

**IDENTIFICATION AND CHARACTERIZATION OF RELICT AND UNIQUE
VEGETATION ON THE GRAND CANYON-PARASHANT NATIONAL
MONUMENT**

Final Report

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BACKGROUND

Designated in 2000, Grand Canyon-Parashant National Monument (PARA) encompasses more than 1 million acres of complex and often remote landforms. Situated at the junction of two major ecoregions, each with unique and diverse floras, PARA contains floristic elements of both the Colorado Plateau and the Mojave Desert. Geologic materials ranging from deeply dissected sandstones characteristic of the Grand Canyon to coarse volcanic intrusions produce a spectacular array of landforms and habitats. Related to the highly variable climatic conditions of the major eco-regions and to the heterogeneous landscape, PARA supports a diverse flora, with vegetation ranging from Ponderosa pine forests on Mt. Trumbull to giant Mohave Yucca on the lower elevations. Our primary goal in working on the monument has been to find assemblages of plant species that represent a pre-settlement landscape, before the advent of domestic livestock. These assemblages occur for the most part in remote areas that have been beyond the reach of grazing animals and other kinds of modern day disturbances.

Within the context of this vast and heterogeneous landscape, PARA arguably contains some of the most remote and un-surveyed lands in the American southwest. This complex and inaccessible landscape likely contains relict and unique vegetation types with low amounts of anthropogenic disturbance. Relict areas contain invaluable information for land managers, who are charged with documenting the important resources of PARA, monitoring ecological trends and changes, and with restoring areas impacted by human activities.

Scientifically sound stewardship is best accomplished when the range of normal variability for natural resources is understood. Relicts illustrate vegetation structure, composition, and resource levels which may differ significantly from more modified landscapes (Madany and West 1984). For example, Schmutz et. al. (1967) examined the relict Boysag Point on the north rim of the Grand Canyon and found perennial grasses made up 36% of the cover in the relict area, compared with only 6% in an adjacent impacted area. Relict and unique vegetation surveys were identified as a research priority for adjacent Grand Canyon National Park in 1998 (http://www.nps.gov/grca/research/Research_Needs.pdf; accessed 4 February 2003).

Data from these communities can be used to evaluate the effectiveness of current ecosystem practices and for other management purposes. Vegetation surveys from such areas can be used in guiding restoration efforts and in monitoring ecosystem change and relicts can be important sources of locally adapted seed for revegetation projects.

The probable inaccessibility of such relict sites, however, dictates that careful examination of existing information about PARA lands should be undertaken prior to expending time and resources for travel. Existing information from such sources as Park personnel, maps, and GIS would greatly aid in the selection of likely areas for survey, and would greatly reduce effort and expense while maximizing the chances of discovering relict vegetation. The major goal of this research was to locate and

characterize the vegetation of relict and unique habitats in Grand Canyon-Parashant National Monument utilizing a range of existing information to select probable sites.

Plant nomenclature follows the current USDA Plants Database (NRCS 2005) with descriptions and distributions extrapolated from the Flora of North America (1992—xx), the Intermountain Flora (Holmgren et al. 2005) and the new Digital Atlas of Utah Plants (Shultz et al. 2006).

METHODS

We conducted field work in the fall of 2003, spring of 2004, and late spring/early summer of 2005. Prior to the beginning of fieldwork, we reviewed current studies on the Grand Canyon Parashant National Monument (PARA) and conducted interviews with Monument personnel. We were assured that intensive grazing by sheep and cattle has occurred throughout the PARA since the mid-1900's. Most monument personnel indicated that the best chance for locating relict vegetation would be to find areas physically inaccessible to grazing animals, either because of landform or distance from available water. The initial observations from early fieldwork and the interviews allowed us to target our approach and we determined that landform is the single most important feature in identifying relict sites on the Monument.

All of our study areas, species observations, and voucher collections are spatially referenced in the ArcView™ disk provided with this report. We combined freeware programs with ArcView™ 3.3 and vegetation maps from the Nature Conservancy to develop a geographic information system (GIS) with geospatial information about plant distributions and potential relict sites within the Grand Canyon Parashant National Monument. This is a dynamic tool that should have considerable utility in the management of natural resources within the monument.

We incorporated 30m resolution Digital Elevation Models (DEMs), polygons with geology coverage, and several digitized soil coverages that described portions of the Monument, all provided by PARA personnel. We added these to GIS layers showing vegetation maps and plant associations, obtained from the Nature Conservancy Colorado Plateau report and the Utah State University Gap Analysis data. After careful examination, we determined that the 30m resolution DEMs were too coarse for our purposes, so we incorporated 10m resolution DEMs in STDS format from the GIS Data Depot (<http://data.geocomm.com/>) and combined these to form a continuous topographic layer using 3 m dems (<http://www.visualizationsoftware.com/3dem.html>), a freeware program. All other GIS manipulations were performed in ArcView™ 3.3 with Spatial Analyst™ or in ArcGIS™ Desktop Version 8.3.

Species observations and vouchers are provided in a separate Excel spreadsheet that has been sent to Kari Yanskey, botanist for the Parashant Monument. They are also integrated as part of the GIS system we have provided, and each location can identified

by clicking a point and making a query. Details of collector, species identification, associated species, and date of observation are provided in the table within the Parashant GIS. All sites and species records were geo-referenced with hand-held geographic positioning systems (GPS) and are reported by longitude, latitude, and elevation.

In 2004, we obtained further information on grazing exclosures and potentially isolated areas from personnel in the St. George Arizona Strip Office of the BLM. We were unable to obtain the precise geographic coordinates for the grazing exclosures, but from verbal descriptions of the locations by Lee Hughes, we were able to find and geo-reference three of these sites. We made a list of species and made ocular measurements of percent cover, with comparisons between the exclosures and surrounding sites. In all instances, we found a greater species richness and abundance of native vegetation within the exclosures. Characterization of these exclosures could give important data on the effects of grazing, but since these studies are an ongoing effort on the part of BLM personnel, we did not focus our efforts on site descriptions.

In 2005, we established plots on Lone Mountain and the comparison site, and in the Toroweap area, that follow the methodology described in detail in the National Vegetation Classification guidelines developed by the Nature Conservancy (Grossman et al. 1998). This methodology produces measures of species richness and abundance. Within 10m X 10m plots, we identified all species of vascular plants within the plots and estimated the cover for each species as well as total cover for non-vascular plants and %bare ground. The identification of non-vascular plants is being performed by scientists from Arizona State University who accompanied us on the fieldtrip.

While the geology and soil type coverages were useful in understanding the diversity of parent materials and soils on the land base, the fine resolution DEM's were most important in examining landform details and were the main source of information for potential relict areas. Visualization of slope and hill shading in Arc View were used extensively to locate areas of any size that appeared to be physically restricted to access by cattle. The coverage depicting slope was especially useful in this process, and simple zooming and panning of this coverage yielded the most information. Physically inaccessible areas are also located some distance from roads or water sources, as might be expected. All potential relict vegetation areas were numbered and marked in a point coverage and we generated and printed maps of each site for use in the field.

OBSERVATIONS AND RESULTS

We identified a total of 20 remote sites for intensive investigation in the field. These are grouped in four main regions within the Monument, as enumerated below. The mapped point coverages of these sites are included on the Parashant CD-ROM which is part of this report. Several of these sites were visited in 2003 and detailed descriptions of those areas are included. Nomenclature in this report follows the Plants Database (www.plants.usda.gov). Throughout our field work, we collected geographic data on

observations as well as voucher specimens of vascular plants. These data are included as a table in the ArcView™ project.

Sites 1-4, Snap Point Region

The area to the west and south of Snap Point had the most promising isolated buttes in the Monument. This area, at approximately 4700 ft in elevation, has sharply defined buttes separated by steep canyons and washes. Each of the four sites in this region is at least 4 miles from any constant source of water. In September 2003, we visited site 2, which is a relatively isolated butte near the border of the Monument. The rocky ledges leading to the site and the site itself showed very little evidence of impact by cattle. There was excellent development of microbiotic crust on most surfaces, no trails were seen, and the vegetation of the slopes leading to and the periphery of the butte consisted of diverse and healthy populations of grasses with few nonnative species. In this area, we located nine species of grasses (Table 1) which we did not find in any other portion of the Monument during our week of field work. We think these grasses would occur in greater abundance across much of the PARA landbase were it not for the long history of grazing. These are species that should be common in native desert grasslands, but in the relict site at Snap Point, we found these species restricted to washes and ledges in an area generally out of the reach of domestic livestock.

Table 1. Assemblage of native grasses found in a protected site near Snap Point, at the southern boundary of the Grand Canyon Parashant National Monument.

<u>Species</u>	<u>Habitat</u>
<i>Achnatherum (Oryzopsis) hymenoides</i>	sandy washes
<i>Aristida purpurea</i>	rock ledges, steep slopes
<i>Bouteloua curtipendula</i>	slopes, protection of rock ledges
<i>Bouteloua eriopoda</i>	rock ledges, sandy slopes
<i>Bouteloua barbata</i>	sandy washes, slopes
<i>Erioneuron (Tridens) muticus</i>	rock ledges, steep slopes
<i>Dasyochloa pulchella</i>	rock ledges, steep slopes
<i>Muhlenbergia porteri</i>	slopes
<i>Pleuraphilis (Hilaria) jamesii</i>	sandy washes
<i>Sporobolus contractus</i>	sandy washes
<i>Stipa speciosa</i>	rock ledges

These species were found in crevices of boulders and along washes below the isolated butte south and west of Snap Point. The species assemblage is representative of a native grassland habitat that was probably widespread in pre-settlement days. The uppermost portion of the butte itself was a relatively uniform blackbrush (*Coleogyne ramosissima*) community. This is an area of shallow soils underlain by bedrock, with extreme xeric conditions that do not provide growing conditions suitable for perennial forbs and grasses.

Notable was one population of a noxious weed, Russian knapweed (*Acroptilon repens*), east of Snap Point. It was located near a stock tank in a disturbed area and is a new record for the area. Kari Yanskey alerted Lake Meade NRA botanists of its presence.

Sites 5-7, Kelly Point Region

Several points were delineated in this region based on a combination of results from interviews and based on general physical remoteness. These sites tend to be relatively far from water sources (at least three miles), though that criterion was not used initially in their selection. We were not able to visit these sites specifically, however, we did visit the point itself, and we noted large stands of *Bouteloua gracilis* and *Muhlenbergia richardsonis* growing in abundance approximately 4.5 miles from the nearest livestock water source, and approximately 1 mile north of the Point. This site was a higher elevation and more forested area than the previous site. The only native grass species noted growing in abundance over parts of the Monument was *Pleuraphis jamesii*, which is regarded as a species that is resistant to decline under intense grazing and is only palatable while actively growing.

Sites 8-16, Andrus/Parashant Canyon and East PARA Region

There are a number of potential relict sites in this area, many of which are concentrated on what appear to be isolated benches above the floor of the Parashant Canyon. While the bottom of the Canyon appears to be developed for livestock use, these upper benches may be physically isolated and may contain relict vegetation.

Sites 17-20, Black Rock Mountain Region

While this area does not appear to be as physically isolated as the other areas delineated within the Monument, it has been included because there is some significant physical relief. The presence of a threatened plant species, the Smith Easter Daisy (*Townsendia smithii* Shultz & Holmgren) in this region, along with more complex landforms and soil types suggests that this region should be further investigated. We were able to visit two grazing exclosures in this area in 2005.

Our preliminary findings from the field in 2004 indicated that distance from livestock water sources may be an important predictor for areas with significant native plant diversity, and this was not initially considered in locating potential relict areas. We created a shape file with buffers of 4000 m (approx. 2.5 miles) radius around the range water sources point coverage in order to visualize areas far from water sources. This did not yield as much information, as there are many water developments on the coverage that are no longer in use. However, a few places on the map should be investigated in the future, and updating the water sources coverage would be highly desirable.

We made observations in several different areas in 2005 to investigate vascular plant assemblages. One area, along a roadcut in the steep switchbacks about 5 miles east of the Mt. Trumbull Schoolhouse, had a diverse and healthy flora. This area had excellent representation of Fendler, or 'mutton' bluegrass (*Poa fendleriana*) and other native grasses in the steep, rocky slopes, but lower cover of native grasses in the less steep

areas. We also investigated higher elevations near Mt. Logan and Mt. Trumbull to gain a better understanding of the ecology of the area.

The Toroweap valley afforded a good look at a valley bottom with two different management histories. The Monument portion on the north is currently grazed, and the southerly portion of the valley bottom had not been grazed in at least 10 years, according to the ranger at the Tuweep Station. This area should be investigated further as an important source of information on changes in vegetation post-grazing. It is relatively unique in that it represents a valley area, and is especially significant in light of the increasing amount of the noxious Rocket mustard weed (*Sisymbrium irio*) that we documented in the valleys of GCPNM in 2005.

In 2004, Parashant personnel also noted that one large area that was recognized as a potential relict early in the study had not been grazed. We had initially excluded this area because of the presence of grazing-related water developments and the presence of a mine (found to be historical) on the GIS coverages provided by the Monument. This area, Lone Mountain, was visited in 2005 and was found to be the largest relict area located thus far on the Monument. It is important to note that the inaccuracies of the GIS coverages nearly caused us to discount this area entirely.

Lone Mountain and Comparison Area

With the generous support of the GCPNM, we were among several scientists flown onto Lone Mountain, southwest of Whitmore Point. After careful consideration of the topography viewed from the helicopter and the information shared with us by ranchers in the area, we suggest that in the heat of the growing season, it will be dangerous to attempt walking to Lone Mountain via the traditional access from the north or east.

Lone Mountain is a dry, relatively flat butte that is surrounded on all sides by steep topography, making access difficult. Overall, on the top of the butte, there are areas with deeper soils that support relatively high cover of vascular plants as well as areas with thinner soils that are characterized by lower cover of vascular plants and a well-developed microbiotic crust. We could not locate any springs or water developments that are indicated on the GIS layers for this area. Anecdotal evidence suggests that the area may have been grazed lightly in the time between the 1920s and the 1950s, but the lack of water would indicate that any grazing that did occur was short-lived. Additionally, a mine is noted on the GIS layers and was mentioned by Orvel Bundy, a local rancher, and we did find a probable mine claim, but no actual excavation seems to have taken place. The claim consists of a pile of rocks with a wooden stake.

We noted the presence of vascular plant species on Lone Mountain, and we established temporary, georeferenced plots for ecological data. The list of vascular plants encountered on Lone Mountain is attached in Appendix A. The ecological plots consisted of 10m square plots, georeferenced with a handheld GPS unit. We established 15 plots total, representing the range of vegetation we encountered. Within the plots, we visually estimated the percent cover of vascular plant species and assigned cover classes for each taxon. For comparison, we also visited sites directly across the fault line to the

east of Lone Mountain. These sites were highly comparable ecologically (same parent material, elevation, slope, etc.), but had been more intensively managed, and had been grazed in 2005. We established 10 plots in the comparison area, and these data are presented together in Appendix B.

Total species richness of the 15 Lone Mountain plots was 54, and the richness of the 10 comparison plots was 35. To provide a more balanced comparison, 10 of the Lone Mountain plots were randomly selected and the total species richness was 42, still higher than the 35 in the comparison plots. While Lone Mountain did support a large amount of the noxious Red brome (*Bromus rubens*), there were also significant bunches of the native galleta grass (*Pleuraphilis jamesii*), and as such, this area would serve as an excellent seed source for this grass. The most striking differences between Lone Mountain and the comparison area were the higher diversity and native plant cover on Lone Mountain, the greater development of microbiotic crust on Lone Mountain, and the relatively small amount of the Eurasian Filaree (*Erodium cicutarium*) on Lone Mountain compared with the grazed sites to the east.

DISCUSSION

With a long history of livestock grazing use, range resources on the Grand Canyon Parashant National Monument are of vital historical as well as ecological importance. For more than 150 years, the Monument lands have provided forage for livestock in relative abundance. While long-term monitoring data for the landbase are scarce, anecdotal evidence and our field observations suggest that the current sixth year of record drought in northern Arizona has had a negative impact on both the diversity and abundance of grasses on the Monument. When combined with continued grazing pressure, this decrease in forage may restrict the ability of grass species to recover when the drought subsides, and may lessen the availability of nearby seed sources (Howery, 1999).

Our fieldwork in the GCPNM focused on locating relict areas or areas with vegetation that is less impacted by humans and livestock. One such area was described by Schmutz, et. al. (1967). This research suggested an increased diversity and abundance of native grass species in a relatively ungrazed area, Boysag Point, which is located east of and ecologically similar to much of the Monument. Thus, one focus of locating relict vegetation was locating areas of significant diversity of native grasses. After preliminary field work in locating relict areas, our findings indicate that there is a marked difference in grass species composition and abundance between areas near water sources and areas far from water or areas which are physically less accessible to livestock.

The relatively isolated butte west of Snap Point was both physically less accessible to livestock due to steep, rocky terrain and was approximately five miles from the nearest available water. In this area, we located nine species of grasses (Table 1) which we did not find in any other portion of the Monument during that week of field work. These finding compare favorably with Schmutz et al. (1967), who found a greater abundance and diversity of native grass specimens on the relatively ungrazed Boysag Point (located just east of PARA) when compared with a grazed area. Seven of the eleven grasses listed

above were also found on Boysag Point, and of those, four were found only on the ungrazed area within their study. In addition to species diversity, the grasses located in this area were well-developed and could serve as valuable seed sources for revegetation efforts of other areas of the Monument. In another area, Kelly Point, we found *Bouteloua gracilis* and *Muhlenbergia filiculmis* growing in abundance approximately 4.5 miles from the nearest livestock water source. Again, these grasses were not seen in abundance across any other portion of the monument that year.

Our overall impression of Lone Mountain is that there is a relatively high diversity of native vascular plants and many examples of large, healthy native shrub and grass species. We would expect it to be an excellent seed source area when the drought lessens. It is a rare example of a relatively large relict with nearby comparable grazed land and as such, warrants further investigation. Our preliminary findings suggest that the overall species diversity (and especially native species diversity) is higher on Lone Mountain than the comparison plots, and the overall plant cover appears to be higher as well. The lower cover of microbiotic crust as well as the higher cover of exotic species (*Erodium cicutarium* and *Bromus rubens*) on the comparison sites are indications that post-drought monitoring of both areas should continue in order to ensure sound stewardship practices.

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Appendix A. Vascular plant taxa encountered on Lone Mountain.

Family	Genus	Species	Notes
Agavaceae	Agave	utahensis	Rocky slopes
Agavaceae	Yucca	angustissima	Common in loose sand
Agavaceae	Yucca	baccata	
Agavaceae	Yucca	elata	
Anacardiaceae	Rhus	aromatica	
Asteraceae	Baileya	multiradiata	
Asteraceae	Chrysothamnus	nauseosus	ssp. junceus (desert form)
Asteraceae	Thymophylla	pentachaeta	
Asteraceae	Machaeranthera	canescens	
Asteraceae	Melampodium	leucanthum	
Asteraceae	Parthenium	incanum	
Asteraceae	Perezia	wrightii	Uncommon, on rocks
Asteraceae	Perityle	tenella	
Asteraceae	Psilostrophe	sparsiflora	
Asteraceae	Stephanomeria	pauciflora	
Asteraceae	Xanthocephalum	microcephala	
Boraginaceae	Cryptantha	conferiflora	Unusually large form
Brassicaceae	Descurainia	spp.	
Brassicaceae	Lepidium	densiflorum	
Brassicaceae	Lepidium	fremontii	
Cactaceae	Echinocactus	wislizeni	
Cactaceae	Echinocereus	engelmannii	
Cactaceae	Ferocactus	sp.	
Cactaceae	Opuntia	echinocarpa	
Cactaceae	Opuntia	sp.	
Caesalpinaceae	Cassia	bauhinioides	
Celastraceae	Mortonia	utahensis	
Chenopodiaceae	Atriplex	canescens	
Chenopodiaceae	Krasheninnikovia	lanata	
Cupressaceae	Juniperus	osteosperma	
Ephedraceae	Ephedra	nevadensis	
Ephedraceae	Ephedra	trifurca	
Euphorbiaceae	Euphorbia	fendleri	
Fabaceae	Astragalus	nuttallianus	
Krameriaceae	Krameria	grayi	
Linaceae	Linum	aristatum	
Linaceae	Linum	perenne	
Loasaceae	Mentzelia	californica	
Mimosaceae	Acacia	greggii	
Nyctaginaceae	Mirabilis	multiflora	
Plantaginaceae	Plantago	patagonica	
Poaceae	Aristida	adscensionis	
Poaceae	Bromus	rubens	Common in loose sand habitats on southern half of mountain
Poaceae	Erioneuron	pulchellum	
Poaceae	Hesperostipa	speciosa	

Poaceae	Muhlenbergia	microsperma	
Poaceae	Munroana	squarrosa	
Poaceae	Pleuraphilis	jamesii	
Poaceae	Schismus	barbatus	In loose sand
Poaceae	Scleropogon	brevifolius	
Poaceae	Vulpia	octoflora	In loose sand
Polemoniaceae	Eriastrum	eremicum	Locally abundant, lavender flrs
Polemoniaceae	Eriastrum	sparsiflorum	
Polemoniaceae	Gilia	inconspicua	
Polemoniaceae	Linanthus	bigelovii	
Polemoniaceae	Linanthus	arenicola	
Polemoniaceae	Phacelia	lemmonii	
Polygonaceae	Eriogonum	davidsoni	
Polygonaceae	Eriogonum	fasciculatum	
Polygonaceae	Eriogonum	hermannii	
Polygonaceae	Eriogonum	howellii	yellow flrs., annual
Polygonaceae	Eriogonum	inflatum var. deflatum	
Polygonaceae	Rumex	venosus	
Pteridaceae	Cheilanthes	feeii	Fern, rock outcrops
Rosaceae	Coleogyne	ramosissima	
Rosaceae	Purshia	mexicana	
Rutaceae	Thamnosma	montana	
Scrophulariaceae	Penstemon	eatoni	
Solanaceae	Datura	stramonium	
Solanaceae	Lycium	pallidum	

Appendix B. Lone Mountain (LN) and Comparison Area (COM) plot data showing species presence and abundance.

	LN1	LN2	LN3	LN4	LN5	LN6	LN7	LN.LMS 292	LN.LMS 294	LN.LMS 295	LN.LMS 296	LN.LMS 298	LN.LMS 301	LN.LMS 302	LN.LMS 303	COM1	COM2	COM3	COM4	COM5	COM6	COM7	COM8	COM9	COM10
<i>Acacia greggii</i>	2							1		1	2								1						
<i>Agave utahensis</i>		2							1					1											1
<i>Astragalus nuttallianus</i>								2																	
<i>Atriplex canescens</i>	2		1		2		3															1			
<i>Baileya multiradiata</i>				1	2	2												1	2		1			3	2
Bare soil					3			2	3	3	3	5	6	6	4	4	4	3	4	3	4	4	3	4	3
<i>Bromus rubens</i> *	2	1	3	3	2	2	1	2	3	1	1			1	2	3	3	1	2	1	1	3	2	3	3
<i>Chrysothamnus nauseosus</i>									1				1			2									
<i>Coleogyne ramosissima</i>		2	3		1	4			3		2	3	2	2		2	4								
Crust & Moss		4			2	2	3	4	3	2	5		1	3	5	2	1	0					1		1
<i>Cryptantha</i> sp. (annual)		1	1			1																			
<i>Descurainia</i> sp.					1	1			1				1				1				1				
<i>Draba cuneata</i>			1																						
<i>Dyssodia</i>									1	1	1		1			1	1						1		1
<i>Echinocereus engelmannii</i>										1	1	1		1		1									
<i>Encelia frutescens</i>									2																
<i>Ephedra nevadensis</i>		2	1						1					1											

Ephedra sp. (trifurca?)								2			2								
Ephedra viridis					1		1		1	2		1	2	2		2		1	1
Eriastrum sparsiflorum	1	1	2	1	1	1	2	2	1					1		1	1	1	1
Eriogonum cf. davidsoni														1				1	
Eriogonum howellii	1		1		3	1	1												
Eriogonum inflatum var. deflatum	1			4		1	1						1		1	1	2	2	1
Eriogonum microthecum										2		1							
Erodium cicutarium *	1			1					1					1	1	2	1	3	3
Euphorbia fendleri													1						
Gilia inconspicua			1	1				1		1	1			1					
Krameria grayi											1			2			1		2
Langloisia											1			1	1		1		2
Lepidium densiflorum	1	1	1			1			1				2	1				1	1
Linum perenne	1		1	1	1	1	1	1							1				
Lycium pallidum								2											
Lygodesmia									1										
Machaeranthera canescens	1				1	1													
Melampodium leucanthum		1							1									1	1
Mentzelia californica	1																		
Mirabilis multiflora	1		2	1	2		1	1										1	
Mortonia scabrella		3									2	2	2	1	2				2
Munroana																		1	
Opuntia echinocarpa					2	3	2					2					1	1	1
Parthenium incanum										2									

Key to cover classes:

*exotic species