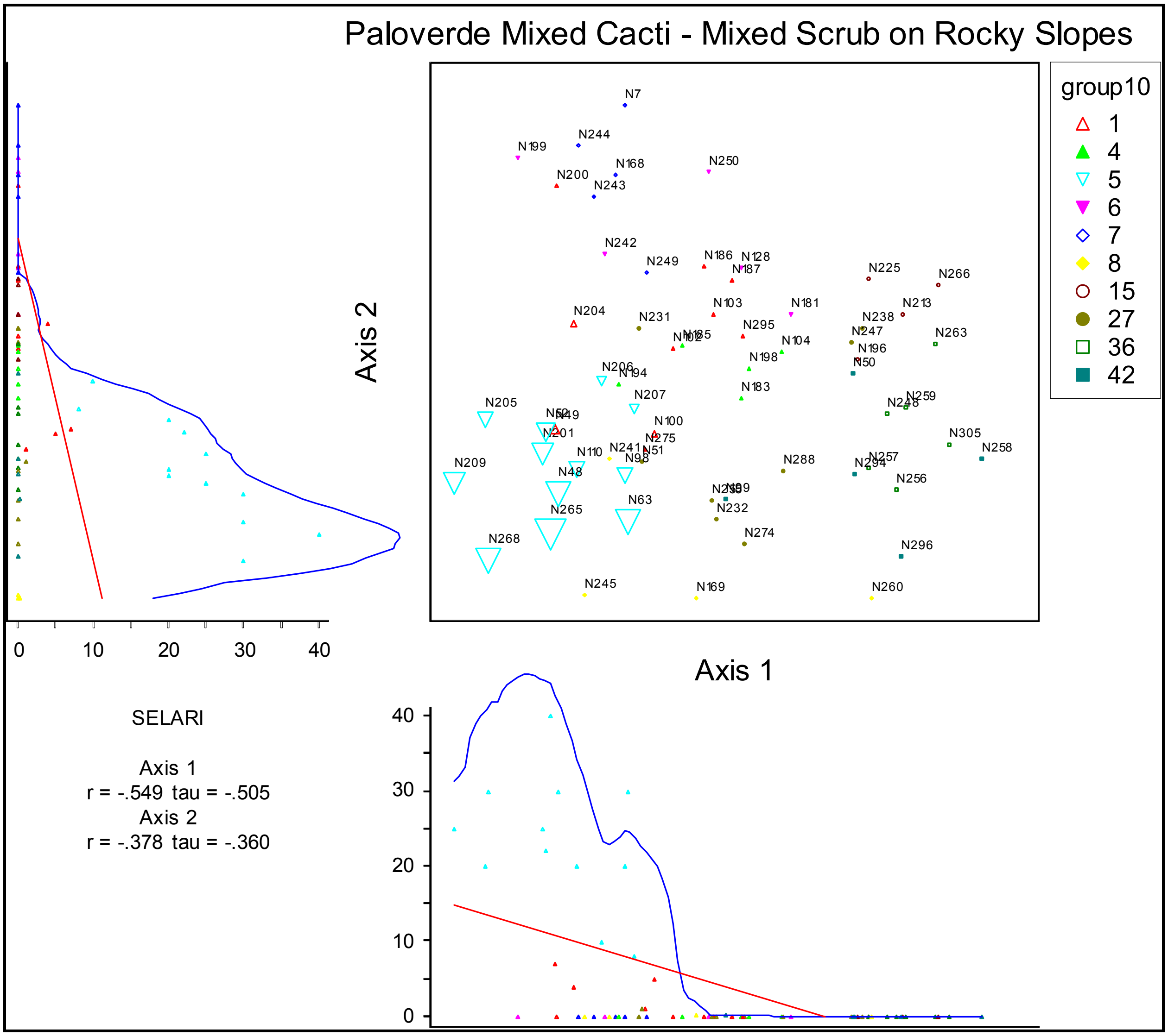
Perityle emoryi



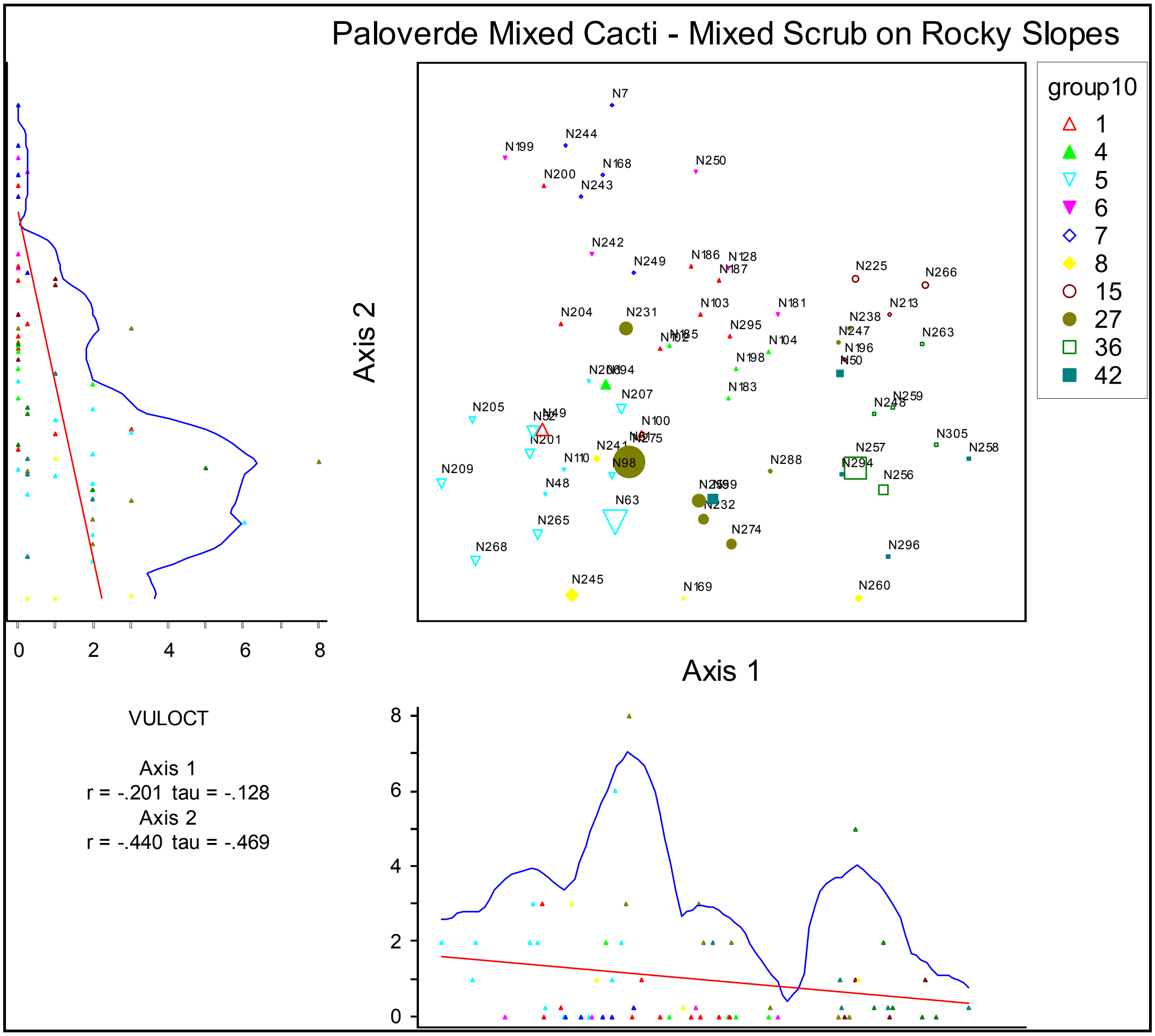
Plantago ovata



Schismus arabicus



Selaginella arizonica



Vulpia octoflora

APPENDIX K
Mountain Uplands
Community Statistics by Cluster Group

Group 1 *Number of Plots in Group:* 15

Growth Form *1. Trees*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Parkinsonia microphylla	1.10	7
Prosopis velutina	0.08	2

Sum of Percent Cover by Growth Form 1.18

Growth Form *2. Shrubs*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Abutilon	0.02	1
Acacia constricta	0.68	5
Acacia greggii	1.13	5
Agave deserti simplex	0.32	7
Aloysia wrightii	1.08	7
Ambrosia deltoidea	0.47	1
Artemisia ludoviciana	0.28	3
Ayenia microphylla	0.08	2
Bernardia incana	0.02	1
Brickellia coulteri	0.07	1
Calliandra eriophylla	0.35	3
Canotia holacantha	6.55	12
Celtis pallida pallida	0.75	5
Condalia warnockii	0.53	5
Ditaxis lanceolata	0.02	1
Encelia farinosa farinosa	0.18	4
Ephedra aspera	3.02	12
Eriogonum fasiculatum	0.80	6
Forestiera phillyreiodes	0.02	1
Fouquieria splendens	1.85	11
Gallium stellatum	0.52	6
Gutierrezia sarothrae	0.08	2
Gymnosperma glutinosum	0.20	2
Hibiscus coulteri	0.07	4
Jatropha cardiophylla	0.02	1
Krameria erecta	0.28	3
Krameria grayi	1.07	9
Larrea divaricata tridentata	0.92	10
Lycium	1.15	10
Lycium berlandieri	0.22	2

Community Statistics by Cluster Group

Natural Community MU

Group 1 *Number of Plots in Group:* 15

Lycium exsertum	0.20	1
Machaeranthera pinnatifida gooddingii	0.02	1
Menodora scabra	0.12	4
Porophyllum gracile	0.07	1
Psilostrophe cooperi	0.13	2
Thymophylla pentachaeta	0.02	1
Tiquilia canescens	1.02	4
Tragia nepetifolia var dissecta	0.02	1
Trixis californica	0.03	2
unknown shrub 1	0.08	2
Viguiera parishii	1.82	11
Yucca baccata	2.93	9
Zinnia acerosa	0.68	5
Ziziphus obtusifolia canescens	0.02	1

Sum of Percent Cover by Growth Form 29.88

Growth Form *3. Cactus*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Carnegiea gigantea	0.17	4
Cylindropuntia acanthocarpa	0.42	7
Cylindropuntia leptocaulis	0.15	2
Echinocereus	0.03	2
Echinocereus engelmannii	0.30	6
Ferocactus cylindraceus	0.02	1
Ferocactus emoryi	0.07	4
Mammillaria grahamii	0.07	1
Opuntia	0.35	6
Opuntia chlorotica	1.00	1
Opuntia engelmannii	2.00	2

Sum of Percent Cover by Growth Form 4.57

Growth Form *4. Herbs*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Acleisanthes longiflora	0.13	2
Acourtia nana	0.03	2
Acourtia wrightii	0.08	2
Allium macropetalon	0.02	1
Amsinckia intermedia	0.80	5

Community Statistics by Cluster Group

Natural Community MU

Group 1 *Number of Plots in Group:* 15

Androsace occidentalis	0.22	4
Arabis perennans	0.02	1
Astragalus nuttallianus	0.03	2
Bowlesia incana	0.02	1
Calycoseris wrightii	0.17	4
Camissonia chamaenerioides	0.02	1
Castilleja lanata	0.02	1
Caulanthus lasiophyllus	0.85	5
Chaenactis	0.02	1
Chaenactis stevioides	0.08	2
Chenopodium	0.02	1
Chenopodium neomexicana	0.10	3
Chorizanthe brevicornus	0.50	3
Cryptantha	0.02	1
Cryptantha barbigera	0.02	1
Cryptantha maritima	0.48	2
Cryptantha pterocarya	3.27	11
Daucus pusillus	0.15	6
Delphinium scaposum	0.07	1
Descurania pinnata	0.97	10
Dichelostemma capitatum ssp. Pauciflor	0.03	2
Draba cuneifolia	0.10	3
Eriastrum diffusum	0.47	6
Eriogonum abertianum	0.32	6
Eriophyllum lanosum	0.07	4
Erodium cicutarium	0.25	4
Erodium texanum	0.02	1
Eschscholzia mexicana	0.13	1
Eucrypta micrantha	0.90	8
Filago arizonica	0.02	1
Gilia	0.03	2
Gilia flavocincta	0.13	1
Gilia stellata	0.02	1
Hedeona nanum var marocalyx	0.02	1
Hybanthus verticillatus var. verticill	0.02	1
Lappula occidentalis	0.03	2
Lappula texana	0.20	1
Lepidium lasiocarpum	2.82	8
Lesquerella gordonii	0.72	6

Community Statistics by Cluster Group

Natural Community MU

Group 1

Number of Plots in Group: 15

Linanthus jonesii	0.07	4
Mentzelia	0.08	2
Mentzelia affinis	0.02	1
Monoptilon bellioides	0.02	1
Oenothera primaveris	0.02	1
Parietaria floridana	0.32	6
Pectocarya	0.02	1
Pectocarya platycarpa	0.02	1
Pectocarya recurvata	0.05	3
Penstemon pseudospectabilis	0.02	1
Phacelia	0.13	1
Phacelia ambigua	0.08	2
Phacelia coerulea	2.20	7
Phacelia distans	0.55	3
Pholistoma auritum var arizonicum	0.77	5
Plantago ovata	0.27	2
Plantago patagonica	1.08	6
Rafinesquia	0.02	1
Rafinesquia californica	0.05	3
Rafinesquia neomexicana	0.12	4
Senecio lemmonii	0.08	5
Silene antirrhina	0.03	2
Sphaeralcea	0.02	1
Sphaeralcea ambigua	0.38	6
Sphaeralcea coulteri	0.02	1
Sphaeralcea laxa	0.07	1
Stephanomeria pauciflora	0.07	1
Streptanthus carinatus	0.05	3
Stylocline micropoides	0.10	3
Teucrium glandulosum	0.08	2
Thysanocarpis curvipes	0.27	6
unknown herb 1	0.02	1
Uropappus lindleyi	0.15	6
Yabea microcarpa	0.05	3

Sum of Percent Cover by Growth Form 21.63

Community Statistics by Cluster Group

Natural Community MU

Group 1

Number of Plots in Group: 15

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing species
Aristida purpurea	0.02	1
Bouteloua repens	0.07	1
Bromus rubens	0.07	4
Digitaria californica	0.02	1
Elymus elymoides	1.20	3
Heptochloa panicea ssp. Brachiata	0.02	1
Muhlenbergia porteri	2.73	13
Pleuraphis mutica	0.70	4
Pleuraphis rigida	0.15	3
Poa bigelovii	1.20	10
Schismus arabicus	0.85	7
Tridens muticus	0.08	2
unknown grass 1	0.22	2
Vulpia octoflora	0.75	9

Sum of Percent Cover by Growth Form 8.07

Growth Form 6. Vines

Scientific Name	Average % Cover by Species	# of plots containing species
Janusia gracile	0.78	9
Matelea parvifolia	0.08	2
Maurandya antirrhinifolia	0.02	1
Metastelma arizonicum	0.02	1
Sarcostemma cynanchoides	0.02	1

Sum of Percent Cover by Growth Form 0.92

Growth Form 7. Ferns and Club Mosses

Scientific Name	Average % Cover by Species	# of plots containing species
Astrolepis cochisensis	0.15	3
Notholaena standleyi	0.05	3
Pellaea truncata	0.12	4
Selaginella arizonica	0.07	1
unknown fern 1	0.08	2

Sum of Percent Cover by Growth Form 0.47

Community Statistics by Cluster Group

Natural Community MU

Group 4

Number of Plots in Group: 4

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing species
Agave deserti simplex	0.13	2
Aloysia wrightii	4.81	3
Canotia holacantha	2.75	3
Ephedra aspera	1.38	4
Fouquieria splendens	3.06	4
Krameria erecta	0.81	2
Krameria grayi	0.06	1
Larrea divaricata tridentata	0.88	3
Lycium	0.06	1
Menodora scabra	2.50	4
Psilostrophe cooperi	0.25	1
Tiquilia canescens	4.00	4
Yucca baccata	1.63	4
Zinnia acerosa	5.50	4

Sum of Percent Cover by Growth Form 27.81

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing species
Cylindropuntia acanthocarpa	0.13	2
Echinocereus	1.50	3
Echinocereus engelmannii	0.75	1
Opuntia	11.75	4

Sum of Percent Cover by Growth Form 14.13

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing species
Acleisanthes longiflora	0.31	2
Acourtia nana	0.25	1
Allium macropetalon	0.13	2
Calycoseris wrightii	0.13	2
Chaenactis stevioides	0.13	2
Cryptantha barbigera	0.06	1
Cryptantha pterocarya	0.31	2
Daucus pusillus	0.63	3
Delphinium scaposum	0.06	1

Community Statistics by Cluster Group

Natural Community MU

Group 4

Number of Plots in Group: 4

Descurania pinnata	0.50	2
Eriastrum diffusum	0.25	1
Eriogonum abertianum	0.31	2
Erodium texanum	0.06	1
Gilia	0.06	1
Lappula occidentalis	1.56	3
Lappula texana	2.50	3
Lepidium lasiocarpum	0.56	2
Lesquerella gordonii	10.00	3
Linum perenne ssp lewisii	0.06	1
Pectocarya	0.06	1
Phacelia	0.50	1
Phacelia distans	0.06	1
Plantago	0.75	1
Plantago ovata	1.06	2
Plantago patagonica	1.75	2
Sphaeralcea ambigua	0.38	3
Stephanomeria pauciflora	0.06	1
unknown herb 1	0.13	2
Uropappus lindleyi	0.19	3

Sum of Percent Cover by Growth Form 22.81

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Muhlenbergia porteri	3.25	3
Pleuraphis mutica	9.50	2
Schismus arabicus	2.06	4
unknown grass 1	5.75	3
Vulpia octoflora	0.06	1

Sum of Percent Cover by Growth Form 20.63

Growth Form *6. Vines*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Janusia gracile	1.25	2

Sum of Percent Cover by Growth Form 1.25

Community Statistics by Cluster Group

Natural Community MU

Group 7

Number of Plots in Group: 2

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing species
Parkinsonia microphylla	1.00	1
Prosopis velutina	1.00	1
Vauquelinia californica ssp. Sonorensi	0.50	1

Sum of Percent Cover by Growth Form 2.50

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing species
Acacia constricta	0.13	1
Acacia greggii	0.50	1
Agave deserti simplex	0.25	2
Aloysia wrightii	0.50	1
Anisacathus thurberi	0.13	1
Artemisia ludoviciana	0.13	1
Bernardia incana	0.50	1
Canotia holacantha	8.00	2
Ephedra aspera	2.50	2
Eriogonum fasiculatum	1.50	1
Fouquieria splendens	0.50	1
Gutierrezia sarothrae	1.00	1
Keckiella antirrhinoides	0.50	1
Krameria erecta	0.13	1
Larrea divaricata tridentata	0.50	1
Lycium	2.00	2
Menodora scabra	0.13	1
Mirabilis laevis v villosa	0.13	1
Psilostrophe cooperi	0.25	2
Trixis californica	0.13	1
Viguiera parishii	5.00	2
Yucca baccata	0.50	1

Sum of Percent Cover by Growth Form 24.88

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing species
Carnegiea gigantea	0.13	1
Cylindropuntia acanthocarpa	0.63	2

Community Statistics by Cluster Group

Natural Community MU

Group 7

Number of Plots in Group: 2

Cylindropuntia leptocaulis	0.13	1
Ferocactus emoryi	0.13	1
Mammillaria	0.13	1
Opuntia chlorotica	0.13	1
Opuntia engelmannii	1.00	1

Sum of Percent Cover by Growth Form 2.25

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing species
Amsinckia intermedia	1.00	1
Castilleja lanata	0.13	1
Caulanthus lasiophyllus	0.13	1
Cryptantha pterocarya	6.00	1
Daucus pusillus	0.63	2
Delphinium scaposum	0.13	1
Descurania pinnata	2.00	1
Draba cuneifolia	0.13	1
Eucrypta micrantha	4.00	1
Gutierrezia arizonica	1.50	1
Lepidium lasiocarpum	1.50	1
Malocothrix sonoraae	0.13	1
Parietaria floridana	0.13	1
Phacelia distans	25.00	2
Pholistoma auritum var arizonicum	0.50	1
Stephanomeria pauciflora	0.13	1
unknown herb 1	0.13	1

Sum of Percent Cover by Growth Form 43.13

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing species
Aristida purpurea	1.00	1
Bromus rubens	0.13	1
Muhlenbergia porteri	2.50	2
Pleuraphis mutica	1.00	1
Poa bigelovii	2.00	2
Vulpia octoflora	1.00	2

Sum of Percent Cover by Growth Form 7.63

Community Statistics by Cluster Group

Natural Community MU

Group 7

Number of Plots in Group: 2

Growth Form *6. Vines*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Galium aparine	0.13	1
Janusia gracile	0.50	1
Nissolia schottii	0.13	1

Sum of Percent Cover by Growth Form 0.75

Growth Form *7. Ferns and Club Mosses*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Cheilanthes yavapensis	0.50	1
Pellaea truncata	0.50	1
Selaginella arizonica	1.50	1

Sum of Percent Cover by Growth Form 2.50

Community Statistics by Cluster Group

Natural Community MU

Group 14 — Number of Plots in Group: 1

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing species
Agave deserti simplex	0.25	1
Menodora scabra	2.00	1
Tiquilia canescens	0.25	1
Zinnia acerosa	3.00	1

Sum of Percent Cover by Growth Form 5.50

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing species
Echinocereus	1.00	1
Opuntia	10.00	1

Sum of Percent Cover by Growth Form 11.00

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing species
Acourtia nana	1.00	1
Atriplex elegans	0.25	1
Eriastrum diffusum	0.25	1
Lappula occidentalis	2.00	1
Lesquerella gordonii	4.00	1
Plantago	2.00	1
Sphaeralcea ambigua	1.00	1
Uropappus lindleyi	0.25	1

Sum of Percent Cover by Growth Form 10.75

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing species
Pleuraphis mutica	75.00	1
Schismus arabicus	1.00	1
unknown grass 1	1.00	1

Sum of Percent Cover by Growth Form 77.00

Growth Form 6. Vines

Scientific Name	Average % Cover by Species	# of plots containing species
Janusia gracile	2.00	1

Sum of Percent Cover by Growth Form 2.00

Community Statistics by Cluster Group

Natural Community MU

Group 16

Number of Plots in Group: 1

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing species
Phoradendron californicum	0.25	1
Prosopis velutina	3.00	1

Sum of Percent Cover by Growth Form 3.25

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing species
Acacia constricta	3.00	1
Acacia greggii	2.00	1
Aloysia wrightii	4.00	1
Brickellia coulteri	0.25	1
Celtis pallida pallida	7.00	1
Ephedra aspera	0.25	1
Krameria grayi	0.25	1
Larrea divaricata tridentata	25.00	1
Lycium	15.00	1
Trixis californica	0.25	1

Sum of Percent Cover by Growth Form 57.00

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing species
Acourtia wrightii	1.00	1
Amsinckia tessellata	2.00	1
Androsace occidentalis	0.25	1
Caulanthus lasiophyllus	6.00	1
Cryptantha pterocarya	5.00	1
Descurania pinnata	12.00	1
Draba cuneifolia	1.00	1
Eucrypta micrantha	5.00	1
Lesquerella gordonii	0.25	1
Myosurus cupulatus	1.00	1
Phacelia coerulea	2.00	1
Pholistoma auritum var arizonicum	4.00	1
Plantago ovata	0.25	1
Rafinesquia neomexicana	0.25	1
Senecio lemmonii	0.25	1
Silene antirrhina	0.25	1
Streptanthus carinatus	0.25	1

Sum of Percent Cover by Growth Form 40.75

Community Statistics by Cluster Group

Natural Community MU

Group 16

Number of Plots in Group: 1

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Muhlenbergia porteri	0.25	1
Poa bigelovii	3.00	1
Schismus arabicus	0.25	1
Vulpia octoflora	2.00	1

Sum of Percent Cover by Growth Form 5.50

Growth Form *6. Vines*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Janusia gracile	0.25	1
Sarcostemma cynanchoides	0.25	1

Sum of Percent Cover by Growth Form 0.50

Community Statistics by Cluster Group

Natural Community MU

Group 20 *Number of Plots in Group:* 1

Growth Form *1. Trees*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Parkinsonia microphylla	5.00	1
Prosopis velutina	2.00	1

Sum of Percent Cover by Growth Form 7.00

Growth Form *2. Shrubs*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Acacia constricta	3.00	1
Ayenia microphylla	0.25	1
Canotia holacantha	2.00	1
Ephedra aspera	1.00	1
Larrea divaricata tridentata	2.00	1
Lycium	3.00	1
Menodora scabra	0.25	1
Viguiera parishii	0.25	1

Sum of Percent Cover by Growth Form 11.75

Growth Form *3. Cactus*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Cylindropuntia leptocaulis	0.25	1
Ferocactus emoryi	0.25	1
Opuntia chlorotica	0.25	1

Sum of Percent Cover by Growth Form 0.75

Growth Form *4. Herbs*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Androsace occidentalis	10.00	1
Caulanthus lasiophyllus	2.00	1
Cryptantha pterocarya	6.00	1
Daucus pusillus	0.25	1
Descurania pinnata	2.00	1
Dichelostemma capitatum ssp. Pauciflor	0.25	1
Draba cuneifolia	0.25	1
Eriastrum diffusum	0.25	1
Eschscholzia mexicana	50.00	1
Eucrypta micrantha	1.00	1

Community Statistics by Cluster Group

Natural Community MU

Group 20

Number of Plots in Group: 1

Filago	0.25	1
Gilia	0.25	1
Lepidium lasiocarpum	25.00	1
Lesquerella gordonii	0.25	1
Lupinus	0.25	1
Phacelia coerulea	7.00	1
Pholistoma auritum var arizonicum	0.25	1
Plantago patagonica	0.25	1
Rafinesquia neomexicana	0.25	1
Sphaeralcea coulteri	0.25	1
Thysanocarpis curvipes	2.00	1

Sum of Percent Cover by Growth Form 108.00

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Aristida purpurea	0.25	1
Bromus rubens	0.25	1
Muhlenbergia porteri	3.00	1
Pleuraphis mutica	1.00	1
Poa bigelovii	0.25	1
Schismus arabicus	0.25	1
Vulpia octoflora	0.25	1

Sum of Percent Cover by Growth Form 5.25

Growth Form *6. Vines*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Janusia gracile	1.00	1

Sum of Percent Cover by Growth Form 1.00

Community Statistics by Cluster Group

Natural Community MU

Group 21 — Number of Plots in Group: 2

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing species
Parkinsonia microphylla	1.00	1
Prosopis velutina	0.13	1

Sum of Percent Cover by Growth Form 1.13

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing species
Acacia constricta	0.13	1
Agave deserti simplex	0.13	1
Ayenia microphylla	0.13	1
Calliandra eriophylla	1.00	2
Canotia holacantha	2.00	2
Carlowrightii arizonica	0.13	1
Condalia warnockii	0.13	1
Encelia farinosa farinosa	0.13	1
Ephedra aspera	4.00	2
Fouquieria splendens	2.50	2
Gallium stellatum	0.13	1
Krameria grayi	0.13	1
Lycium	0.25	2
Machaeranthera pinnatifida gooddingii	0.13	1
Psilostrophe cooperi	0.50	1
Talinum auantiacum Englemann	0.13	1
Tiquilia canescens	0.13	1
Trixis californica	0.13	1
unknown shrub 1	0.50	1
Viguiera parishii	0.13	1
Yucca baccata	7.50	2
Zinnia acerosa	0.50	1
Ziziphus obtusifolia canescens	1.00	1

Sum of Percent Cover by Growth Form 21.38

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing species
Carnegiea gigantea	0.13	1
Cylindropuntia acanthocarpa	0.63	2

Community Statistics by Cluster Group

Natural Community MU

Group 21 — Number of Plots in Group: 2

Echinocereus engelmannii	0.63	2
Ferocactus emoryi	0.13	1
Mammillaria grahamii	0.13	1
Opuntia	0.13	1
Opuntia engelmannii	0.13	1

Sum of Percent Cover by Growth Form 1.88

Growth Form 4. Herbs

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Acourtia nana	0.25	2
Allium macropetalon	0.13	1
Androsace occidentalis	1.13	2
Caulanthus lasiophyllus	0.13	1
Chenopodium neomexicana	0.13	1
Cryptantha	0.13	1
Cryptantha barbigera	0.13	1
Cryptantha pterocarya	0.25	2
Daucus pusillus	0.13	1
Descurania pinnata	0.13	1
Dichelostemma capitatum ssp. Pauciflor	0.25	2
Draba cuneifolia	1.00	2
Eriogonum maculatum	0.13	1
Erodium cicutarium	2.50	2
Eucrypta micrantha	1.00	1
Gilia stellata	0.25	2
Hedeona nanum var marocalyx	0.13	1
Lepidium lasiocarpum	30.00	2
Lesquerella gordonii	0.13	1
Lotus	0.13	1
Pectocarya recurvata	0.50	1
Phacelia ambigua	0.25	2
Phacelia coerulea	0.63	2
Plantago patagonica	4.00	2
Rafinesquia neomexicana	0.13	1
Silene antirrhina	0.13	1
Sphaeralcea ambigua	0.13	1
Streptanthus carinatus	0.13	1
Stylocline micropoides	0.25	2

Community Statistics by Cluster Group

Natural Community MU

Group 21

Number of Plots in Group: 2

Thysanocarpis curvipes	0.25	2
Uropappus lindleyi	0.25	2
Verbena	0.50	1

Sum of Percent Cover by Growth Form 45.13

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Bouteloua	3.00	1
Bromus rubens	0.13	1
Muhlenbergia porteri	4.00	2
Poa bigelovii	0.13	1
unknown grass 1	0.13	1
Vulpia octoflora	1.00	2

Sum of Percent Cover by Growth Form 8.38

Growth Form *6. Vines*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Janusia gracile	2.00	2
Sarcostemma cynanchoides	0.13	1

Sum of Percent Cover by Growth Form 2.13

Growth Form *7. Ferns and Club Mosses*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Astrolepis cochisensis	0.13	1

Sum of Percent Cover by Growth Form 0.13

Community Statistics by Cluster Group

Natural Community MU

Group 22 *Number of Plots in Group:* 1

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing species
Prosopis velutina	2.00	1

Sum of Percent Cover by Growth Form 2.00

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing species
Acacia constricta	1.00	1
Aloysia wrightii	1.00	1
Artemisia ludoviciana	0.25	1
Atriplex canescens	1.00	1
Bernardia incana	3.00	1
Canotia holacantha	1.00	1
Encelia farinosa farinosa	0.25	1
Ephedra aspera	1.00	1
Eriogonum fasiculatum	1.00	1
Eriogonum wrightii	3.00	1
Lycium	1.00	1
Trixis californica	0.25	1
Viguiera parishii	0.25	1

Sum of Percent Cover by Growth Form 14.00

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing species
Acourtia nana	0.25	1
Amsinckia intermedia	1.00	1
Cryptantha pterocarya	2.00	1
Daucus pusillus	0.25	1
Delphinium scaposum	0.25	1
Descurania pinnata	1.00	1
Dichelostemma capitatum ssp. Pauciflor	0.25	1
Gilia	0.25	1
Gutierrezia arizonica	2.00	1
Lepidium lasiocarpum	1.00	1
Parietaria floridana	0.25	1
Phacelia	1.00	1
Sphaeralcea ambigua	1.00	1
Thysanocarpis curvipes	1.00	1
Uropappus lindleyi	1.00	1

Sum of Percent Cover by Growth Form 12.50

Community Statistics by Cluster Group

Natural Community MU

Group 22

Number of Plots in Group: 1

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Bromus rubens	3.00	1
Muhlenbergia porteri	70.00	1
Pleuraphis rigida	20.00	1
Poa bigelovii	8.00	1
Vulpia octoflora	0.25	1

Sum of Percent Cover by Growth Form 101.25

Growth Form *6. Vines*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Galium aparine	0.25	1
Janusia gracile	0.25	1

Sum of Percent Cover by Growth Form 0.50

Growth Form *7. Ferns and Club Mosses*

Scientific Name	*Average % Cover by Species*	*# of plots containing species*
Astrolepis sinuata sinuata	0.25	1
Pellaea truncata	0.25	1

Sum of Percent Cover by Growth Form 0.50

Community Statistics by Cluster Group

Natural Community MU

Group 23

Number of Plots in Group: 6

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing species
Parkinsonia microphylla	1.38	3

Sum of Percent Cover by Growth Form 1.38

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing species
Abutilon incanum	0.04	1
Acacia constricta	0.67	2
Acacia greggii	0.04	1
Agave deserti simplex	0.33	5
Aloysia wrightii	0.38	2
Artemisia ludoviciana	0.21	2
Bebbia juncea aspera	0.17	1
Bernardia incana	0.33	1
Brickellia coulteri	0.04	1
Calliandra eriophylla	1.00	3
Canotia holacantha	0.38	3
Carlowrightii arizonica	0.33	1
Condalia warnockii	0.17	1
Coursetia glandulosa	0.67	1
Crossosma bigelovii	0.17	1
Ditaxis lanceolata	0.17	1
Encelia farinosa farinosa	2.50	1
Ephedra aspera	2.50	5
Eriogonum fasiculatum	1.83	4
Eriogonum wrightii	0.21	2
Fouquieria splendens	1.75	6
Gallium stellatum	1.38	3
Gutierrezia sarothrae	0.17	1
Gymnosperma glutinosum	0.17	1
Hyptis emoryi	0.17	1
Jatropha cardiophylla	0.21	2
Koeberlinia spinosa	0.38	3
Krameria erecta	0.17	1
Lycium	0.50	3
Menodora scabra	0.29	4
Porophyllum gracile	0.08	2

Community Statistics by Cluster Group

Natural Community MU

Group 23 — Number of Plots in Group: 6

Psilostrophe cooperi	0.17	1
Tidestromia lanuginosa	0.04	1
Trixis californica	0.33	2
unknown shrub 1	1.00	2
Viguiera parishii	2.83	5
Yucca baccata	4.71	5
Zinnia acerosa	0.21	2

Sum of Percent Cover by Growth Form 26.67

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing species
Carnegiea gigantea	0.04	1
Cylindropuntia acanthocarpa	0.29	4
Echinocereus engelmannii	0.13	3
Mammillaria grahamii	0.04	1
Opuntia chlorotica	0.04	1

Sum of Percent Cover by Growth Form 0.54

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing species
Acleisanthes longiflora	0.08	2
Amsinckia intermedia	0.75	5
Calocortus kennedeyi	0.04	1
Camissonia	0.04	1
Camissonia californica	0.04	1
Caulanthus lasiophyllus	0.08	2
Cirsium neomexicana	0.04	1
Cryptantha barbigera	0.04	1
Cryptantha pterocarya	1.04	5
Daucus pusillus	0.04	1
Delphinium scaposum	0.04	1
Descurania pinnata	0.58	3
Dichelostemma capitatum ssp. Pauciflor	0.13	3
Draba cuneifolia	0.08	2
Eriastrum diffusum	0.08	2
Eriogonum abertianum	0.04	1
Erodium cicutarium	0.50	3
Eschscholzia mexicana	0.38	2

Community Statistics by Cluster Group

Natural Community MU

Group 23

Number of Plots in Group: 6

Eucrypta micrantha	0.54	2
Euphorbia	0.08	2
Euphorbia eriantha	0.08	2
Euphorbia polycarpa	0.04	1
Filago	0.04	1
Gilia	0.04	1
Gilia stellata	0.17	4
Hedeona nanum var marocalyx	0.13	3
Lactuca serrulata	0.04	1
Lepidium lasiocarpum	4.04	6
Linanthus jonesii	0.04	1
Lupinus	0.04	1
Lupinus sparsiflorus	0.04	1
Myosurus cupulatus	0.04	1
Pectocarya platycarpa	0.04	1
Pectocarya recurvata	0.17	1
Penstemon	0.04	1
Phacelia	0.33	1
Phacelia ambigua	0.17	1
Phacelia coerulea	4.00	4
Plantago ovata	0.33	1
Plantago patagonica	0.38	3
Rafinesquia neomexicana	0.13	3
Senecio lemmonii	0.17	1
Sisymbrium irio	0.17	1
Sphaeralcea ambigua	0.08	2
Sphaeralcea coulteri	0.17	1
Stephanomeria pauciflora	0.25	3
Streptanthus carinatus	0.04	1
Stylocline micropoides	0.04	1
Thysanocarpis curvipes	1.38	5
Uropappus lindleyi	0.13	3
Yabea microcarpa	0.04	1

Sum of Percent Cover by Growth Form 17.46

Community Statistics by Cluster Group

Natural Community MU

Group 23

Number of Plots in Group: 6

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing species
Bromus rubens	0.88	2
Heteropogon contortus	0.04	1
Muhlenbergia porteri	2.83	3
Pleuraphis mutica	0.04	1
Poa bigelovii	1.00	4
Schismus arabicus	0.04	1
Tridens muticus	0.04	1
unknown grass 1	0.04	1
Vulpia octoflora	0.54	4

Sum of Percent Cover by Growth Form 5.46

Growth Form 6. Vines

Scientific Name	Average % Cover by Species	# of plots containing species
Janusia gracile	2.17	5
Matelea parvifolia	0.04	1
Phaseolus filiformis	0.04	1
Sarcostemma cynanchoides	0.04	1

Sum of Percent Cover by Growth Form 2.29

Growth Form 7. Ferns and Club Mosses

Scientific Name	Average % Cover by Species	# of plots containing species
Astrolepis cochisensis	0.46	5
Astrolepis sinuata sinuata	0.04	1
Notholaena standleyi	0.17	1
Pellaea truncata	0.13	3
Selaginella arizonica	22.17	6

Sum of Percent Cover by Growth Form 22.96

Community Statistics by Cluster Group

Natural Community MU

Group 25 *Number of Plots in Group:* 3

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing species
Parkinsonia microphylla	0.08	1
Quercus turbinella	0.08	1

Sum of Percent Cover by Growth Form 0.17

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing species
Acacia constricta	4.00	1
Acacia greggii	1.75	2
Agave deserti simplex	0.17	2
Aloysia wrightii	1.67	2
Artemisia ludoviciana	1.00	1
Atriplex canescens	0.08	1
Bernardia incana	0.33	1
Canotia holacantha	1.33	1
Crossosma bigelovii	0.33	1
Ephedra aspera	3.67	3
Ericameria laricifolia	0.67	2
Eriogonum fasiculatum	2.08	3
Eriogonum wrightii	2.33	2
Fouquieria splendens	1.08	3
Gallium stellatum	1.08	2
Gutierrezia sarothrae	1.00	1
Krameria erecta	0.08	1
Lycium	0.33	1
Menodora scabra	0.08	1
Psilostrophe cooperi	0.08	1
unknown shrub 1	0.08	1
Viguiera parishii	2.00	3
Yucca baccata	5.00	2
Zinnia acerosa	0.08	1

Sum of Percent Cover by Growth Form 30.33

Community Statistics by Cluster Group

Natural Community MU

Group 25

Number of Plots in Group: 3

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing species
Carnegiea gigantea	0.08	1
Cylindropuntia acanthocarpa	0.67	2
Echinocereus engelmannii	0.08	1
Opuntia	0.67	1
Opuntia phaeacantha	0.33	1

Sum of Percent Cover by Growth Form 1.83

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing species
Acourtia nana	0.08	1
Acourtia wrightii	0.17	2
Amsinckia intermedia	4.08	2
Androsace occidentalis	0.17	2
Castilleja lanata	0.08	1
Chenopodium murale	0.33	1
Cirsium neomexicana	0.08	1
Cryptantha pterocarya	1.75	3
Delphinium scaposum	0.08	1
Descurania pinnata	1.42	2
Dichelostemma capitatum ssp. Pauciflor	0.08	1
Draba cuneifolia	0.42	2
Erodium cicutarium	0.33	1
Eucrypta chrysanthemifolia	0.75	2
Filago arizonica	0.08	1
Gilia	0.33	1
Lepidium lasiocarpum	1.00	1
Phacelia coerulea	9.00	2
Plantago ovata	0.08	1
Rafinesquia californica	0.08	1
Rafinesquia neomexicana	0.75	2
Sisymbrium irio	0.08	1
Sphaeralcea ambigua	0.42	2
Streptanthus carinatus	1.00	2
Stylocline micropoides	0.08	1
Thysanocarpis curvipes	1.00	2
Uropappus lindleyi	0.17	2

Sum of Percent Cover by Growth Form 23.92

Community Statistics by Cluster Group

Natural Community MU

Group 25 — Number of Plots in Group: 3

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing species
Bromus carinatus	0.08	1
Bromus rubens	3.00	2
Muhlenbergia microsperma	0.33	1
Muhlenbergia porteri	25.00	3
Pleuraphis mutica	5.00	1
Poa bigelovii	2.67	3
Schismus arabicus	0.42	2
Tridens muticus	0.33	1
unknown grass 1	0.08	1
unknown grass 2	0.08	1
Vulpia octoflora	1.42	3

Sum of Percent Cover by Growth Form 38.42

Growth Form 6. Vines

Scientific Name	Average % Cover by Species	# of plots containing species
Janusia gracile	0.67	1
Sarcostemma cynanchoides	0.08	1

Sum of Percent Cover by Growth Form 0.75

Growth Form 7. Ferns and Club Mosses

Scientific Name	Average % Cover by Species	# of plots containing species
Astrolepis cochisensis	0.25	3
Astrolepis sinuata sinuata	0.08	1
Selaginella arizonica	8.67	2

Sum of Percent Cover by Growth Form 9.00

APPENDIX L

Mesquite Woodlands
Community Statistics by Cluster Group

Group 1 *Number of Plots in Group:* 8

Growth Form *1. Trees*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Olneya tesota	0.03	1
Parkinsonia florida	1.41	3
Phoradendron californicum	0.50	2
Prosopis velutina	53.00	8

Sum of Percent Cover by Growth Form 54.94

Growth Form *2. Shrubs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Ambrosia deltoidea	3.53	5
Ambrosia dumosa	2.13	4
Castela emoryi	0.06	2
Larrea divaricata tridentata	7.00	6
Lycium	2.56	4
Lycium andersonii	0.03	1

Sum of Percent Cover by Growth Form 15.31

Growth Form *3. Cactus*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Cylindropuntia leptocaulis	0.03	1
Ferocactus	0.03	1

Sum of Percent Cover by Growth Form 0.06

Growth Form *4. Herbs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Allionia incarnata	0.25	1
Ambrosia ambrosioides	0.03	1
Ambrosia confertifolia	0.03	1
Amsinckia intermedia	1.69	5
Astragalus	0.03	1
Bowlesia incana	0.78	4
Brassica tournefortii	0.03	1
Camissonia chamaenerioides	0.19	3
Cryptantha	0.03	1
Daucus pusillus	0.28	2
Descurania pinnata	0.56	4

Community Statistics by Cluster Group

Natural Community M

Group 1

Number of Plots in Group: 8

Draba cuneifolia	0.03	1
Eriophyllum lanosum	0.06	2
Erodium cicutarium	2.09	7
Erodium texanum	0.03	1
Evax multicaulis	0.25	2
Filago arizonica	3.50	5
Herniaria cinerea	0.63	2
Lepidium lasiocarpum	1.66	8
Lesquerella gordonii	1.13	7
Matricaria discoidea	0.13	1
Mentzelia	0.03	1
Oenothera	0.03	1
Pectocarya	0.06	2
Pectocarya platycarpa	3.66	4
Plagiobothrys	0.16	2
Plantago ovata	1.09	5
Sisymbrium irio	2.53	6
Sonchus oleraceus	0.03	1
Sphaeralcea coulteri	0.88	4
unknown herb 1	0.16	2

Sum of Percent Cover by Growth Form 22.03

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Bromus	0.03	1
Cynodon dactylon	0.03	1
Muhlenbergia microsperma	0.25	2
Schismus arabicus	22.75	8

Sum of Percent Cover by Growth Form 23.06

Community Statistics by Cluster Group

Natural Community M

Group 2 — *Number of Plots in Group:* 1

Growth Form *1. Trees*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Parkinsonia florida	3.00	1
Prosopis velutina	90.00	1

Sum of Percent Cover by Growth Form 93.00

Growth Form *2. Shrubs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Celtis pallida pallida	0.25	1
Larrea divaricata tridentata	3.00	1
Lycium	1.00	1

Sum of Percent Cover by Growth Form 4.25

Growth Form *4. Herbs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Amsinckia intermedia	15.00	1
Draba cuneifolia	0.25	1
Lappula occidentalis	0.25	1
Pectocarya	8.00	1
Sisymbrium irio	75.00	1

Sum of Percent Cover by Growth Form 98.50

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Schismus arabicus	3.00	1

Sum of Percent Cover by Growth Form 3.00

Community Statistics by Cluster Group

Natural Community M

Group 6

Number of Plots in Group: 2

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Prosopis velutina	7.00	2

Sum of Percent Cover by Growth Form 7.00

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia deltoidea	6.00	2
Ambrosia dumosa	0.50	1
Larrea divaricata tridentata	50.00	2
Lycium andersonii	0.25	2

Sum of Percent Cover by Growth Form 56.75

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Allionia incarnata	2.50	1
Amsinckia intermedia	0.63	2
Astragalus	0.50	1
Bowlesia incana	0.13	1
Camissonia chamaenerioides	0.13	1
Crassula connata	0.13	1
Cryptantha	0.13	1
Daucus pusillus	0.25	2
Draba cuneifolia	0.13	1
Eriophyllum lanosum	0.13	1
Erodium cicutarium	45.00	2
Erodium texanum	0.50	1
Evax multicaulis	1.00	1
Filago arizonica	3.00	2
Herniaria cinerea	3.50	2
Lepidium lasiocarpum	0.50	1
Lesquerella gordonii	0.50	1
Pectocarya	0.50	1
Plagiobothrys	0.13	1
Plantago ovata	0.50	1
Sisymbrium irio	1.00	1
Sphaeralcea coulteri	0.63	2

Sum of Percent Cover by Growth Form 61.38

Community Statistics by Cluster Group

Natural Community M

Group 6 — *Number of Plots in Group:* 2

Growth Form *5. Grasses and Sedges*

Scientific Name	Average % Cover by Species	# of plots containing
Muhlenbergia microsperma	2.63	2
Schismus arabicus	6.50	2
Vulpia octoflora	1.00	1

Sum of Percent Cover by Growth Form 10.13

Community Statistics by Cluster Group

Natural Community M

Group 7

Number of Plots in Group: 2

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Prosopis velutina	60.50	2

Sum of Percent Cover by Growth Form 60.50

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia deltoidea	0.63	2
Larrea divaricata tridentata	33.50	2
Lycium	0.13	1
Lycium andersonii	2.00	1

Sum of Percent Cover by Growth Form 36.25

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia ambrosioides	0.13	1
Ambrosia confertifolia	0.50	1
Amsinckia intermedia	1.50	2
Bowlesia incana	5.50	1
Crassula connata	0.13	1
Cryptantha	0.50	1
Daucus pusillus	1.00	1
Draba cuneifolia	0.13	1
Erodium cicutarium	46.00	2
Erodium texanum	0.13	1
Evax multicaulis	0.50	1
Filago arizonica	1.50	1
Herniaria cinerea	1.00	1
Lepidium lasiocarpum	0.25	2
Lesquerella gordonii	6.50	2
Matricaria discoidea	0.50	1
Oenothera	0.13	1
Parietaria floridana	0.50	1
Plagiobothrys	0.50	1
Plantago ovata	0.63	2
Sisymbrium irio	1.00	1
Sonchus oleraceus	0.13	1
Sphaeralcea coulteri	1.50	2
Uropappus lindleyi	0.13	1

Sum of Percent Cover by Growth Form 70.25

Community Statistics by Cluster Group

Natural Community M

Group 7

Number of Plots in Group: 2

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Cynodon dactylon	0.50	1
Muhlenbergia microsperma	63.50	2
Poa bigelovii	0.13	1
Schismus arabicus	12.00	1
Vulpia octoflora	0.25	2

Sum of Percent Cover by Growth Form 76.38

APPENDIX M

Mountain Xeroriparian Scrub
Community Statistics by Cluster Group

Group **1** *Number of Plots in Group:* **4**

Growth Form ***1. Trees***

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Olneya tesota	2.00	3
Parkinsonia microphylla	11.50	4
Phoradendron californicum	0.06	1

Sum of Percent Cover by Growth Form **13.56**

Growth Form ***2. Shrubs***

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Acacia constricta	7.00	3
Acacia greggii	2.50	3
Ambrosia deltoidea	3.75	4
Ayenia filiformis	0.06	1
Ayenia microphylla	0.06	1
Brickellia coulteri	3.00	3
Brickellia fructescens	1.25	1
Calliandra eriophylla	4.25	4
Celtis pallida pallida	2.25	2
Ditaxis lanceolata	0.56	3
Encelia farinosa farinosa	2.25	3
Ephedra aspera	1.56	3
Eriogonum fasiculatum	1.25	3
Fagonia californica ssp longipes	0.75	2
Fouquieria splendens	0.56	3
Gallium stellatum	0.06	1
Hibiscus coulteri	0.06	1
Hibiscus denudatus	0.06	1
Hyptis emoryi	0.75	1
Jatropha cardiophylla	1.25	3
Krameria grayi	0.31	2
Larrea divaricata tridentata	0.56	3
Lycium	0.50	2
Lycium berlandieri	4.75	3
Menodora scabra	0.06	1
Mirabilis laevis v villosa	0.06	1
Tragia nepetifolia var dissecta	0.06	1
Trixis californica	1.31	4
Viguiera parishii	0.13	2

Sum of Percent Cover by Growth Form **41.00**

Community Statistics by Cluster Group

Natural Community MXR

Group 1 *Number of Plots in Group:* 4

Growth Form *3. Cactus*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Carnegiea gigantea	0.44	4
Cylindropuntia acanthocarpa	0.63	4
Cylindropuntia leptocaulis	0.06	1
Opuntia	0.50	2

Sum of Percent Cover by Growth Form 1.63

Growth Form *4. Herbs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Acleisanthes longiflora	0.06	1
Allionia incarnata	0.06	1
Ambrosia ambrosioides	0.56	2
Amsinckia tessellata	0.50	1
Calycoseris wrightii	0.25	1
Camissonia	0.38	3
Camissonia californica	0.25	1
Camissonia chamaenerioides	0.25	1
Caulanthus lasiophyllus	0.31	2
Chaenactis stevioides	0.13	2
Chenopodium neomexicana	0.13	2
Chorizanthe brevicornus	0.69	4
Chorizanthe rigida	0.06	1
Cryptantha barbigera	0.38	3
Cryptantha maritima	1.50	4
Cryptantha pterocarya	2.50	4
Descurania pinnata	0.81	3
Eriastrum diffusum	0.44	4
Eriogonum deflexum	0.06	1
Eriogonum inflatum	0.25	1
Eriophyllum lanosum	0.13	2
Eucrypta micrantha	0.50	2
Euphorbia albomarginata	0.06	1
Euphorbia arizonica	0.06	1
Euphorbia polycarpa	0.50	1
Filago	0.13	2

Community Statistics by Cluster Group

Natural Community MXR

Group 1

Number of Plots in Group: 4

Filago californica	0.06	1
Gilia	0.06	1
Gilia stellata	1.25	3
Herissantia crispa	0.50	1
Lepidium lasiocarpum	1.00	3
Lesquerella gordonii	0.25	1
Linanthus jonesii	0.38	3
Marina parryi	0.06	1
Mentzelia	0.06	1
Mentzelia involucrata	0.25	1
Nemacladus glanduliferous var. orienta	0.06	1
Pectocarya recurvata	1.00	3
Phacelia	0.75	2
Phacelia distans	0.50	1
Plantago patagonica	0.25	1
Silene	0.06	1
Silene antirrhina	0.06	1
Sphaeralcea ambigua	0.56	3
Stylocline micropoides	0.06	1
Thysanocarpis curvipes	0.06	1
Uropappus lindleyi	0.06	1

Sum of Percent Cover by Growth Form 18.25

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Aristida	0.06	1
Heteropogon contortus	0.13	2
Muhlenbergia porteri	0.06	1
Pennisetum ciliare	0.06	1
Pleuraphis rigida	0.06	1
Poa bigelovii	0.31	2
Schismus arabicus	2.00	4
Vulpia octoflora	2.25	3

Sum of Percent Cover by Growth Form 4.94

Growth Form *6. Vines*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Janusia gracile	1.50	3

Sum of Percent Cover by Growth Form 1.50

Community Statistics by Cluster Group

Natural Community MXR

Group 1

Number of Plots in Group: 4

Growth Form *7. Ferns and Club Mosses*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Astrolepis cochisensis	0.56	2

Sum of Percent Cover by Growth Form 0.56

Community Statistics by Cluster Group

Natural Community MXR

Group 4

Number of Plots in Group: 7

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	1.04	3
Parkinsonia florida	1.14	1
Parkinsonia microphylla	3.14	6
Phoradendron californicum	0.21	3
Prosopis velutina	1.29	2
Vauquelinia californica ssp. Sonorensi	0.04	1

Sum of Percent Cover by Growth Form 6.86

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Abutilon incanum	0.07	2
Acacia constricta	3.00	5
Acacia greggii	1.00	3
Agave deserti simplex	0.04	1
Aloysia wrightii	0.04	1
Ambrosia deltoidea	0.46	2
Ambrosia dumosa	0.29	1
Artemisia ludoviciana	0.07	2
Ayenia microphylla	0.04	1
Baccharis sarothroides	0.14	1
Bernardia incana	0.71	2
Brickellia coulteri	0.43	1
Calliandra eriophylla	0.43	2
Carlowrightii arizonica	0.18	2
Celtis pallida pallida	0.43	2
Condalia warnockii	1.14	1
Coursetia glandulosa	0.14	1
Ditaxis lanceolata	0.36	4
Encelia farinosa farinosa	0.82	6
Ephedra aspera	1.71	4
Eriogonum fasiculatum	1.04	5
Eriogonum wrightii	0.71	3
Fouquieria splendens	0.86	4
Gallium stellatum	0.18	2
Gymnosperma glutinosum	0.04	1
Hibiscus coulteri	0.04	1

Community Statistics by Cluster Group

Natural Community MXR

Group 4 — Number of Plots in Group: 7

Jatropha cardiophylla	0.18	2
Krameria grayi	0.79	4
Larrea divaricata tridentata	1.86	5
Lycium	1.61	6
Menodora scabra	0.14	1
Mirabilis laevis v villosa	0.14	1
Sebastiania bilocularis	0.57	1
Senna covesii	0.04	1
Simmondsia chinensis	1.43	1
Tiquilia canescens	0.04	1
Tragia nepetifolia var dissecta	0.04	1
Trixis californica	0.21	3
unknown shrub 1	0.04	1
Viguiera parishii	0.29	1
Zinnia acerosa	0.04	1
Ziziphus obtusifolia canescens	0.14	1

Sum of Percent Cover by Growth Form 21.89

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.07	2
Cylindropuntia	0.04	1
Cylindropuntia acanthocarpa	0.39	4
Cylindropuntia leptocaulis	0.04	1
Echinocereus engelmannii	0.11	3
Ferocactus emoryi	0.07	2
Mammillaria grahamii	0.04	1
Opuntia	0.29	1
Opuntia engelmannii	0.04	1

Sum of Percent Cover by Growth Form 1.07

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Acourtia wrightii	0.04	1
Allionia incarnata	0.04	1
Ambrosia ambrosioides	0.18	2
Amsinckia intermedia	1.07	6
Amsinkia	0.14	1

Community Statistics by Cluster Group

Natural Community MXR

Group 4 *Number of Plots in Group:* 7

Androsace occidentalis	0.75	3
Astragalus nuttallianus	0.18	2
Calycoseris wrightii	0.07	2
Camissonia	0.18	2
Camissonia californica	0.29	5
Castilleja lanata	0.04	1
Caulanthus lasiophyllus	0.64	3
Chaenactis stevioides	0.29	5
Chenopodium neomexicana	0.71	3
Chorizanthe brevicornus	0.50	4
Chorizanthe rigida	0.14	1
Cryptantha barbigera	0.18	2
Cryptantha maritima	0.14	1
Cryptantha micrantha	0.04	1
Cryptantha pterocarya	2.14	5
Daucus pusillus	0.21	3
Delphinium scaposum	0.07	2
Descurania pinnata	0.68	5
Dichelostemma capitatum ssp. Pauciflor	0.07	2
Ditaxis neomexicana	0.07	2
Draba cuneifolia	0.29	5
Eriastrum diffusum	0.07	2
Eriogonum abertianum	0.07	2
Eriogonum deflexum	0.04	1
Eriogonum inflatum	0.04	1
Eriogonum maculatum	0.32	2
Eriogonum thomasii	0.04	1
Eriophyllum lanosum	0.07	2
Erodium cicutarium	1.75	4
Eschscholzia mexicana	0.07	2
Eucrypta micrantha	1.29	4
Euphorbia	0.04	1
Euphorbia albomarginata	0.04	1
Euphorbia polycarpa	0.04	1
Filago	0.11	3
Filago arizonica	0.04	1
Gilia	0.54	4
Gilia stellata	0.32	2
Hedeona nanum var marocalyx	0.18	2

Community Statistics by Cluster Group

Natural Community MXR

Group 4 — *Number of Plots in Group:* 7

Lepidium lasiocarpum	3.00	6
Lesquerella gordonii	1.18	4
Linanthus jonesii	0.18	5
Lotus	0.04	1
Lupinus	0.04	1
Lupinus sparsiflorus	0.21	3
Marina parryi	0.04	1
Mentzelia	0.07	2
Pectocarya	0.18	2
Pectocarya recurvata	0.07	2
Penstemon pseudospectabilis	0.04	1
Perityle emoryii	0.04	1
Phacelia	0.32	2
Phacelia ambigua	0.50	5
Phacelia coerulea	1.61	4
Pholistoma auritum var arizonicum	1.04	4
Plantago ovata	0.54	4
Plantago patagonica	0.36	3
Rafinesquia californica	0.04	1
Rafinesquia neomexicana	0.11	3
Silene antirrhina	0.18	2
Sisymbrium irio	0.75	4
Sonchus oleraceus	0.04	1
Sphaeralcea ambigua	0.18	2
Sphaeralcea coulteri	0.07	2
Stephanomeria pauciflora	0.18	2
Stylocline micropoides	0.18	5
Thysanocarpis curvipes	0.11	3
unknown herb 1	0.04	1
Uropappus lindleyi	0.04	1

Sum of Percent Cover by Growth Form 25.50

Growth Form 5. Grasses and Sedges

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Aristida adsensionis	0.04	1
Aristida purpurea	0.04	1
Bouteloua curtipendula	0.04	1
Bromus carinatus	0.04	1

Community Statistics by Cluster Group

Natural Community MXR

Group 4

Number of Plots in Group: 7

Bromus rubens	2.14	3
Erioneuron pulchellum	0.04	1
Muhlenbergia porteri	1.29	3
Pleuraphis	0.71	1
Pleuraphis mutica	0.14	1
Pleuraphis rigida	0.29	1
Poa bigelovii	1.61	6
Schismus arabicus	3.04	5
Vulpia octoflora	0.89	5

Sum of Percent Cover by Growth Form 10.29

Growth Form 6. Vines

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Antirrhinum filipes	0.04	1
Cucurbita digitata	0.04	1
Janusia gracile	0.64	4
Sarcostemma cynanchoides	0.04	1

Sum of Percent Cover by Growth Form 0.75

Growth Form 7. Ferns and Club Mosses

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Notholaena standleyi	0.04	1
Pellaea truncata	0.07	2
Selaginella arizonica	1.43	1

Sum of Percent Cover by Growth Form 1.54

Community Statistics by Cluster Group

Natural Community MXR

Group 6

Number of Plots in Group: 2

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	0.13	1
Parkinsonia florida	19.00	2
Phoradendron californicum	0.13	1
Prosopis velutina	3.00	1

Sum of Percent Cover by Growth Form 22.25

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Acacia constricta	0.13	1
Acacia greggii	3.50	1
Adenophyllum porophylloides	0.13	1
Ambrosia deltoidea	0.13	1
Anisacathus thurberi	2.00	1
Atriplex canescens	0.13	1
Ditaxis lanceolata	0.50	1
Encelia farinosa farinosa	2.00	1
Ephedra aspera	0.13	1
Eriogonum fasiculatum	1.50	1
Fouquieria splendens	1.00	1
Gallium stellatum	0.13	1
Hyptis emoryi	1.00	1
Lycium	1.50	2
Mirabilis laevis v villosa	0.13	1
Psilostrophe cooperi	0.13	1
Trixis californica	0.50	1

Sum of Percent Cover by Growth Form 14.50

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.13	1
Cylindropuntia acanthocarpa	0.50	1

Sum of Percent Cover by Growth Form 0.63

Community Statistics by Cluster Group

Natural Community MXR

Group 6 *Number of Plots in Group:* 2

Growth Form ***4. Herbs***

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Allionia incarnata	0.13	1
Ambrosia ambrosioides	2.00	1
Amsinckia intermedia	0.63	2
Androsace occidentalis	0.13	1
Calycoseris wrightii	0.13	1
Camissonia	0.13	1
Camissonia californica	0.25	2
Camissonia chamaenerioides	0.13	1
Caulanthus lasiophyllus	0.50	1
Chaenactis stevioides	0.13	1
Chenopodium neomexicana	0.13	1
Chorizanthe brevicornus	0.13	1
Cryptantha maritima	0.63	2
Cryptantha micrantha	0.13	1
Cryptantha pterocarya	1.50	2
Descurania pinnata	0.50	1
Draba cuneifolia	0.13	1
Eriastrum diffusum	0.13	1
Eriogonum	0.13	1
Eriogonum abertianum	0.13	1
Eriogonum deflexum	0.13	1
Eriogonum inflatum	0.13	1
Eriophyllum lanosum	0.13	1
Erodium cicutarium	0.50	1
Eschscholzia mexicana	0.13	1
Eucrypta micrantha	2.63	2
Euphorbia eriantha	0.13	1
Euphorbia pediculifera	0.13	1
Euphorbia polycarpa	0.13	1
Filago	0.25	2
Gilia stellata	0.63	2
Lappula occidentalis	0.13	1
Lepidium lasiocarpum	1.63	2
Lesquerella gordonii	0.13	1
Linanthus jonesii	0.25	2
Lupinus sparsiflorus	0.13	1
Machaeranthera tagetina	0.13	1
Marina parryi	0.13	1
Mentzelia affinis	0.50	1

Community Statistics by Cluster Group

Natural Community MXR

Group 6 — Number of Plots in Group: 2

Nemacladus glanduliferous var. orienta	0.13	1
Parietaria floridana	0.13	1
Pectocarya recurvata	0.50	1
Phacelia ambigua	1.00	2
Phacelia coerulea	2.00	1
Pholistoma auritum var arizonicum	0.13	1
Plagiobothrys jonesii	0.13	1
Plantago ovata	0.13	1
Rafinesquia neomexicana	0.13	1
Silene antirrhina	0.13	1
Sphaeralcea coulteri	0.13	1

Sum of Percent Cover by Growth Form 20.00

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Aristida purpurea	0.50	1
Bromus rubens	0.13	1
Heteropogon contortus	0.13	1
Pleuraphis	0.13	1
Poa bigelovii	5.00	1
Schismus arabicus	1.63	2
Vulpia octoflora	0.25	2

Sum of Percent Cover by Growth Form 7.75

Growth Form 6. Vines

Scientific Name	Average % Cover by Species	# of plots containing
Janusia gracile	0.13	1
Sarcostemma cynanchoides	0.13	1

Sum of Percent Cover by Growth Form 0.25

Growth Form 7. Ferns and Club Mosses

Scientific Name	Average % Cover by Species	# of plots containing
Selaginella arizonica	0.13	1

Sum of Percent Cover by Growth Form 0.13

Community Statistics by Cluster Group

Natural Community MXR

Group 9

Number of Plots in Group: 1

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Parkinsonia microphylla	7.00	1
Phoradendron californicum	1.00	1
Prosopis velutina	1.00	1

Sum of Percent Cover by Growth Form 9.00

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Acacia constricta	25.00	1
Acacia greggii	0.25	1
Brickellia coulteri	0.25	1
Calliandra eriophylla	5.00	1
Condalia warnockii	0.25	1
Ephedra aspera	15.00	1
Fouquieria splendens	0.25	1
Krameria grayi	2.00	1
Larrea divaricata tridentata	2.00	1
Lycium	2.00	1
Senna covesii	0.25	1
Tragia nepetifolia var dissecta	0.25	1
Ziziphus obtusifolia canescens	0.25	1

Sum of Percent Cover by Growth Form 52.75

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	1.00	1
Cylindropuntia acanthocarpa	1.00	1
Cylindropuntia leptocaulis	4.00	1
Echinocereus engelmannii	0.25	1
Opuntia	0.25	1

Sum of Percent Cover by Growth Form 6.50

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Acleisanthes longiflora	1.00	1
Acourtia wrightii	2.00	1

Community Statistics by Cluster Group

Natural Community MXR

Group 9

Number of Plots in Group: 1

Ambrosia confertifolia	0.25	1
Amsinckia intermedia	7.00	1
Astragalus arizonicus	0.25	1
Astragalus nuttallianus	0.25	1
Calycoseris wrightii	0.25	1
Castilleja exserta ssp. Exserta	0.25	1
Caulanthus lasiophyllus	0.25	1
Chaenactis stevioides	0.25	1
Chenopodium neomexicana	0.25	1
Chorizanthe brevicornus	0.25	1
Cryptantha barbigera	2.00	1
Cryptantha pterocarya	4.00	1
Daucus pusillus	1.00	1
Descurania pinnata	3.00	1
Dichelostemma capitatum ssp. Pauciflor	0.25	1
Ditaxis neomexicana	0.25	1
Draba cuneifolia	1.00	1
Eriastrum diffusum	0.25	1
Eriogonum abertianum	1.00	1
Eriogonum thomasii	1.00	1
Erodium cicutarium	1.00	1
Eucrypta micrantha	0.25	1
Filago arizonica	1.00	1
Gilia stellata	1.00	1
Lappula occidentalis	2.00	1
Lepidium lasiocarpum	3.00	1
Lesquerella gordonii	3.00	1
Linanthus bigelovii	1.00	1
Lotus	0.25	1
Malocothrix sonoraae	0.25	1
Mentzelia	0.25	1
Nemacladus glanduliferous var. orienta	0.25	1
Phacelia ambigua	3.00	1
Phacelia coerulea	2.00	1
Plantago ovata	1.00	1
Plantago patagonica	0.25	1
Rafinesquia neomexicana	0.25	1
Silene antirrhina	5.00	1
Sisymbrium irio	0.25	1

Community Statistics by Cluster Group

Natural Community MXR

Group 9 — Number of Plots in Group: 1

Sphaeralcea laxa	0.25	1
Stephanomeria pauciflora	0.25	1
Stylocline micropoides	0.25	1
Uropappus lindleyi	0.25	1

Sum of Percent Cover by Growth Form 52.00

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Aristida	0.25	1
Bromus rubens	0.25	1
Muhlenbergia porteri	0.25	1
Poa bigelovii	10.00	1
Schismus arabicus	5.00	1
Trisetum interruptum	0.25	1
unknown grass 1	1.00	1
unknown grass 2	1.00	1
Vulpia octoflora	2.00	1

Sum of Percent Cover by Growth Form 20.00

Growth Form 6. Vines

Scientific Name	Average % Cover by Species	# of plots containing
Matelea parvifolia	0.25	1

Sum of Percent Cover by Growth Form 0.25

Community Statistics by Cluster Group

Natural Community MXR

Group 13

Number of Plots in Group: 1

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Prosopis velutina	1.00	1
Quercus turbinella	2.00	1

Sum of Percent Cover by Growth Form 3.00

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Abutilon incanum	0.25	1
Acacia greggii	15.00	1
Anisacathus thurberi	2.00	1
Artemisia ludoviciana	0.25	1
Bebbia juncea aspera	0.25	1
Brickellia atrostyloides	0.25	1
Brickellia coulteri	2.00	1
Calliandra eriophylla	0.25	1
Celtis pallida pallida	40.00	1
Coursetia glandulosa	10.00	1
Crossosma bigelovii	3.00	1
Ditaxis lanceolata	0.25	1
Ephedra aspera	5.00	1
Ericameria laricifolia	0.25	1
Eriogonum fasiculatum	1.00	1
Eriogonum wrightii	0.25	1
Forestiera phillyreiodes	2.00	1
Gymnosperma glutinosum	0.25	1
Justicia longii	0.25	1
Lycium andersonii	5.00	1
Lycium exsertum	5.00	1
Machaeranthera pinnatifida gooddingii	0.25	1
Tragia nepetifolia var dissecta	0.25	1
Trixis californica	1.00	1
unknown shrub 1	0.25	1
Viguiera parishii	1.00	1

Sum of Percent Cover by Growth Form 95.25

Community Statistics by Cluster Group

Natural Community MXR

Group 13

Number of Plots in Group: 1

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Acourtia nana	0.25	1
Amsinckia intermedia	2.00	1
Camissonia	0.25	1
Chenopodium neomexicana	1.00	1
Descurania pinnata	2.00	1
Ditaxis neomexicana	0.25	1
Eucrypta micrantha	3.00	1
Herissantia crispa	0.25	1
Lactuca serrulata	0.25	1
Lepidium lasiocarpum	4.00	1
Malvastrum bicuspidatum	0.25	1
Phacelia	1.00	1
Phacelia coerulea	3.00	1
Pholistoma auritum var arizonicum	1.00	1
Plantago ovata	0.25	1
Rafinesquia neomexicana	0.25	1
Salvia pinguifolia	5.00	1
Senecio lemmonii	0.25	1
Silene antirrhina	0.25	1
Sphaeralcea ambigua	0.25	1
Streptanthus carinatus	0.25	1
Trifolium wormskioldii	0.25	1

Sum of Percent Cover by Growth Form 25.25

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Bromus rubens	0.25	1
Muhlenbergia porteri	0.25	1
Poa bigelovii	2.00	1

Sum of Percent Cover by Growth Form 2.50

Growth Form 6. Vines

Scientific Name	Average % Cover by Species	# of plots containing
Galium aparine	0.25	1
Janusia gracile	1.00	1
Nissolia schottii	0.25	1
Rhynchosia senna var. texana	0.25	1

Sum of Percent Cover by Growth Form 1.75

Community Statistics by Cluster Group

Natural Community **MXR**

Group 13

Number of Plots in Group: 1

Growth Form *7. Ferns and Club Mosses*

Scientific Name	Average % Cover by Species	# of plots containing
Pellaea truncata	0.25	1

Sum of Percent Cover by Growth Form 0.25

Community Statistics by Cluster Group

Natural Community MXR

Group 16 *Number of Plots in Group:* 1

Growth Form 1. Trees

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Parkinsonia microphylla	5.00	1
Prosopis velutina	6.00	1

Sum of Percent Cover by Growth Form 11.00

Growth Form 2. Shrubs

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Acacia constricta	1.00	1
Acacia greggii	4.00	1
Aloysia wrightii	1.00	1
Canotia holacantha	0.25	1
Celtis pallida pallida	6.00	1
Ephedra aspera	1.00	1
Eriogonum fasiculatum	1.00	1
Eriogonum wrightii	0.25	1
Fouquieria splendens	0.25	1
Krameria grayi	0.25	1
Lycium	4.00	1
Menodora scabra	1.00	1
Psilostrophe cooperi	0.25	1
Trixis californica	0.25	1
unknown shrub 1	0.25	1
Viguiera parishii	3.00	1

Sum of Percent Cover by Growth Form 23.75

Growth Form 4. Herbs

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Ambrosia ambrosioides	2.00	1
Amsinckia intermedia	3.00	1
Camissonia	0.25	1
Caulanthus lasiophyllus	0.25	1
Cryptantha pterocarya	3.00	1
Daucus pusillus	0.25	1
Delphinium scaposum	0.25	1
Descurania pinnata	0.25	1
Dichelostemma capitatum ssp. Pauciflor	0.25	1

Community Statistics by Cluster Group

Natural Community MXR

Group 16 — Number of Plots in Group: 1

Draba cuneifolia	0.25	1
Eriastrum diffusum	0.25	1
Erodium cicutarium	2.00	1
Eucrypta micrantha	1.00	1
Euphorbia	0.25	1
Gilia stellata	0.25	1
Hedeona nanum var marocalyx	0.25	1
Lactuca serrulata	0.25	1
Lepidium lasiocarpum	4.00	1
Lesquerella tenella	0.25	1
Linanthus jonesii	0.25	1
Lupinus sparsiflorus	0.25	1
Pectocarya recurvata	0.25	1
Phacelia coerulea	15.00	1
Plantago patagonica	0.25	1
Rafinesquia neomexicana	0.25	1
Silene antirrhina	0.25	1
Sisymbrium irio	1.00	1
Stephanomeria pauciflora	0.25	1
Streptanthus carinatus	0.25	1
Stylocline micropoides	0.25	1
Uropappus lindleyi	1.00	1
Verbena neomexicana	0.25	1

Sum of Percent Cover by Growth Form 37.75

Growth Form 5. Grasses and Sedges

Scientific Name	Average % Cover by Species	# of plots containing
Aristida purpurea	0.25	1
Bromus carinatus	0.25	1
Bromus rubens	0.25	1
Muhlenbergia porteri	20.00	1
Poa bigelovii	6.00	1
Schismus arabicus	0.25	1
Vulpia octoflora	3.00	1

Sum of Percent Cover by Growth Form 30.00

Community Statistics by Cluster Group

Natural Community MXR

Group 16

Number of Plots in Group: 1

Growth Form *6. Vines*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Lyrocarpa coulteri	0.25	1
Sarcostemma cynanchoides	0.25	1

Sum of Percent Cover by Growth Form 0.50

APPENDIX N

Valley Xeroriparian Scrub
Community Statistics by Cluster Group

Group 1 *Number of Plots in Group:* 6

Growth Form *1. Trees*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Olneya tesota	5.17	4
Parkinsonia florida	1.33	1
Parkinsonia microphylla	27.50	6
Phoradendron californicum	0.50	3
Prosopis velutina	1.00	2

Sum of Percent Cover by Growth Form 35.50

Growth Form *2. Shrubs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Abutilon incanum	0.04	1
Acacia constricta	3.00	4
Ambrosia deltoidea	2.92	6
Brickellia coulteri	0.38	3
Calliandra eriophylla	1.71	3
Celtis pallida pallida	1.00	3
Ditaxis lanceolata	0.25	3
Encelia farinosa farinosa	0.67	2
Ephedra aspera	0.04	1
Eriogonum fasiculatum	0.17	1
Fagonia californica ssp longipes	0.04	1
Fouquieria splendens	0.33	2
Hibiscus coulteri	0.04	1
Jatropha cardiophylla	0.21	2
Krameria grayi	0.54	3
Larrea divaricata tridentata	2.17	6
Lycium	1.50	3
Lycium andersonii	0.50	1
Lycium berlandieri	2.33	2
Lycium fremontii	0.17	1
Lycium parishii	0.17	1
Mirabilis laevis v villosa	0.17	1
Senna covesii	0.21	2
Tragia nepetifolia var dissecta	0.04	1
Trixis californica	0.42	4
unknown shrub 1	0.21	2

Sum of Percent Cover by Growth Form 19.21

Community Statistics by Cluster Group

Natural Community VXR

Group 1

Number of Plots in Group: 6

Growth Form 3. Cactus

Scientific Name	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.17	4
Cylindropuntia acanthocarpa	0.46	5
Cylindropuntia leptocaulis	0.08	2

Sum of Percent Cover by Growth Form 0.71

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia ambrosioides	0.17	1
Amsinckia intermedia	1.00	2
Amsinkia	0.17	1
Astragalus nuttallianus	0.04	1
Calycoseris wrightii	0.08	2
Camissonia	0.08	2
Camissonia californica	0.33	1
Camissonia chamaenerioides	0.38	2
Caulanthus lasiophyllus	1.17	3
Chaenactis carphoclinia	0.17	1
Chaenactis stevioides	0.13	3
Chenopodium neomexicana	0.17	1
Chorizanthe brevicornus	0.63	4
Chorizanthe rigida	0.33	1
Cryptantha barbigera	0.67	2
Cryptantha maritima	0.33	2
Cryptantha pterocarya	2.50	5
Daucus pusillus	0.17	1
Delphinium scaposum	0.04	1
Descurania pinnata	1.21	4
Draba cuneifolia	0.54	2
Eriastrum diffusum	0.04	1
Eriogonum deflexum	0.04	1
Eriophyllum lanosum	0.21	2
Erodium cicutarium	0.04	1
Eschscholzia mexicana	0.04	1
Eucrypta micrantha	1.17	3

Community Statistics by Cluster Group

Natural Community VXR

Group 1 *Number of Plots in Group:* 6

Euphorbia	0.17	1
Euphorbia albomarginata	0.04	1
Filago	0.04	1
Filago arizonica	0.13	3
Gilia	1.21	2
Gilia stellata	0.04	1
Lepidium lasiocarpum	6.83	6
Lesquerella gordonii	2.54	5
Linanthus jonesii	0.25	3
Lupinus sparsiflorus	0.13	3
Mentzelia	0.17	1
Parietaria floridana	1.00	1
Pectocarya	0.33	1
Pectocarya platycarpa	0.83	3
Pectocarya recurvata	1.00	4
Perityle emoryii	0.88	2
Phacelia	0.88	2
Phacelia ambigua	0.33	1
Phacelia coerulea	0.83	1
Phacelia distans	0.50	1
Pholistoma auritum var arizonicum	0.33	1
Plantago ovata	0.71	4
Rafinesquia neomexicana	0.67	1
Silene antirrhina	0.04	1
Sphaeralcea ambigua	0.17	1
Sphaeralcea coulteri	0.21	2
Stylocline micropoides	0.08	2
unknown herb 1	0.04	1

Sum of Percent Cover by Growth Form 32.21

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Aristida	0.04	1
Aristida purpurea	0.04	1
Poa bigelovii	0.50	3
Schismus arabicus	7.04	6
unknown grass 1	0.04	1
Vulpia octoflora	0.88	4

Sum of Percent Cover by Growth Form 8.54

Community Statistics by Cluster Group

Natural Community VXR

Group 1

Number of Plots in Group: 6

Growth Form *6. Vines*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Janusia gracile	0.71	4

Sum of Percent Cover by Growth Form 0.71

Growth Form *7. Ferns and Club Mosses*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Astrolepis cochisensis	0.04	1
Notholaena standleyi	0.04	1

Sum of Percent Cover by Growth Form 0.08

Community Statistics by Cluster Group

Natural Community VXR

Group 2

Number of Plots in Group: 15

Growth Form *1. Trees*

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	1.80	6
Parkinsonia florida	5.40	9
Parkinsonia microphylla	2.62	8
Phoradendron californicum	1.13	7
Prosopis velutina	5.80	10

Sum of Percent Cover by Growth Form 16.75

Growth Form *2. Shrubs*

Scientific Name	Average % Cover by Species	# of plots containing
Abutilon incanum	0.07	1
Acacia constricta	1.28	5
Acacia greggii	3.45	8
Aloysia wrightii	0.07	1
Ambrosia deltoidea	1.40	9
Ambrosia dumosa	0.07	1
Anisacathus thurberi	0.20	2
Atriplex canescens	0.02	1
Baccharis sarothroides	0.02	1
Bebbia juncea aspera	0.40	2
Brickellia coulteri	0.18	4
Calliandra eriophylla	0.02	1
Celtis pallida pallida	0.15	2
Condalia warnockii	1.08	3
Ditaxis lanceolata	0.08	5
Encelia farinosa farinosa	0.10	3
Ephedra aspera	0.27	3
Fagonia californica ssp longipes	0.08	2
Fouquieria splendens	0.02	1
Hymenoclea salsola	1.53	4
Hyptis emoryi	0.08	2
Krameria grayi	0.17	3
Larrea divaricata tridentata	2.88	13
Lycium	0.87	6
Lycium andersonii	0.67	3
Lycium berlandieri	0.13	1
Lycium macrodon	0.13	1

Community Statistics by Cluster Group

Natural Community VXR

Group 2

Number of Plots in Group: 15

Lycium parishii	0.20	1
Sebastiania bilocularis	0.02	1
Senna covesii	0.07	1
Trixis californica	0.15	2
Ziziphus obtusifolia canescens	0.37	5

Sum of Percent Cover by Growth Form 16.22

Growth Form 3. Cactus

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Carnegiea gigantea	0.05	3
Cylindropuntia acanthocarpa	0.07	4
Cylindropuntia leptocaulis	0.05	3
Mammillaria grahamii	0.02	1

Sum of Percent Cover by Growth Form 0.18

Growth Form 4. Herbs

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Acourtia nana	0.20	1
Acourtia wrightii	0.02	1
Allionia incarnata	0.05	3
Ambrosia ambrosioides	0.95	7
Ambrosia confertifolia	0.07	1
Amsinckia intermedia	0.60	9
Amsinckia tessellata	0.22	3
Amsinkia	0.03	2
Astragalus nuttallianus	0.03	2
Calycoseris wrightii	0.07	4
Camissonia	0.05	3
Camissonia boothii ssp condensata	0.02	1
Camissonia californica	0.17	4
Camissonia chamaenerioides	0.13	5
Camissonia claviformis	0.02	1
Caulanthus lasiophyllus	0.63	12
Chaenactis stevioides	0.28	7
Chenopodium murale	0.02	1
Chenopodium neomexicana	0.05	3
Chorizanthe brevicornus	0.40	12
Chorizanthe rigida	0.12	4

Community Statistics by Cluster Group

Natural Community VXR

Group 2

Number of Plots in Group: 15

Crassula connata	0.10	3
Cryptantha barbigera	0.43	7
Cryptantha maritima	0.73	10
Cryptantha micrantha	0.30	4
Cryptantha pterocarya	2.83	14
Daucus pusillus	0.05	3
Descurania pinnata	0.52	11
Ditaxis neomexicana	0.02	1
Draba cuneifolia	0.12	7
Eriastrum diffusum	0.22	6
Eriogonum abertianum	0.03	2
Eriogonum deflexum	0.08	5
Eriogonum maculatum	0.02	1
Eriogonum thomasii	0.08	2
Eriophyllum lanosum	0.08	5
Erodium cicutarium	1.18	6
Erodium texanum	0.02	1
Eschscholzia mexicana	0.05	3
Eucrypta micrantha	0.25	9
Euphorbia	0.17	4
Euphorbia albomarginata	0.07	4
Euphorbia arizonica	0.02	1
Euphorbia polycarpa	0.10	3
Evax multicaulis	0.07	1
Filago	0.12	4
Filago arizonica	0.03	2
Gilia	0.12	4
Gilia stellata	0.13	5
Langloisia setosissima ssp. Setosissim	0.02	1
Lappula occidentalis	0.02	1
Lepidium lasiocarpum	1.98	14
Lesquerella gordonii	0.68	14
Linanthus jonesii	0.15	6
Loeflingia squarrosa ssp. Cactorum	0.13	1
Lotus salsuginosus	0.02	1
Lotus strigosa var tomentellum	0.02	1
Lupinus	0.02	1
Lupinus Arizonicus	0.07	1
Lupinus concinnus	0.02	1

Community Statistics by Cluster Group

Natural Community VXR

Group 2 *Number of Plots in Group:* 15

Lupinus sparsiflorus	0.13	5
Marina parryi	0.03	2
Mentzelia	0.02	1
Mentzelia affinis	0.03	2
Monoptilon bellioides	0.03	2
Nama hispidum	0.07	1
Nemacladus glanduliferous var. orienta	0.02	1
Nicotiana obtusifolia	0.73	7
Orobanche cooperi	0.02	1
Parietaria floridana	0.02	1
Pectocarya	1.35	5
Pectocarya platycarpa	0.20	3
Pectocarya recurvata	0.97	7
Perityle emoryii	0.03	2
Phacelia	0.08	5
Phacelia ambigua	0.10	3
Phacelia coerulea	0.30	5
Phacelia distans	0.02	1
Plagiobothrys	0.02	1
Plantago ovata	0.57	6
Plantago patagonica	0.03	2
Rafinesquia neomexicana	0.02	1
Salvia columbariae	0.03	2
Silene antirrhina	0.12	7
Sisymbrium irio	0.53	8
Sphaeralcea	0.02	1
Sphaeralcea ambigua	0.03	2
Sphaeralcea coulteri	0.03	2
Stylocline micropoides	0.32	9
unknown herb 1	0.02	1

Sum of Percent Cover by Growth Form 21.05

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Aristida	0.03	2
Aristida purpurea	0.20	2
Bromus rubens	0.10	3
Muhlenbergia microsperma	0.15	2

Community Statistics by Cluster Group

Natural Community VXR

Group 2 *Number of Plots in Group:* 15

Muhlenbergia porteri	0.03	2
Pleuraphis mutica	0.02	1
Poa bigelovii	0.60	8
Schismus arabicus	8.48	15
unknown grass 1	0.02	1
Vulpia octoflora	0.42	8

Sum of Percent Cover by Growth Form 10.05

Growth Form *6. Vines*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Asclepias subulata	0.07	1
Clematis drummondii	0.02	1
Commicarpas scandens	0.03	2
Janusia gracile	0.02	1
Lyrocarpa coulteri	0.17	3
Maurandya antirrhinifolia	0.02	1

Sum of Percent Cover by Growth Form 0.32

Community Statistics by Cluster Group

Natural Community VXR

Group 9

Number of Plots in Group: 3

Growth Form 1. Trees

Scientific Name	Average % Cover by Species	# of plots containing
Olneya tesota	32.67	3
Parkinsonia microphylla	1.67	3
Prosopis velutina	1.33	1

Sum of Percent Cover by Growth Form 35.67

Growth Form 2. Shrubs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia deltoidea	0.33	1
Ditaxis lanceolata	0.25	3
Encelia farinosa farinosa	0.08	1
Hymenoclea salsola	0.33	1
Hyptis emoryi	0.42	2
Larrea divaricata tridentata	3.00	3
Lycium	0.33	1
Lycium berlandieri	3.33	1
Senna covesii	0.08	1

Sum of Percent Cover by Growth Form 8.17

Growth Form 4. Herbs

Scientific Name	Average % Cover by Species	# of plots containing
Ambrosia ambrosioides	1.00	2
Amsinckia intermedia	0.33	1
Amsinkia	0.42	2
Camissonia chamaenerioides	0.08	1
Caulanthus lasiophyllus	0.08	1
Chaenactis stevioides	0.33	1
Chenopodium murale	0.08	1
Chorizanthe brevicornus	0.33	1
Chorizanthe rigida	1.00	1
Cryptantha barbigera	0.67	1
Cryptantha maritima	0.67	1
Cryptantha pterocarya	1.67	3
Daucus pusillus	0.08	1
Descurania pinnata	0.42	2
Eriastrum diffusum	0.08	1

Community Statistics by Cluster Group

Natural Community VXR

Group 9

Number of Plots in Group: 3

Euphorbia	0.42	2
Euphorbia polycarpa	0.08	1
Gilia	0.17	2
Gilia stellata	0.08	1
Lepidium lasiocarpum	2.67	3
Lesquerella gordonii	0.42	2
Linanthus jonesii	0.08	1
Lupinus sparsiflorus	0.75	3
Nicotiana obtusifolia	0.08	1
Pectocarya	1.33	2
Phacelia	1.42	3
Salvia columbariae	0.08	1
Sisymbrium irio	3.00	2
Sphaeralcea ambigua	0.67	1
Stylocline micropoides	0.33	1

Sum of Percent Cover by Growth Form 18.83

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Erioneuron pulchellum	0.08	1
Poa bigelovii	0.08	1
Schismus arabicus	5.00	3

Sum of Percent Cover by Growth Form 5.17

Community Statistics by Cluster Group

Natural Community VXR

Group 21 *Number of Plots in Group:* 1

Growth Form *1. Trees*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Parkinsonia florida	35.00	1
Prosopis velutina	0.25	1

Sum of Percent Cover by Growth Form 35.25

Growth Form *2. Shrubs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Ambrosia deltoidea	0.25	1
Larrea divaricata tridentata	4.00	1
Lycium andersonii	15.00	1

Sum of Percent Cover by Growth Form 19.25

Growth Form *4. Herbs*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Amsinckia intermedia	6.00	1
Camissonia chamaenerioides	3.00	1
Caulanthus lasiophyllus	0.25	1
Cryptantha angustifolia	0.25	1
Cryptantha micrantha	0.25	1
Cryptantha pterocarya	0.25	1
Descurania pinnata	2.00	1
Eriophyllum lanosum	2.00	1
Erodium cicutarium	0.25	1
Eucrypta micrantha	0.25	1
Lepidium lasiocarpum	10.00	1
Lesquerella gordonii	0.25	1
Lupinus sparsiflorus	0.25	1
Parietaria floridana	2.00	1
Pectocarya platycarpa	12.00	1
Plantago ovata	3.00	1
Sisymbrium irio	10.00	1
Sphaeralcea coulteri	0.25	1

Sum of Percent Cover by Growth Form 52.25

Community Statistics by Cluster Group

Natural Community VXR

Group 21

Number of Plots in Group: 1

Growth Form *5. Grasses and Sedges*

Scientific Name	*Average % Cover by Species*	*# of plots containing*
Poa bigelovii	2.00	1
Schismus arabicus	50.00	1

Sum of Percent Cover by Growth Form 52.00

APPENDIX O

Braided Channel Floodplains
Community Statistics by Cluster Group

Group 1 *Number of Plots in Group:* 1

Growth Form *1. Trees*

ScientificName	*Average % Cover by Species*	*# of plots containing*
Parkinsonia florida	2.00	1
Phoradendron californicum	4.00	1
Prosopis velutina	0.25	1

Sum of Percent Cover by Growth Form 6.25

Growth Form *2. Shrubs*

ScientificName	*Average % Cover by Species*	*# of plots containing*
Acacia greggii	35.00	1
Ambrosia deltoidea	0.25	1
Baccharis sarothroides	0.25	1
Bebbia juncea aspera	0.25	1
Hymenoclea salsola	0.25	1
Larrea divaricata tridentata	13.00	1
Lycium andersonii	45.00	1

Sum of Percent Cover by Growth Form 94.00

Growth Form *4. Herbs*

ScientificName	*Average % Cover by Species*	*# of plots containing*
Ambrosia ambrosioides	0.25	1
Ambrosia confertifolia	0.25	1
Amsinckia intermedia	0.25	1
Bowlesia incana	0.25	1
Descurania pinnata	0.25	1
Eriophyllum lanosum	0.25	1
Erodium cicutarium	0.25	1
Lepidium lasiocarpum	1.00	1
Parietaria floridana	1.00	1
Pectocarya platycarpa	2.00	1
Plantago ovata	1.00	1
Sisymbrium irio	0.25	1

Sum of Percent Cover by Growth Form 7.00

Community Statistics by Cluster Group

Natural Community BCF

Group 1

Number of Plots in Group: 1

Growth Form *5. Grasses and Sedges*

ScientificName	*Average % Cover by Species*	*# of plots containing*
Poa bigelovii	0.25	1
Schismus arabicus	15.00	1

Sum of Percent Cover by Growth Form 15.25

Growth Form *6. Vines*

ScientificName	*Average % Cover by Species*	*# of plots containing*
Sarcostemma cynanchoides	0.25	1

Sum of Percent Cover by Growth Form 0.25

Community Statistics by Cluster Group

Natural Community BCF

Group 2 — Number of Plots in Group: 9

Growth Form 1. Trees

ScientificName	Average % Cover by Species	# of plots containing
Parkinsonia florida	0.39	5
Prosopis velutina	0.61	3

Sum of Percent Cover by Growth Form 1.00

Growth Form 2. Shrubs

ScientificName	Average % Cover by Species	# of plots containing
Acacia constricta	0.11	1
Acacia greggii	0.03	1
Ambrosia deltoidea	0.03	1
Baccharis sarothroides	0.47	3
Bebbia juncea aspera	0.08	3
Chilopsis linearis arcuata	0.42	5
Hymenoclea salsola	0.36	2
Larrea divaricata tridentata	0.06	2
Petalonyx thurberi	0.03	1

Sum of Percent Cover by Growth Form 1.58

Growth Form 4. Herbs

ScientificName	Average % Cover by Species	# of plots containing
Ambrosia ambrosioides	0.86	7
Ambrosia confertifolia	0.03	1
Amsinckia intermedia	0.75	8
Astragalus	0.03	1
Calycoseris wrightii	0.11	4
Camissonia	0.06	2
Camissonia boothii ssp condensata	0.03	1
Camissonia chamaenerioides	0.11	4
Caulanthus lasiophyllus	0.11	4
Chaenactis stevioides	0.39	8
Chenopodium neomexicana	0.03	1
Chorizanthe brevicornus	0.36	7
Chorizanthe rigida	0.11	4
Crassula connata	0.03	1
Cryptantha	0.06	2
Cryptantha barbigera	0.08	3

Community Statistics by Cluster Group

Natural Community BCF

Group 2

Number of Plots in Group: 9

Cryptantha maritima	0.61	5
Cryptantha micrantha	0.08	3
Cryptantha pterocarya	0.86	6
Daucus pusillus	0.03	1
Descurania pinnata	0.22	5
Ditaxis neomexicana	0.03	1
Draba cuneifolia	0.03	1
Eriastrum diffusum	0.03	1
Eriogonum deflexum	0.28	4
Eriophyllum lanosum	0.36	7
Erodium cicutarium	0.28	7
Erodium texanum	0.03	1
Eucrypta micrantha	0.03	1
Euphorbia albomarginata	0.08	3
Euphorbia polycarpa	0.17	3
Euphorbia setiloba	0.28	4
Gilia	0.67	1
Lappula occidentalis	0.08	3
Lepidium lasiocarpum	0.97	8
Lesquerella gordonii	0.58	8
Linanthus	0.03	1
Linanthus bigelovii	0.08	3
Linanthus jonesii	0.03	1
Lotus	0.03	1
Lotus strigosa var tomentellum	0.03	1
Lupinus concinnus	0.14	2
Lupinus sparsiflorus	1.53	5
Mentzelia	0.06	2
Monoptilon bellioides	0.06	2
Nicotiana obtusifolia	0.11	1
Parietaria floridana	0.03	1
Pectocarya	3.39	5
Pectocarya platycarpa	1.36	4
Phacelia ambigua	0.11	1
Plagiobothrys	0.03	1
Plantago ovata	0.08	3
Silene	0.08	3
Sisymbrium irio	0.11	4
Sphaeralcea	0.06	2

Community Statistics by Cluster Group

Natural Community BCF

Group 2 — Number of Plots in Group: 9

Sphaeralcea ambigua	0.03	1
Stylocline micropoides	0.06	2
unknown herb 1	0.03	1

Sum of Percent Cover by Growth Form 16.28

Growth Form 5. Grasses and Sedges

ScientificName	Average % Cover by Species	# of plots containing
Erioneuron pulchellum	0.03	1
Poa bigelovii	0.11	4
Schismus arabicus	5.50	8
Vulpia octoflora	0.14	2

Sum of Percent Cover by Growth Form 5.78

Growth Form 6. Vines

ScientificName	Average % Cover by Species	# of plots containing
Clematis drummondii	0.03	1

Sum of Percent Cover by Growth Form 0.03

Community Statistics by Cluster Group

Natural Community BCF

Group 3

Number of Plots in Group: 3

Growth Form 1. Trees

ScientificName	Average % Cover by Species	# of plots containing
Olneya tesota	18.33	2
Parkinsonia florida	36.67	3
Phoradendron californicum	2.00	2
Prosopis velutina	2.00	2

Sum of Percent Cover by Growth Form 59.00

Growth Form 2. Shrubs

ScientificName	Average % Cover by Species	# of plots containing
Acacia greggii	0.67	1
Baccharis sarothroides	0.08	1
Hymenoclea salsola	4.33	3
Larrea divaricata tridentata	0.08	1
Lycium	0.08	1
Lycium andersonii	2.33	2

Sum of Percent Cover by Growth Form 7.58

Growth Form 3. Cactus

ScientificName	Average % Cover by Species	# of plots containing
Cylindropuntia leptocaulis	0.33	1

Sum of Percent Cover by Growth Form 0.33

Growth Form 4. Herbs

ScientificName	Average % Cover by Species	# of plots containing
Ambrosia ambrosioides	0.67	2
Amsinckia intermedia	2.00	2
Camissonia chamaenerioides	0.42	2
Chaenactis stevioides	0.17	2
Cryptantha	1.67	1
Cryptantha maritima	0.33	1
Descurania pinnata	2.00	1
Draba cuneifolia	0.08	1
Eriogonum	0.08	1
Eriophyllum lanosum	0.08	1
Gilia	0.08	1
Lepidium lasiocarpum	3.75	3

Community Statistics by Cluster Group

Natural Community BCF

Group 3

Number of Plots in Group: 3

Lesquerella gordonii	0.33	1
Lotus salsuginosus	0.08	1
Lupinus concinnus	0.08	1
Lupinus sparsiflorus	0.17	2
Mentzelia	0.08	1
Parietaria floridana	3.33	1
Pectocarya	0.42	2
Pectocarya platycarpa	1.00	1
Phacelia	0.08	1
Plantago ovata	0.08	1
Sisymbrium irio	3.67	3
Stylocline micropoides	0.08	1

Sum of Percent Cover by Growth Form 20.75

Growth Form *5. Grasses and Sedges*

ScientificName	*Average % Cover by Species*	*# of plots containing*
Poa bigelovii	0.67	1
Schismus arabicus	43.33	3

Sum of Percent Cover by Growth Form 44.00

Community Statistics by Cluster Group

Natural Community BCF

Group 5

Number of Plots in Group: 6

Growth Form 1. Trees

ScientificName	Average % Cover by Species	# of plots containing
Olneya tesota	0.50	2
Parkinsonia florida	1.88	4
Parkinsonia microphylla	0.88	2
Phoradendron californicum	0.04	1
Prosopis velutina	0.21	2

Sum of Percent Cover by Growth Form 3.50

Growth Form 2. Shrubs

ScientificName	Average % Cover by Species	# of plots containing
Acacia greggii	0.21	2
Ambrosia deltoidea	0.38	2
Baccharis sarothroides	1.67	2
Chilopsis linearis arcuata	0.17	1
Hymenoclea salsola	1.50	3
Larrea divaricata tridentata	2.25	5
Lycium	0.04	1
Lycium andersonii	1.00	2

Sum of Percent Cover by Growth Form 7.21

Growth Form 3. Cactus

ScientificName	Average % Cover by Species	# of plots containing
Carnegiea gigantea	0.08	2
Cylindropuntia acanthocarpa	0.17	1
Cylindropuntia bigelovii	0.04	1
Echinocereus engelmannii	0.04	1
Ferocactus cylindraceus	0.04	1

Sum of Percent Cover by Growth Form 0.38

Growth Form 4. Herbs

ScientificName	Average % Cover by Species	# of plots containing
Ambrosia ambrosioides	3.67	2
Amsinckia intermedia	0.46	5
Camissonia	0.04	1
Camissonia boothii ssp condensata	0.04	1
Camissonia chamaenerioides	0.21	2

Community Statistics by Cluster Group

Natural Community BCF

Group 5 *Number of Plots in Group:* 6

Camissonia claviformis	0.04	1
Caulanthus lasiophyllus	0.21	2
Chenopodium	0.17	1
Chorizanthe brevicornus	0.67	2
Chorizanthe rigida	0.04	1
Cryptantha	0.17	1
Cryptantha maritima	0.71	3
Cryptantha micrantha	0.17	1
Cryptantha pterocarya	0.21	2
Descurania pinnata	0.75	5
Eriogonum deflexum	0.04	1
Eriophyllum lanosum	0.17	4
Erodium cicutarium	0.58	3
Eucrypta micrantha	0.17	1
Euphorbia	0.04	1
Euphorbia polycarpa	0.04	1
Gilia	0.04	1
Gilia stellata	0.04	1
Lappula occidentalis	0.04	1
Lepidium lasiocarpum	3.33	5
Lesquerella gordonii	0.25	3
Linanthus	0.04	1
Linanthus bigelovii	0.04	1
Lupinus concinnus	0.04	1
Lupinus sparsiflorus	0.42	3
Monoptilon bellioides	0.04	1
Oligomeris linifolia	0.04	1
Pectocarya	3.67	4
Pectocarya platycarpa	1.50	1
Pectocarya recurvata	0.33	1
Perityle emoryii	0.04	1
Phacelia	0.04	1
Plantago ovata	3.88	3
Salvia columbariae	0.04	1
Sisymbrium irio	0.33	2
Sphaeralcea ambigua	0.04	1
Stylocline micropoides	0.71	3

Sum of Percent Cover by Growth Form 23.50

Community Statistics by Cluster Group

Natural Community BCF

Group 5

Number of Plots in Group: 6

Growth Form *5. Grasses and Sedges*

ScientificName	*Average % Cover by Species*	*# of plots containing*
Poa bigelovii	0.21	2
Schismus arabicus	42.83	6
Vulpia octoflora	0.04	1

Sum of Percent Cover by Growth Form 43.08

Community Statistics by Cluster Group

Natural Community BCF

Group 14

Number of Plots in Group: 2

Growth Form 1. Trees

ScientificName	Average % Cover by Species	# of plots containing
Phoradendron californicum	5.50	2
Prosopis velutina	22.50	2

Sum of Percent Cover by Growth Form 28.00

Growth Form 2. Shrubs

ScientificName	Average % Cover by Species	# of plots containing
Acacia greggii	1.00	1
Ambrosia deltoidea	0.50	1
Baccharis sarothroides	0.50	1
Celtis pallida pallida	1.00	1
Larrea divaricata tridentata	14.50	2
Lycium	4.50	2

Sum of Percent Cover by Growth Form 22.00

Growth Form 4. Herbs

ScientificName	Average % Cover by Species	# of plots containing
Ambrosia ambrosioides	0.13	1
Amsinckia intermedia	2.50	2
Camissonia chamaenerioides	0.13	1
Caulanthus lasiophyllus	1.00	1
Cryptantha barbigera	0.50	1
Cryptantha maritima	0.13	1
Cryptantha pterocarya	0.13	1
Descurania pinnata	0.13	1
Draba cuneifolia	0.13	1
Eucrypta micrantha	0.50	1
Lappula occidentalis	1.63	2
Lesquerella gordonii	0.25	2
Parietaria floridana	0.13	1
Pectocarya	15.00	1
Pectocarya recurvata	2.50	1
Plantago ovata	0.63	2
Sisymbrium irio	1.00	1
Sphaeralcea	0.13	1
Sphaeralcea coulteri	0.13	1

Sum of Percent Cover by Growth Form 26.63

Community Statistics by Cluster Group

Natural Community BCF

Group 14

Number of Plots in Group: 2

Growth Form 5. Grasses and Sedges

ScientificName	Average % Cover by Species	# of plots containing
Poa bigelovii	0.63	2
Schismus arabicus	10.00	2
Vulpia octoflora	1.00	1

Sum of Percent Cover by Growth Form 11.63

Growth Form 6. Vines

ScientificName	Average % Cover by Species	# of plots containing
Clematis drummondii	0.50	1

Sum of Percent Cover by Growth Form 0.50

Appendix P - Natural Community Condition Assessment Plot Form

Plot Number______	Date_______	AS	EL	SL	Sample Area	GPS Unit Number	
Observer__________					Location	GPS Waypoints	
Natural Community 1							
Natural Community 2					Transect # _______		
Natural Community 3					Transect Distance ____		

Description

	Camera #		
Geology	Photo Notes & #s		
Soil Texture	Bedrock		
Landform	Rock		
	Gravel		
Comments	Sand		
	Soil		
	Litter		
	Biotic crust		
	Moss		

Disturbances	Plot Diagram		
Cowtrails		Roadway	
Cowprints		Car tracks	
Cow & horse dung		Motorcycles tracks	
Horse prints		Wildfire	
Trash		Water Erosion	
Fence	Camp Site	Wind Erosion	
		Flooding	
		Plant pedastaling	

Trees	*Olneya tesota*	desert ironwood		
Trees	*Prosopis velutina*	velvet mesquite		
Trees	*Parkinsonia florida*	blue paloverde		
Trees	*Parkinsonia microphylla*	foothill paloverde		
Trees	*Phoradendron californicum*	mistletoe		
Trees	Saguaro height (tall)	greater than 5 meters		
Cactacae	Saguaro height (medium)	1 to 5 meters		
Cactacae	Saguaro height (short)	less than 1 meters		
Cactacae	*Carnegiea gigantea*	saguaro		
Cactacae	*Cylindropuntia acanthocarpa*	buckhorn cholla		
Cactacae	*Cylindropuntia arbuscula*	Arizona pencil cholla		
Cactacae	*Cylindropuntia bigelovii*	teddybear cholla		
Cactacae	*Cylindropuntia fulgida*	chainfruit cholla		
Cactacae	*Cylindropuntia leptocaulis*	Christmas cholla		
Cactacae	*Cylindropuntia spinosior*	cane cholla		
Cactacae	*Echinocereus*	hedgehog cactus		
Cactacae	*Echinocereus engelmannii*	Engelmann's hedgehog		
Cactacae	*Echinocereus fendleri*	Boyce Thompson hedgehog		
Cactacae	*Ferocactus*	barrel cactus		
Cactacae	*Ferocactus cylindraceus*	mountain barrel cactus		
Cactacae	*Ferocactus emoryi*	barrel cactus		
Cactacae	*Ferocactus wislizeni*	fishhook barrelcactus		
Cactacae	*Mammillaria grahamii*	pincushion cactus		
Cactacae	*Mammillaria tetransitra*			
Cactacae	*Opuntia*	prickly pear cactus		
Cactacae	*Opuntia chlorotica*	pancake prickly-pear		
Cactacae	*Opuntia engelmannii*	Engelmann's prickly pear		
Cactacae	*Opuntia macrocentra*	shrub-sized prickly-pear		
Cactacae	*Opuntia phaeacantha*	brown-spine prickly pear		
Cactacae	*Peniocereus greggii*	night blooming cereus		

Shrubs	*Abulion incanum*			
Shrubs	*Acacia constricta*	whitethorn acacia		
Shrubs	*Acacia greggii*	catclaw acacia		
Shrubs	*Agave deserti simplex*	desert agave		
Shrubs	*Adenophyllum porophylloides*			
Shrubs	*Ambrosia deltoidea*	triangle-leaved bursage		
Shrubs	*Ambrosia dumosa*	white bursage		
Shrubs	*Atriplex canescens*	four-wing saltbush		
Shrubs	*Ayenia filiformis*			
Shrubs	*Ayenia microphylla*			
Shrubs	*Baccharis salicifolia*			
Shrubs	*Baccharis sarothroides*			
Shrubs	*Bebbia juncea aspera*	seep willow		
Shrubs	*Bernardia incana*	desertbroom		
Shrubs	*Brickellia coulteri*	sweetbush		
Shrubs	*Brickellia fructescens*	Coulter's brickellbush		
Shrubs	*Calliandra eriophylla*	fairyduster		
Shrubs	*Canotia holacantha*	canotia crucifixion thorn		
Shrubs	*Carlowrightii arizonica*			
Shrubs	*Condalia warnockii*			
Shrubs	*Castela emoryi*	castela crucifixion thorn		
Shrubs	*Celtis pallida pallida*	spiny hackberry		
Shrubs	*Chilopsis linearis arcuata*	desert willow		
Shrubs	*Crossosma bigelovii*			
Shrubs	*Ditaxis lanceolata*			
Shrubs	*Encelia farinosa farinosa*	brittlebush		
Shrubs	*Encelia frutescens*	button brittlebush		
Shrubs	*Ephedra aspera*	boundary ephedra		
Shrubs				

Shrubs (continued)	*Eriogonum fasciculatum*	flattop buckwheat		
	Eriogonum wrightii	Eriogonum wrightii		
	Fagonia laevis	California fagonbush		
	Forestiera phillyreiodes			
	Fouquieria splendens	ocotillo		
	Gallium stellatum			
	Hibiscus coulteri			
	Hymenoclea salsola	cheesebush		
	Hyptis emoryi	desert lavender		
	Isocoma acradenia			
	Keckiella antirrhinoides			
	Koeberlinia spinosa	allthorn		
	Jatropha cardiophylla	limberbush		
	Justicia californica	chuparosa		
	Krameria erecta	range ratany		
	Krameria grayi	white ratany		
	Larrea divaricata tridentata	creosotebush		
	Lycium	desertthorn		
	Lycium andersonii	desert wolfberry		
	Lycium berlandieri	Berlandier's wolfberry		
	Lycium exsertum	Arizona desertthorn		
	Lycium parishii	Parish's desertthorn		
	Machaeranthera pinnatifida			
	Menodora scabra			
	Petalonyx thurberi			
	Polygala macrodemia			
	Porophyllum gracile			
	Psilostrophe cooperi			
	Sebastiania bilocularis	Mexican jumping bean		
	Senna covesii			
	Simmondsia chinensis	jojoba		
	Sphaeralcea ambigua	desert globemallow		
	Stephanomeria pauciflora	desert straw		
	Tamaricaceae ramosissima	salt cedar, tamarisk		
	Thymophylla concinna			
	Thymophylla pentachaeta			
	Tiquilia canescens			
	Tragia nepetifolia var dissecta			
	Trixis californica	California trixis		
	Viguiera deltoidea			
	Viguiera parishii			
	Yucca baccata	banana yucca		
	Yucca elata	soap tree yucca		
	Ziziphus obtusifolia canescens	graythorn		
Vines	*Asclepias subulata*	rush milkweed		
	Clematis drummondii	clematis		
	Commicarpas scandens			
	Janusia gracile	janusia		
	Lyrocarpa coulteri	banana scent vine		
	Rhynchosia texana	rosary bean		
	Sarcostemma cynanchoides			
Ferns, etc.	*Astrolepis cochisensis*			
	Astrolepis sinuata sinuata			
	Notholaena standleyi			
	Pellaea truncata			
	Selaginella arizonica			

Grasses and Sedges	*Aristida*	3 awn		
	Aristida adsensionis			
	Aristida purpurea			
	Bouteloua	gramma		
	Bromus			
	Bromus arizonica			
	Bromus catharticus @			
	Bromus rubens	red brome		
	Carex	sedge		
	Cynodon dactylon @	Bermuda grass		
	Elymus elymoides			
	Eragrostis lehmanniana @*	Lehmann lovegrass		
	Erioneuron pulchellum	fluff-grass		
	Hordeum pusillum			
	Heteropogon contortus			
	Melinis repens @*	natal grass		
	Muhlenbergia microsperma			
	Muhlenbergia porteri			
	Pennisetum ciliare @*	buffelgrass		
	Pennisetum setaceum @*	fountain grass		
	Phalaris minor @	canary grass		
	Poa			
	Poa bigeloviii			
	Pleuraphis jamesii *			
	Pleuraphis mutica	tobosa grass		
	Pleuraphis rigida	big galleta		
	Schismus arabicus @	mediterranean grass		
	Schismus barbatus @	mediterranean grass		
	Sorghum halepense @*	Johnson grass		
	Tridens muticus			
	Vulpia octoflora			

APPENDIX Q

SDNM Invasive Exotic Plant Survey **Plot Number ____ Sampling Area___**

Date _______ Observer _________ GPS Unit #________

LOCATION: Road Name/Number ___________________________ Road Type _____________Travel Direction ______

Description of Site____

Dominant Natural Community ______________________Secondary Natural Community_______________________

Landscape History/Comments ____

Dominant native species

Left side of road:______________________________ Right side of road :____

____ ____

Disturbances

3 meter from road edge plots

Slope Steepness:_____________________________	Slope Steepness:___________________________________
Erosion:__________________________________	Erosion:____
Cow trails_____ Cow prints____ Cow dung _____	Cow trails_____ Cow prints_____ Cow dung _______
Horse prints___ Horse dung___ Human prints_____	Horse prints______ Horse dung_____ Human prints______
Trash____ Car tracks______ ATV tracks ________	Trash____ Car tracks_________ ATV tracks ___________
Natural Disturbances__________________________	Natural Disturbances_________________________________

10 meter from road edge plots

Slope Steepness:_____________________________	Slope Steepness:___________________________________
Erosion:__________________________________	Erosion:____
Cow trails_____ Cow prints____ Cow dung _____	Cow trails_____ Cow prints_____ Cow dung _______
Horse prints___ Horse dung___ Human prints_____	Horse prints______ Horse dung_____ Human prints______
Trash____ Car tracks______ ATV tracks ________	Trash____ Car tracks_________ ATV tracks ___________
Natural Disturbances__________________________	Natural Disturbances_________________________________

		Left Side of Road		Right Side of Road	
		GPS Waypoint	Accuracy	GPS Waypoint	Accuracy
		Percent Cover	Stem Frequency	Percent Cover	Stem Frequency
	Exotic Species	3-m | 10-m	3-m | 10-m	3-m | 10-m	3-m | 10-m
Grasses	*Bromus rubens*				
	Cynodon dactylon				
	Eragrostis lehmanniana				
	Melinis repens				
	Pennisetum ciliare				
	Pennisetum setaceum				
	Schismus arabicus				
	Schismus barbatus				
	Sorghum halepense				
Herbs					
	Brassica tournefortii				
	Centaurea melitensis				
	Erodium cicutarium				
	Malva parviflora				
	Mesembrayanthemum crystallinum				
	Peganum harmala				
	Sonchus oleraceus				
	Sisymbrium irio				
	% native vegetation				
	% bare/litter				
	photo numbers				

Weeds seen between plots ____ & ________ if none, check here ___________________________

Grasses	*Bromus rubens*
	Cynodon dactylon
	Eragrostis lehmanniana
	Melinis repens
	Pennisetum ciliare
	Pennisetum setaceum
	Schismus arabicus
	Schismus barbatus
	Sorghum halepense
Herbs	*Brassica tournefortii*
	Centaurea melitensis
	Erodium cicutarium
	Malva parviflora
	Mesembrayanthemum crystallinum
	Peganum harmala
	Sonchus oleraceus
	Sisymbrium irio
	photo numbers

Appendix R

VEGETATION CLASSIFICATION POINT INTERCEPT DATA FORM

Plot #					Transcect #
Date		Person			Site #:
Degrees (declination adjusted) of transect line:					Sheet of

DISTANCE (meters)	POINT	PLANT CODE1	HT CLASS	PLANT CODE2	HT CLASS	PLANT CODE3	HT CLASS	PLANT CODE4	HT CLASS	PLANT CODE5	HT CLASS
0.5	1										
1	2										
1.5	3										
2	4										
2.5	5										
3	6										
3.5	7										
4	8										
4.5	9										
5	10										
5.5	11										
6	12										
6.5	13										
7	14										
7.5	15										
8	16										
8.5	17										
9	18										
9.5	19										
10	20										
10.5	21										
11	22										
11.5	23										
12	24										
12.5	25										

Degrees (declination adjusted) of transect line:	Transect #	Person		Date	

DISTANCE (meters)	POINT	PLANT CODE1	HT CLASS	PLANT CODE2	HT CLASS	PLANT CODE3	HT CLASS	PLANT CODE4	HT CLAS	PLANT CODE5	HT CLASS
0.5	1										
1	2										
1.5	3										
2	4										
2.5	5										
3	6										
3.5	7										
4	8										
4.5	9										
5	10										
5.5	11										
6	12										
6.5	13										
7	14										
7.5	15										
8	16										
8.5	17										
9	18										
9.5	19										
10	20										
10.5	21										
11	22										
11.5	23										
12	24										
12.5	25										

APPENDIX S

MESQUITE OBSERVATIONS FORM

Sampling Area___ Date _________ Observer ________ GPS unit______ Camera #__________

Waypoint #: _______ Photos #: _______
Observation radius ________
% Canopy Closure ________
Structure Index __________
% Mesquite ___________
Others ________________
____
____

Disturbances
Flooding ______________ Cutting_________________
Cow trails_____ Cow prints____ Cow dung _____
Horse prints___ Horse dung___ Human prints_____
Trash____ Car tracks______ ATV tracks ________

Decadence : Low - Moderate - High
Understory: ________________

Landscape History/Comments ____

Waypoint #: _______ Photos #: _______
Observation radius ________
% Canopy Closure ________
Structure Index __________
% Mesquite ___________
Others ________________
____
____

Disturbances
Flooding ______________ Cutting_________________
Cow trails_____ Cow prints____ Cow dung _____
Horse prints___ Horse dung___ Human prints_____
Trash____ Car tracks______ ATV tracks ________

Decadence : Low - Moderate - High
Understory: ________________

Landscape History/Comments ____

Waypoint #: _______ Photos #: _______
Observation radius ________
% Canopy Closure ________
Structure Index __________
% Mesquite ___________
Others ________________
____
____

Disturbances
Flooding ______________ Cutting_________________
Cow trails_____ Cow prints____ Cow dung _____
Horse prints___ Horse dung___ Human prints_____
Trash____ Car tracks______ ATV tracks ________

Decadence : Low - Moderate - High
Understory: ________________

Landscape History/Comments ____

Waypoint #: _______ Photos #: _______
Observation radius ________
% Canopy Closure ________
Structure Index __________
% Mesquite ___________
Others ________________
____
____

Disturbances
Flooding ______________ Cutting_________________
Cow trails_____ Cow prints____ Cow dung _____
Horse prints___ Horse dung___ Human prints_____
Trash____ Car tracks______ ATV tracks ________

Decadence : Low - Moderate - High
Understory: ________________

Landscape History/Comments ____

(Structure Index – Even/old = Even aged, large diameters at base >20 cm
Even/mid = Even aged, mid size diameters at base 5<x<20 cm
Even/young = Even aged, small diameters at base <5 cm
Multi-Mid = Mixed young to mid age stems, multi layered canopy
Multi-Old = Mixed young to old age stems, multi layered canopy)

If not Mesquite, write NOT MESQUITE after observation radius

APPENDIX T

LONG TRANSECT, BETWEEN PLOTS FORM

Transect Number ______
Observer__________ Date_________ Sample Area____________
Declination of Transect Line_________

Transect Start Point to Plot 1 Distance__________
GPS Unit Number____ GPS Waypoints_____ , _____ Camera #________
Natural Community1___________ Photo #s_________
Natural Community2___________
Natural Community3___________
Comments/Description

Plot 1 to Plot 2 Distance__________
GPS Unit Number____ GPS Waypoints_____ , _____ Camera #________
Natural Community1___________ Photo #s_________
Natural Community2___________
Natural Community3___________
Comments/Description

Plot 2 to Plot 3 Distance__________
GPS Unit Number____ GPS Waypoints_____ , _____ Camera #________
Natural Community1___________ Photo #s_________
Natural Community2___________
Natural Community3___________
Comments/Description

Plot 3 to Plot 4 Distance__________
GPS Unit Number____ GPS Waypoints_____ , _____ Camera #________
Natural Community1___________ Photo #s_________
Natural Community2___________
Natural Community3___________
Comments/Description