



Integrated Upland Vegetation and Soils Monitoring for Glen Canyon National Recreation Area

2009 Summary Report (revised)

Natural Resource Data Series NPS/SCPN/NRDS—2011/208



ON THE COVER

Field crew member reading a quadrat in the Desert Sand ecological site at Glen Canyon National Recreation Area
Photograph by Jim DeCoster

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2009 Summary Report (revised)

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November 2011

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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Funding for the SCPN upland field crew was provided to Northern Arizona University by the National Park Service through Colorado Plateau CESU Agreement H1200040002 (Tasks NAU-285/289).

This report is available from the Southern Colorado Plateau Network website (<http://science.nature.nps.gov/im/units/scpn/>) and the Natural Resource Publications Management website (<http://www.nature.nps.gov/publications/nrpm/>).

The corresponding author and project manager for this project is Jim DeCoster (jim_decoster@nps.gov). Megan Swan is the botanist and crew leader for the project. Other contributions were made by the SCPN staff. The 2009 field crew consisted of Teresa DeKoker, Lara Dickson, Hillary Hudson, and Steve Till.

Please cite this publication as:

DeCoster, J. K., and M. C. Swan. 2011. Integrated upland vegetation and soils monitoring for Glen Canyon National Recreation Area: 2009 summary report (revised). Natural Resource Data Series NPS/SCPN/NRDS—2011/170. National Park Service, Fort Collins, Colorado.

NPS 608/111640, November 2011

Introduction and background

The National Park Service Inventory and Monitoring (I&M) Program was designed to determine the status and monitor the conditions of park natural resources, providing park managers with a strong scientific foundation that informs resource management decisions. The Southern Colorado Plateau Network (SCPN) is monitoring vegetation and soils as overall indicators of upland ecosystem integrity (Thomas et al. 2006).

SCPN and park staff selected the Desert Sand ecological site for long-term monitoring of upland vegetation and soils at Glen Canyon National Recreation Area (GLCA). An ecological site is a landscape division with characteristic soils, hydrology, plant communities, and disturbance regimes and responses, and its classification is based on soil survey data (Butler et al. 2003). The Desert Sand ecological site is a unique ecosystem that faces numerous threats, including grazing, erosion, climate change, and invasion by nonnative species.

In 2008 the Integrated Upland Monitoring program of SCPN began monitoring upland sites at GLCA with the installation of 10 plots in the Desert Sand ecological site. We plan to sample the quadrats and gap intercept transects annually for three years to determine the range of temporal variability for key metrics. In this report, we document monitoring activities in the 2009 field season and compare these data with the data collected in 2008.

Methods

Sampling frame

The sampling frame is the area from which we randomly select our sites, and hence the area to which statistical inferences can be made. We typically derived our sampling frames from maps of ecological sites developed by the US Natural Resources Conservation Service (NRCS) (See Appendix A of DeCoster et al., in review). However, defining the Desert Sand sampling frame was challenging because the soil map was outdated and the area is currently being remapped. In order to begin sampling prior to the completion of the new soil map, we selected an initial sampling frame that encompassed all potential Desert Sand sites in the park unit. We then developed a smaller, secondary sampling frame located in an area that had already been mapped as Desert Sand ecological site in the 2008 mapping effort. Once the new NRCS map is finalized, we will use it to create the final Desert sand sampling frame.

We modified the initial sampling frame using Geographical Information System (GIS) technology by removing roads and areas with slopes exceeding 20%. We generated a set of spatially distributed sampling points using the Generalized Random Tessellation Stratified (GRTS) design (Stevens and Olsen 2004) across the initial sampling frame. We then submitted the points that landed within the secondary sampling frame to park staff to give them an opportunity to reject sites that landed near sensitive resources. Before establishing a plot, the Integrated Upland crew conducted an ecological site assessment for each sampling point and rejected sites that did not fall within the ecological site, had a slope greater than 20%, or contained a major disturbance.

Field methods

In 2009, the SCPN Upland Monitoring crew sampled the same 10 plots that were established at GLCA in 2008. The plots were 0.50 ha in size, measuring 71 × 71 m. Shrub and herbaceous data and soil data were collected on three 50 m transects, spaced 25 m apart, within each plot. In both years

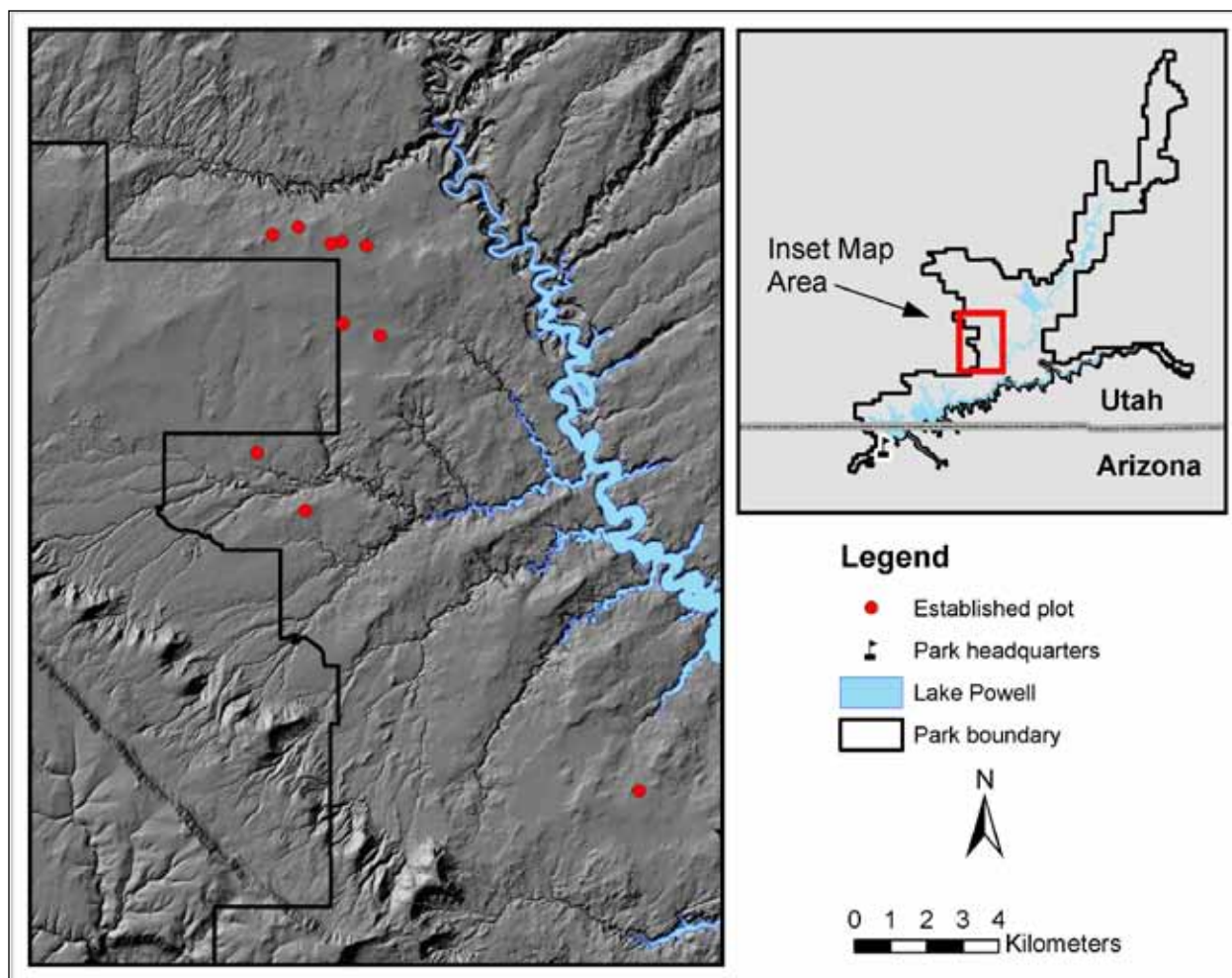


Figure 1. The 10 plots established in the Desert Sand ecological site in 2008

the crew collected the data from the plots in May. Field methodology is provided in detail in the SCPN Integrated Upland Protocol (DeCoster et al., in review).

Shrub and herbaceous vegetation

The crew sampled shrub and herbaceous vegetation within five sets of nested quadrats at 10 m intervals along each transect. The largest quadrat size was 10 m² (2 × 5 m), with four smaller quadrats nested inside (0.01 m², 0.1 m², 1 m², 5 m²). For each nested sub-quadrat we recorded the presence of individual vascular species. For each 10 m² quadrat we estimated percent cover for herbaceous and shrub species and recorded it as one of 12 cover classes (e.g. 2%–5%, 5%–10%, etc.). We also estimated the percent cover for functional groups (e.g. perennial grasses, forbs, shrubs) in the 10 m² quadrats and recorded the cover class for each.

Overstory trees and saplings

There were no trees in any of the plots.

Soil stability and hydrologic function

To measure the amount of bare soil, the crew recorded the length of basal gaps (the space between plant bases) along each transect. Percent cover of soil surface features was estimated in the 1 m² quadrats in conjunction with shrub and herbaceous data and recorded in one of 12 cover classes. A soil aggregate stability test was conducted in 2008, using 18 soil samples collected along the transects. This procedure was not repeated in 2009.

Data summary

The sample unit for summary and analysis is the plot; hence, we summarized data at the level of the plot. In order to calculate summary statistics for the ecological site, means and standard deviations were calculated from the plot means.

For herbaceous and shrub vegetation, cover was calculated for each species from the cover class midpoints, e.g. using 7.5% for cover class 5%–10%. The mean cover was calculated for each plot, and the mean and standard deviation (SD) were calculated for the ecological site from the plot means. Species frequency was calculated for quadrats (mean percentage of quadrats per plot where the species occurs) and for plots (percentage of plots where the species occurs). Mean cover and SD of functional groups and soil surface features were calculated in a similar fashion.

We calculated four diversity measures for herbaceous and shrub species (Magurran 1988), first for all species and then for native species only.

(1) Species richness (S) is the number of species at a given spatial scale, and it was calculated at the level of the plot and at the level of the ecological site.

(2) The Shannon Diversity Index (H') provides a measure of species diversity that takes into account the relative abundance of each species:

$$- \sum_{i=1}^n p_i \ln p_i$$

where p_i is the abundance of each species.

(3) Species evenness (E) is a measure of the degree to which all species are equal in abundance:

$$H' / \ln(S)$$

(4) Beta diversity (β_w) is a measure of within-ecological site heterogeneity:

$$S_e / (S_p - 1)$$

where S_e is the total number of species found in the ecological site, and S_p is the mean number of species found per plot.

We made five calculations for the basal gaps data: median basal gap size, percentage of transects comprised by gaps and plant bases, percentage of transects comprised by each size class, and total number of gaps. Mean and SD were calculated for each metric.

Results

Shrub and herbaceous vegetation

Shrubs dominated the vegetation of the Desert Sand ecological site at GLCA (table 1 and fig. 2) with less cover of perennial grasses, annual grasses, forbs, and cacti/succulents. Total live vegetative cover was 11.58% in 2007, decreasing to 8.42% in 2008. This change was mostly a result of a large decrease in forb cover, which was 2.23% in 2008 and 0.23% in 2009; the other functional groups showed little change.

Table 1. Mean foliar cover of functional groups for 2008 and 2009

Functional groups	Foliar cover (%)			
	2008		2009	
	Mean	(SD)	Mean	(SD)
Total live foliar cover	11.58	(2.68)	8.42	(2.30)
Perennial grasses, graminoids	0.52	(0.29)	0.56	(0.15)
Annual grasses	0.11	(0.10)	0.11	(0.09)
Forbs	2.23	(1.30)	0.23	(0.16)
Shrubs	8.20	(2.42)	7.86	(2.46)
Cacti, succulents	0.19	(0.16)	0.12	(0.07)
Standing dead herbaceous	0.38	(0.13)	0.45	(0.22)
Standing dead woody	2.10	(0.75)	2.07	(0.70)

Note: Components of total live vegetation are not strictly additive because calculations were made from cover class midpoints, the various components may overlap, and estimations were derived independently.

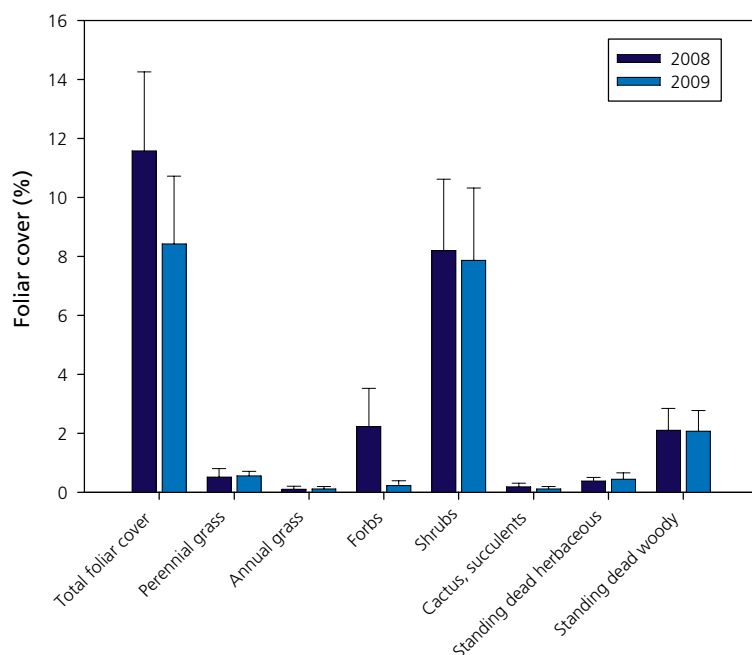


Figure 2. Mean cover of functional groups in 2008 and 2009. Error bars represent one standard deviation.

Cover and quadrat and plot frequencies of many individual species showed little change between the two years, especially considering the large standard deviations among plots (table 2 and fig. 3). The largest decreases were seen in *Plantago patagonica* (wooly plantain), *Astragalus lentiginosus* (specklepod milkvetch), and *Oenothera pallida* (pale evening-primrose). *Gutierrezia sarothrae* (broom snakeweed) showed a moderate decrease in plot and quadrat frequencies and in cover; *Coleogyne ramosissima* (blackbrush) showed a moderate decrease in cover, but little change in frequencies. There appeared to be large changes in *Sporobolus cryptandrus* (sand dropseed) and *Sporobolus* spp. (dropseed), but this was the result of the inability to distinguish between the various dropseed species in 2009. A number of species were present in 2008, while other species were only present in 2009 (See Appendix A).

We found three nonnative species in the plots. *Bromus tectorum* (cheatgrass), which decreased in 2009, occurred in most of the plots but in low abundance. *Salsola tragus* (prickly Russian thistle) and *Descurainia sophia* (herb sophia) occurred only in 2009 in low abundance. Appendix A lists all species, along with common names, families, mean foliar covers, and plot frequencies by year.

Table 2. Foliar cover and frequency of the fifteen most abundant vascular species and all nonnative species in 2008 and 2009

Species	2008				2009			
	Mean cover (%)	SD	Quad freq	Plot freq	Mean cover (%)	SD	Quad freq	Plot freq
<i>Ephedra viridis</i>	2.794	1.328	52.00	100	3.327	1.948	53.33	100
<i>Psoralea argemonea</i>	1.156	0.833	36.00	100	0.989	0.685	39.33	100
<i>Plantago patagonica</i>	0.873	0.737	86.67	100	0.021	0.024	28.00	70
<i>Artemisia filifolia</i>	0.871	0.584	50.67	100	0.834	0.486	55.33	100
<i>Coleogyne ramosissima</i>	0.776	1.046	16.00	80	0.460	0.613	16.00	80
<i>Gutierrezia sarothrae</i>	0.702	1.051	33.33	70	0.377	0.804	20.67	40
<i>Astragalus lentiginosus</i>	0.621	0.626	30.00	80	0.005	0.016	1.33	20
<i>Eriogonum leptocladon</i>	0.618	0.464	39.33	80	0.681	0.600	42.67	80
<i>Chrysothamnus Greenei</i>	0.474	1.036	12.67	20	0.304	0.645	12.67	20
<i>Sporobolus</i> spp.	0.319	0.385	54.00	60	0.382	0.135	89.33	100
<i>Vandewea stylosa</i>	0.311	0.349	14.67	50	0.214	0.294	17.33	50
<i>Opuntia</i> spp.	0.194	0.202	21.33	100	0.083	0.075	22.00	80
<i>Oenothera pallida</i>	0.177	0.303	21.33	30	0.009	0.027	4.00	10
<i>Sporobolus cryptandrus</i>	0.114	0.145	32.67	50	0	0	0	0
<i>Abronia fragrans</i>	0.101	0.305	10.67	20	0.014	0.033	10.67	30
<i>Vulpia octoflora</i>	0.095	0.088	66.67	90	0.099	0.098	63.33	90
<i>Bromus tectorum</i> ^a	0.023	0.033	26.67	80	0.013	0.022	16.00	70
<i>Descurainia sophia</i> ^a	0	0	0	0	.005	0.012	6.00	30
<i>Salsola tragus</i> ^a	0	0	0	0	<0.001	0.001	0.67	10

Note: Species are arranged in descending order by their 2008 cover.

^a Nonnative species

On the scale of the plot, mean species richness was 25.8 in 2008, and it decreased to 24.6 in 2009 (table 3). Shannon diversity (which takes into account relative species abundance, and generally ranges between 1.5 and 3.5), and evenness (the degree to which all species are of equal abundance, ranging from 0 to 1) also decreased (Margalef 1972). On the scale of the ecological site, species richness decreased from 55 to 51. Beta diversity (a measure of within site heterogeneity, generally ranging between 1 and 5) also decreased (McClune and Grace 2002). When these indices were recalculated using only native species, the indices did not substantially change.

Table 3. Species diversity metrics for all species and for native species only

	2008		2009	
	Mean	(SD)	Mean	(SD)
All species				
Plot				
Plot richness	25.8	(4.3)	24.6	(3.9)
Shannon diversity	2.233	(0.223)	1.971	(0.290)
Evenness	0.688	(0.042)	0.616	(0.072)
Ecological site				
Ecological site richness	55		51	
Beta diversity	2.218		2.161	
Native species				
Plot				
Plot richness	25.2	(4.2)	23.5	(3.8)
Shannon diversity	2.225	(0.224)	1.961	(0.284)
Evenness	0.691	(0.043)	0.622	(0.074)
Ecological site				
Ecological site richness	54		48	
Beta diversity	2.231		2.133	

Soil stability and hydrologic function

The crew monitored the amount of exposed soil in two ways: cover estimates of soil surface features in quadrats and measurements of basal gaps along transects. These measurements were undertaken both years. There was a moderate change in several of the features: decreases in undifferentiated crust, woody debris, moss, live plant base, cyanobacteria and dead herbaceous base, and an increase in bare soil (table 4 and fig. 4). While the number of basal gaps increased and the median basal gap size decreased, the percentage of the transect in each gap size class did not change substantially (table 5 and fig. 5).

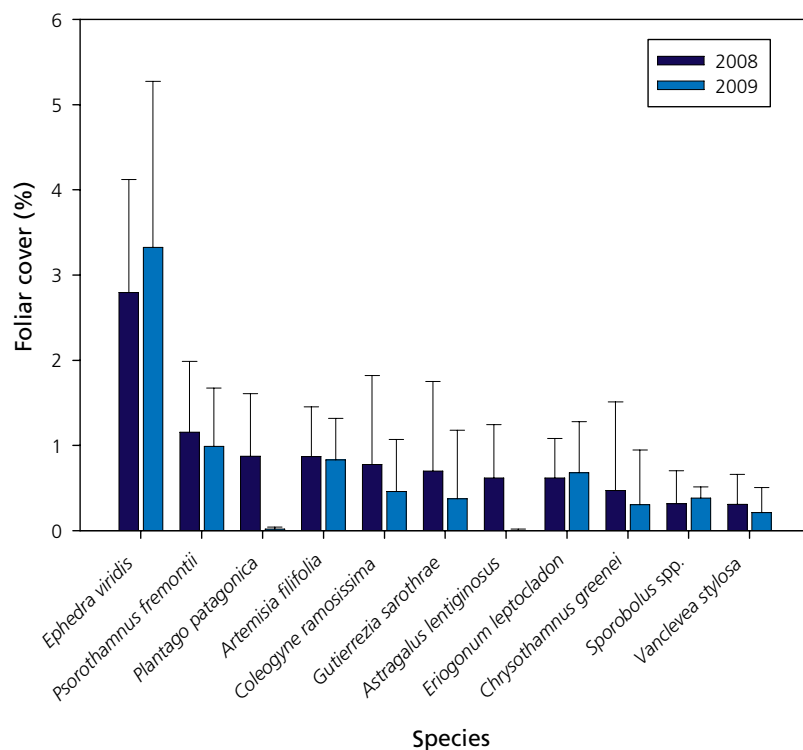


Figure 3. Mean foliar cover of the ten most abundant shrub and herbaceous species in 2008 and 2009. Error bars represent one standard deviation.

Table 4. Cover of soil surface features

Surface feature	2008		2009	
	Mean (%)	(SD)	Mean (%)	(SD)
Live plant base	2.91	(0.77)	1.61	(0.55)
Dead woody base	0.75	(0.25)	0.67	(0.33)
Dead herbaceous base	0.48	(0.27)	0.22	(0.15)
Bare soil	41.73	(30.57)	84.08	(4.09)
Duff and litter	7.48	(4.52)	5.93	(4.80)
Undifferentiated crust	39.88	(29.53)	1.81	(1.23)
Moss	0.38	(0.49)	0.10	(0.21)
Lichen	<0.01	(0)	0	(0)
Cyanobacteria	3.13	(2.31)	0.42	(1.13)
Fine gravel (0.2–2cm)	0.09	(0.11)	0.28	(0.58)
Coarse gravel (2–7.5 cm)	0.05	(0.09)	0.06	(0.18)
Cobble (7.5–25 cm)	0.01	(0.02)	0	(0.01)
Stone, bedrock (>25 cm)	0	(0)	0	(0)
Woody debris	0.44	(0.35)	0.04	(0.06)

Note: The surface feature components do not add up to 100% because the calculations were made from cover class midpoints, and the estimations have observer error.

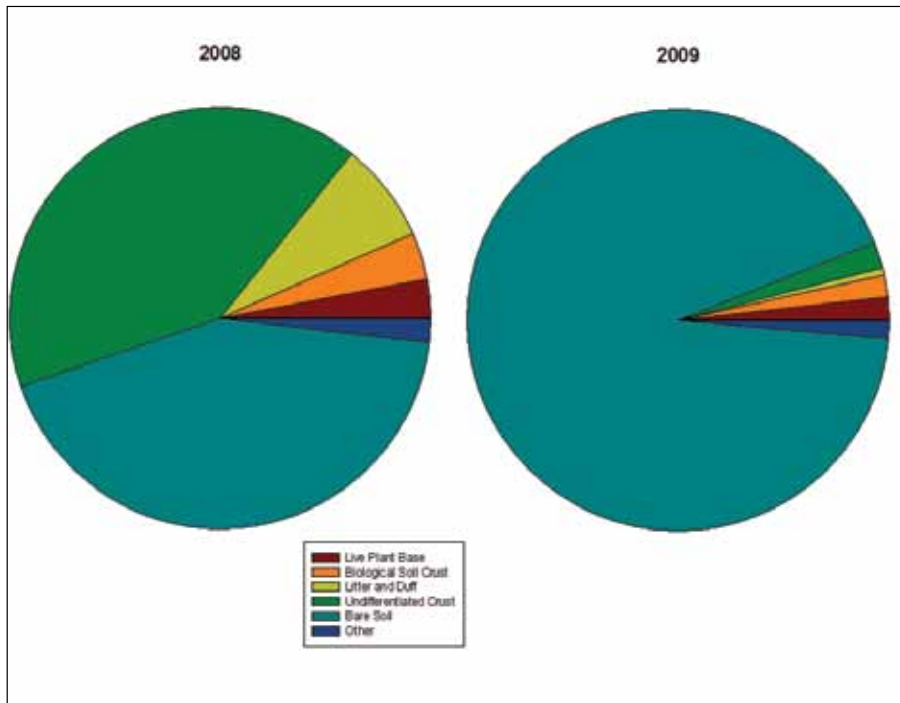


Figure 4. Mean cover of soil surface features in 2008 and 2009

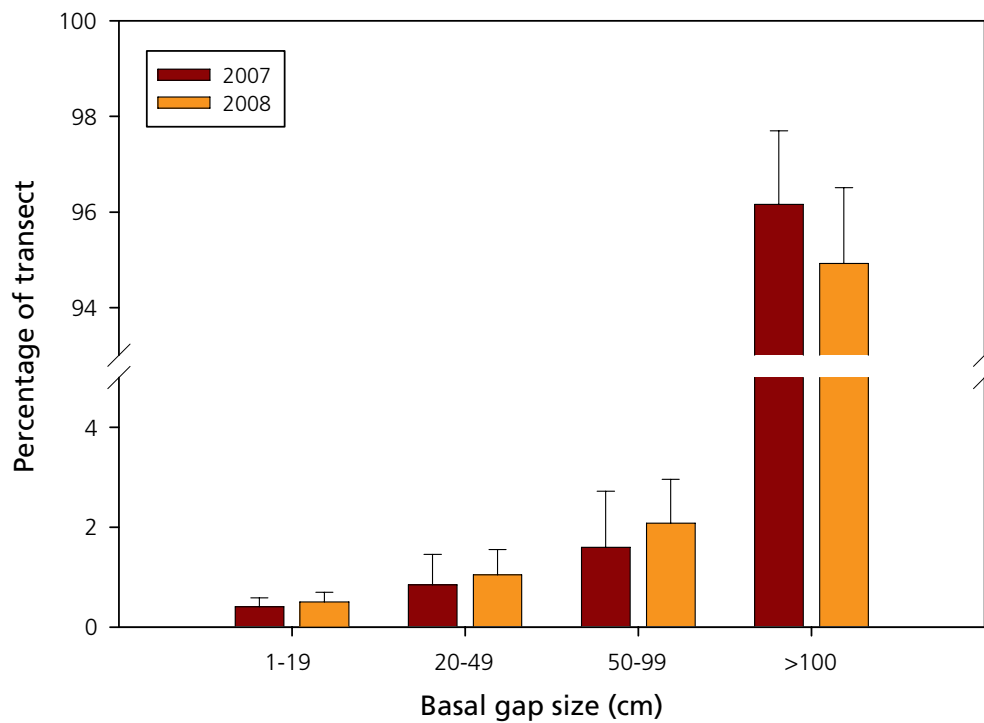


Figure 5. Percentage of transect in different gap sizes in 2008 and 2009. Error bars represent one standard deviation.

Table 5. Number of basal gaps, median gap size, and percentage of transect in different gap size classes in 2008 and 2009

Metric	2008		2009	
	Mean	(SD)	Mean	(SD)
Number of gaps	42.3	(9.5)	47.4	(7.2)
Median gap size (cm)	207.9	(81.3)	176.6	(51.1)
Percent of transect in gaps 0–19 cm	0.4	(0.2)	0.5	(0.2)
Percent of transect in gaps 20–49 cm	0.8	(0.6)	1.0	(0.5)
Percent of transect in gaps 50–99 cm	1.6	(1.1)	2.1	(0.9)
Percent of transect in gaps ≥100 cm	96.2	(1.5)	94.9	(1.6)
Percent of transect in gaps	99.0	(0.2)	98.6	(0.6)
Percent of transect in plant bases	1.0	(0.2)	1.4	(0.6)

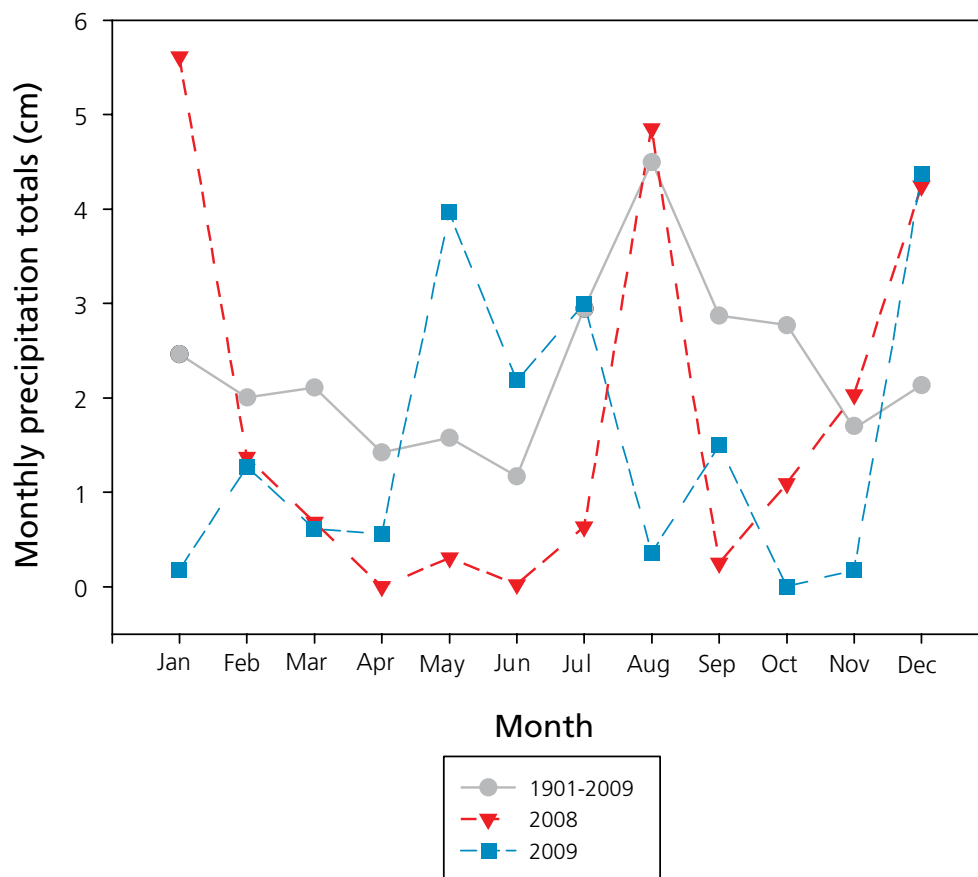


Figure 6. Total monthly precipitation for 2008 and 2009, with the mean monthly totals for 1901 through 2009 (WRCC 2010)

Discussion

The data presented here indicate relatively small variation in the vegetation of the Desert Sand ecological site between the years 2008 and 2009. Variation in functional group cover and in species cover and frequency was generally small, especially considering the high variability among plots. The largest change was a decrease in forbs, as evidenced both in the functional group cover and the individual species cover. The variation that did occur is, in part, attributable to variation in precipitation. In 2008 the precipitation in January was above average, but below average through May; in 2009, precipitation in May was above average. (fig. 6). The timing and the amount of precipitation differentially influences germination, growth, and flowering of species. Annual species and perennial forbs show the largest among year variation in frequency and cover. Only one nonnative species was found in the plots both years; *Bromus tectorum* occurred in 90% of the plots, but in moderately low abundance. *Salsola tragus* and *Descurainia sophia* were found only in 2009 and in very low abundance.

Some of the soil properties did show substantial changes between the two years. Some of these changes may be attributable to how soil surface features appear in wet conditions versus dry conditions. When the ground surface is wet, cyanobacteria are much more visible, and undifferentiated crust becomes more difficult to distinguish from bare soil. In addition, physical crust is formed by raindrop impact and decreases over time since the last rainfall. In 2008, a number of plots were sampled during or shortly after precipitation events, which may have caused the crew to incorrectly estimate the cover of soil surface features. Other changes may be attributed to erosion and deposition of sand. In 2009, the rebars that mark the transects were buried in a couple of plots, indicating that sand deposition had occurred. Erosion and deposition of sand through wind and water may have uncovered or covered certain soil surface features such as gravel and other rock components.

We stress that the differences noted between years are not indicative of any trend, since trends cannot be determined with only three years of sampling. Nor should they be interpreted as being ecologically significant. Differences are due to ecological variability, such as annual climatic fluctuation, or sampling errors inherent in the field sampling process. Cover estimation may vary among individuals (and crews), species may be mis-identified, slight differences between observers in applying sampling methods may go unnoticed, and the location of transects and quadrats vary slightly from year to year. We strive to minimize these errors by ensuring that transect lines are as straight as possible, quadrats are placed correctly, and field crews are thoroughly trained on methods and species identification and remain calibrated on cover estimation.

We plan to resample the plots for a third year and then conduct power analysis using the three years of data, which will help determine the total number of plots necessary to detect change in the key metrics. A temporal sampling design will then be implemented, with the installation of additional plots in subsequent years. Each year's data will be compared to the previously collected data to analyze changes through time in vegetation composition and structure and in soil stability and hydrologic function. Trend analyses will be conducted once sufficient data have been collected.

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Appendix A

Complete species list with mean foliar cover and frequency for species in 2008 and 2009

Species	Common name	Family	2008		2009	
			Foliar cover (%)	Plot frequency (%)	Foliar cover (%)	Plot frequency (%)
<i>Abronia fragrans</i>	snowball sand verbena	Nyctaginaceae	0.101	20	0.014	30
<i>Achnatherum hymenoides</i>	Indian ricegrass	Poaceae	0.055	80	0.103	100
<i>Amsonia tomentosa</i>	woolly luestar	Apocynaceae	0.004	10	0	0
<i>Artemisia filifolia</i>	sand sagebrush	Asteraceae	0.871	100	0.834	100
<i>Asclepias asperula</i>	antelope horns	Asclepiadaceae	0.005	20	0.001	10
<i>Asclepias cryptoceras</i>	pallid milkweed	Asclepiadaceae	<0.001	10	<0.001	10
<i>Astragalus amphioxys</i>	Crescent milkvetch	Fabaceae	<0.001	10	0	0
<i>Astragalus lentiginosus</i>	specklepod milkvetch	Fabaceae	0.621	80	0.005	20
<i>Bromus tectorum</i> ^a	cheatgrass	Poaceae	0.023	60	0.013	70
<i>Chaenactis stevioides</i>	Steve's dustymaiden	Asteraceae	0.062	60	0.008	70
<i>Chamaesyce parryi</i>	Parry's sandmat	Euphorbiaceae	0.018	40	0.008	60
<i>Chrysothamnus Greenei</i>	Greene's rabbitbrush	Asteraceae	0.474	20	0.304	20
<i>Coleogyne ramosissima</i>	blackbrush	Rosaceae	0.776	80	0.460	80
<i>Comandra umbellata</i>	bastard toadflax	Santalaceae	0.066	40	0.035	60
<i>Cordylanthus wrightii</i>	Wright's bird's beak	Scrophulariaceae	0.014	20	0.004	20
<i>Cryptantha</i> spp.	cryptantha	Boraginaceae	0.046	100	0.032	100
<i>Cryptantha flava</i>	Brenda's yellow cryptantha	Boraginaceae	0.002	10	0.001	10
<i>Descurainia pinnata</i>	western tansymustard	Brassicaceae	0.001	20	<0.001	10
<i>Descurainia sophia</i> ^a	herb sophia	Brassicaceae	0	0	0.005	30
<i>Dimorphocarpa wislizeni</i>	spectacle pod	Brassicaceae	0.008	20	0.000	0
<i>Ephedra viridis</i>	mormon tea	Ephedraceae	2.794	100	3.327	100
<i>Erigeron bellidiistrum</i>	western daisy fleabane	Asteraceae	0.029	70	0	0
<i>Eriogonum leptoclodon</i>	sand buckwheat	Polygonaceae	0.618	80	0.681	80
<i>Gutierrezia sarothrae</i>	broom snakeweed	Asteraceae	0.702	60	0.377	40

Appendix A continued

Species	Common name	Family	2008		2009	
			Foliar cover (%)	Plot frequency (%)	Foliar cover (%)	Plot frequency (%)
<i>Helianthus annuus</i>	common sunflower	Asteraceae	0.000	10	0.001	30
<i>Hymenopappus filifolius</i>	fineleaf hymenopappus	Asteraceae	0.042	60	0.023	70
<i>Ipomopsis gunnisonii</i>	sanddune ipomopsis	Polemoniaceae	0.050	100	0.012	90
<i>Lepidium montanum</i>	mountain pepperweed	Brassicaceae	0.040	10	0.031	10
<i>Linum aristatum</i>	bristle flax	Linaceae	0.008	60	0	0
<i>Lupinus pusillus</i>	rusty lupine	Fabaceae	0.019	70	0.013	70
<i>Machaeranthera canescens</i>	hoary tansyaster	Asteraceae	0.000	10	0.003	10
<i>Mentzelia albicaulis</i>	whitestem blazingstar	Loasaceae	0.000	10	0.003	40
<i>Mentzelia multiflora</i>	Adonis blazingstar	Loasaceae	0.010	30	0.000	0
<i>Monroa squarrosa</i>	false buffalograss	Poaceae	0.001	20	0.015	50
<i>Muhlenbergia pungens</i>	sandhill muhly	Poaceae	0.007	30	0.015	20
<i>Oenothera pallida</i>	pale evening-primrose	Onagraceae	0.177	30	0.009	10
<i>Opuntia</i> sp.	prickly pear	Cactaceae	0.194	100	0.083	80
<i>Penstemon ambiguus</i>	pink plains beardtongue	Scrophulariaceae	0.053	20	0.066	30
<i>Phacelia ivesiana</i>	lves' phacelia	Hydrophyllaceae	0.004	10	0.004	20
<i>Plantago patagonica</i>	woolly plantain	Plantaginaceae	0.873	100	0.021	70
<i>Pleuraphis jamesii</i>	James' galleta	Poaceae	0.044	20	0.069	20
<i>Poliomintha incana</i>	frosted mint	Lamiaceae	0.054	30	0.089	30
<i>Psoralea fremontii</i>	Fremont's dalea	Fabaceae	1.156	100	0.989	100
<i>Quercus</i> sp.	oak	Fagaceae	0	0	<0.001	10
<i>Rumex</i> sp.	dock	Polygonaceae	0	0	0.004	10
<i>Salsola tragus</i>	prickly Russian thistle	Chenopodiaceae	0	0	<0.001	10
<i>Sphaeralcea grossulariifolia</i>	gooseberryleaf globemallow	Malvaceae	0.037	90	0.033	90
<i>Sporobolus</i> spp.	dropseed	Poaceae	0.319	60	0.382	100
<i>Sporobolus contractus</i>	spike dropseed	Poaceae	0.001	20	0.028	10
<i>Sporobolus cryptandrus</i>	sand dropseed	Poaceae	0.114	50	0	0
<i>Sporobolus flexuosus</i>	mesa dropseed	Poaceae	0.018	20	0	0
<i>Stephanomeria exigua</i>	small wirelettuce	Asteraceae	0.055	100	0.031	100

Appendix A continued

Species	Common name	Family	2008		2009	
			Foliar cover (%)	Plot frequency (%)	Foliar cover (%)	Plot frequency (%)
<i>Townsendia incana</i>	hoary Townsend daisy	Asteraceae	0.000	10	0.002	10
<i>Vandevaea stylosa</i>	pillar false gumweed	Asteraceae	0.311	50	0.214	50
<i>Vulpia octoflora</i>	sixweeks fescue	Poaceae	0.095	90	0.099	90
<i>Yucca angustissima</i>	narrowleaf yucca	Agavaceae	0.037	80	0.038	80
<i>Zigadenus paniculatus</i>	foothill deathcamas	Liliaceae	0.028	50	0.025	50
Unknown 05132008-4			0.020	10	0.469	60
Unknown 05162009-1			0	0	0.001	20
Unknown 05212008-2			<0.001	10	0	0

^a Nonnative species