



Integrated Upland Vegetation and Soils Monitoring for Aztec Ruins National Monument

2008 Summary Report

Natural Resource Data Series NPS/SCPN/NRDS—2009/014



ON THE COVER

Integrated Upland Crew sampling vegetation in the Limy ecological site at Aztec Ruins National Monument.
Photograph by: Jim DeCoster

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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 2008 field crew consisted of Jessica Erickson, Anna Lowell, and Eric Vasquez.

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Introduction and Background

The National Park Service Inventory and Monitoring (I&M) Program was designed to determine the current status and monitor long-term trends in the condition of park natural resources, providing park managers with a strong scientific foundation for making decisions and working with other agencies and the public for the protection of park ecosystems. The Southern Colorado Plateau Network (SCPN) is monitoring vegetation and soils as overall indicators of upland ecosystem integrity (Thomas et al. 2006).

At Aztec Ruins National Monument (AZRU), the SCPN and park staff selected the Limy ecological site as an important system to monitor. An ecological site is a landscape division with characteristic soils, hydrology, plant communities, and disturbance regimes and responses. The classification of ecological sites is based on soil survey data. (Butler et al. 2003). The Limy ecological site, which is composed of grasslands and shrublands, encompasses large portions of the monument. It faces a number of threats, including climate change, soil erosion, and invasion by nonnative species.

In 2008 the Integrated Upland Monitoring program of SCPN began monitoring upland sites at AZRU. In this report, we document monitoring activities in the 2008 field season and summarize the data that were collected.

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 derived the sampling frame for integrated upland monitoring at AZRU from the map of the Limy ecological site, which was developed by the US Natural Resources Conservation Service (See Appendix A of DeCoster et al., in review).

To create the sampling frame, we modified the map of the ecological site with Geographic Information System (GIS) technology by removing roads and areas where the slope exceeded 20% (fig. 1). We then generated a set of spatially distributed sampling points using the Generalized Random-Tessellation Stratified (GRTS) design (Stevens and Olsen 2004). A park archaeologist visited the sampling points and rejected sites that were too close to major archaeological sites. Before establishing a plot, the Integrated Upland crew conducted an ecological site assessment for each sampling point, and they rejected the site if (1) more than 20% of the plot fell outside the ecological site, (2) it had a slope exceeding 20%, or (3) it contained a major disturbance. Nine points were rejected: two sites contained major archaeological sites, six sites were bisected by steep-sided gullies (such that more than 20% of the site represented a different ecological site), and one site overlapped with an existing plot.

Field methods

The SCPN Upland Monitoring crew began monitoring at AZRU in 2008 with the establishment of six plots in the Limy ecological site. All plots were installed and read in early October. The plots are 0.50 ha in size, measuring 71 m x 71 m. Shrub and herbaceous vegetation data and soil data were collected on three 50 m transects, spaced 25 meters apart, within each plot. Overstory tree and sapling data were collected in a nested subplot located between two of the transects. Field methodology is provided in detail in the SCPN Integrated Upland Protocol (DeCoster et al., in review).

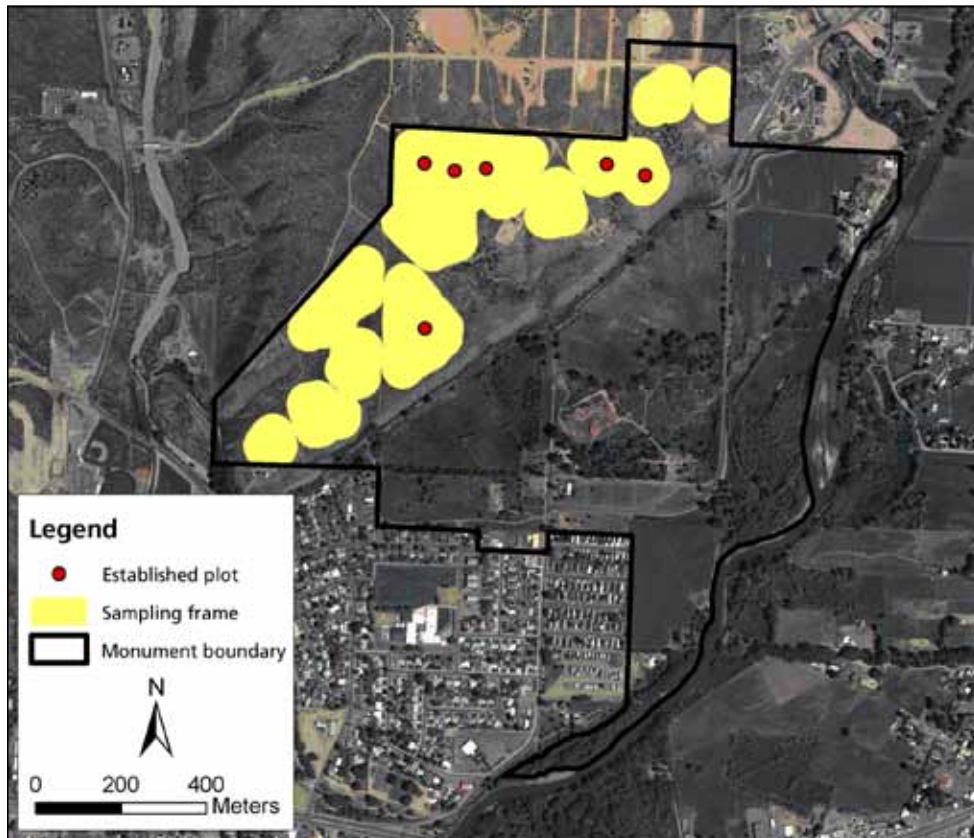


Figure 1. Sampling frame of the Limy ecological site with the six plots established in 2008.

Shrub and herbaceous vegetation

At 10 m intervals along each transect, the crew sampled shrub and herbaceous vegetation with five sets of nested quadrats. The largest quadrat size was 10 m² (2m x 5m), with four smaller quadrats nested inside (0.01 m², 0.1 m², 1 m², 5 m²). The presence of individual shrub and herbaceous species was recorded for each nested sub-quadrat. For each herbaceous and shrub species, percent cover was then estimated in the 10 m² quadrat and recorded as one of 12 cover classes, e.g. 2-5%, 5-10%, etc. Percent cover of functional groups (e.g. graminoids, forbs, shrubs) was also estimated in the largest quadrat and recorded as one of 12 cover classes.

Overstory trees and saplings

Overstory trees, defined as having a diameter greater than 15 cm, were measured within a 50 m x 50 m (0.25 ha) subplot between the outer two transects. Due to their multi-stemmed growth form, diameter at root crown (drc) was used to measure the size of *Juniperus* spp. (juniper species). For each individual overstory tree, species, drc, and status (live or dead) was recorded. Saplings (>2.5 and ≤15 cm diameter) were sampled in a 25 m x 25 m subplot and were tallied by species and size class. Tree seedlings were sampled in the 10 m² quadrats in conjunction with the shrub and herbaceous data and were tallied by species and size class.

Soil stability and hydrologic function

The crew measured the amount of bare soil by recording the size of the basal gaps (the space be-

tween plant bases) along each transects. A soil aggregate stability test was conducted with 18 of the soil samples collected along the transects. Percent cover of ground surface features was estimated in the 1 m² quadrats in conjunction with the shrub and herbaceous data, and the percent cover was recorded as one of 12 cover classes.

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 and frequency were 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, standard deviation (SD) and range of cover (range between the minimum and maximum of measured foliar covers, only including those plots where that species occurs) were calculated for the ecological site. 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 surface features were calculated in a similar fashion.

We calculated four diversity measures for herbaceous and shrub species (Magurran 1988)—first for all species in a site 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 all spatial scales (i.e. for each nested quadrat size, for the plot, and for 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 (J') 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 (diversity among plots):

$$S_e / (S_p - 1)$$

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.

Tree basal area (the total area of the tree cross-sections at root crown) was calculated for each overstory tree species in terms of m²/ha. Tree density (stems/ha) was calculated for all species and size classes for overstory, sapling, and seedling layers in terms of stems/ha. Mean diameter of overstory trees was also calculated by species.

We made five calculations for the basal gaps data: (1) median basal gap size, (2) percentage of transects comprised by gaps, (3) percentage of transects comprised by gaps $\geq$ 50 cm, (4) number of gaps

by size class, and (5) total number of gaps. Mean and SD were calculated for each metric.

The mean soil aggregate stability index and its standard deviation were calculated. This index ranges between 1 and 6, where 1 indicates low aggregate stability and 6 indicates high aggregate stability. The index was also calculated separately for samples with vegetative cover and for samples without vegetative cover.

Results

Shrub and herbaceous vegetation

A diverse mixture of grasses, shrubs, succulents and forbs comprised the herbaceous and shrub vegetation of the AZRU Limy Ecological Site. Table 1 lists the 15 most abundant species. *Artemisia tridentata* (big sagebrush) was the dominant shrub with a cover of 3.368%; other common shrubs included *Gutierrezia sarothrae* (broom snakeweed), *Ephedra viridis* (Mormon tea), *Ephedra torreyana* (Torrey's jointfir), and *Atriplex canescens* (fourwing saltbush). *Pleuraphis jamesii* (James' galleta) was the dominant grass, but *Sporobolus airoides* (alkali sacaton), *Elymus elymoides* (squirreltail), *Bromus tectorum* (cheatgrass), and *Aristida purpurea* (Fendler's threeawn) were also common. Common forbs included *Chamaesyce fendleri* (Fendler's sandmat), *Salsola tragus* (prickly Russian thistle), and

Table 1. Foliar cover and frequency of the fifteen most abundant shrub and herbaceous species and all nonnative species.

Species	Foliar cover (%)			Frequency (%)	
	Mean	SD	Range	Quadrat	Plot
<i>Artemisia tridentata</i>	3.368	2.262	0.270 - 5.817	71.11	100.00
<i>Pleuraphis jamesii</i>	2.076	1.355	0.407 - 3.600	72.22	100.00
<i>Gutierrezia sarothrae</i>	1.198	0.667	0.150 - 2.033	90.00	100.00
<i>Chamaesyce fendleri</i>	0.742	1.638	0.057 - 4.083	56.67	83.33
<i>Ephedra viridis</i>	0.407	0.487	0.020 - 1.167	8.89	66.67
<i>Sporobolus airoides</i>	0.379	0.528	0.050 - 1.337	12.22	66.67
<i>Bromus tectorum</i> ^a	0.311	0.194	0.087 - 0.630	74.44	100.00
<i>Opuntia</i> spp.	0.304	0.201	0.050 - 0.590	27.78	100.00
<i>Salsola tragus</i> ^a	0.245	0.325	0.003 - 0.847	27.78	100.00
<i>Elymus elymoides</i>	0.169	0.104	0.020 - 0.320	53.33	100.00
<i>Ephedra torreyana</i>	0.146	0.222	0.023 - 0.500	6.67	50.00
<i>Aristida purpurea</i>	0.106	0.083	0.040 - 0.253	33.33	100.00
<i>Atriplex canescens</i>	0.079	0.083	0.023 - 0.193	17.78	83.33
<i>Mentzelia multiflora</i>	0.059	0.074	0.010 - 0.203	21.11	83.33
<i>Sisymbrium altissimum</i> ^a	0.043	0.097	0.003 - 0.240	21.11	66.67
<i>Erodium cicutarium</i> ^a	0.015	0.032	0.003 - 0.080	13.33	50.00
<i>Lactuca serriola</i> ^a	0.004	0.008	0.003 - 0.020	2.22	33.33

Note: The ranges only include plots where the species occurs. (Many species do not occur in every plot of an ecological site; for these species, we did not include the plots with 0% cover in the range).

^a Nonnative species.

Mentzelia multiflora (Adonis blazingstar). *Opuntia* spp. was the only succulent. Species composition was variable among plots as indicated by the moderately wide ranges and standard deviations that were similar to or that exceeded their means. A number of species, including *Sporobolus airoides*, *Ephedra* spp., and *Opuntia* spp., were patchily distributed but abundant where they did occur, as suggested by low quadrat frequencies. Appendix A lists all the species found, along with common names, families, mean foliar cover, and plot frequencies.

Five nonnative species were found in the plots: the annual grass *Bromus tectorum* and the annual forb *Salsola tragus* were both moderately abundant, and occurred in all of the plots, with moderately high mean foliar cover; *Erodium cicutarium* (stork's bill), *Sisymbrium altissimum* (tumble mustard), and *Lactuca serriola* (prickly lettuce) were less abundant with low cover and low quadrat frequencies.

The cover of the functional groups further shows that shrubs and grasses were dominant. While the total vegetative cover was almost 10%, the mean cover of shrubs was 5.38% and the mean cover of perennial grass was 2.69% (table 2). Forb cover comprised 1.32%. Cacti and annual grasses comprised less than 1% cover. Cover of standing dead herbaceous was low with less than 1%, while standing dead woody cover was 2.61%.

Table 2. Foliar cover of functional groups.

Functional group	Foliar cover (%)		
	Mean	SD	Range
Total live vegetation	9.99	1.70	7.50 - 11.72
Perennial grass	2.69	1.15	1.44 - 4.30
Annual grass	0.34	0.23	0.09 - 0.73
Forbs	1.32	1.49	0.38 - 4.29
Shrubs	5.38	3.01	1.04 - 8.39
Cacti, succulents	0.39	0.37	0.05 - 1.09
Standing dead herbaceous	0.58	0.18	0.40 - 0.89
Standing dead woody	2.61	1.24	0.72 - 4.20

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

A total of 50 species was recorded in this ecological site, with a mean species richness of 29.7 species per plot (table 3). Shannon diversity, which generally falls between 1.5 and 3.5, was 1.915, which is low (Margalef 1972). Evenness was moderate—0.566. The Evenness Index is bounded by 0 and 1, where a value of 1 indicates that all species are of equal abundance. Beta diversity was 1.744, which is low. High values (greater than 5) indicate large differences among plots, whereas low values (less than 1) indicate similar composition (McCune and Grace 2002). When these indices were recalculated using only native species, all indices were slightly lower, except beta diversity, which was slightly higher (table 3). The species area curve (fig. 2) illustrates how species richness accumulates with increased area. The concave shape of the curve indicates low species richness at finer spatial scales, which is typical for the grasslands and shrublands of the region. The small error bars at areas 10 m² and finer indicate that variability is low at these spatial scales.

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

Metric	Mean	SD	Range
All species			
Plot			
Plot richness	29.7	2.6	27 – 32
Shannon diversity	1.915	0.162	
Evenness	0.566	0.049	
Ecological site			
Ecological site richness	50		
Beta diversity	1.744		
Native species			
Plot			
Plot richness	26.2	2.8	23 – 30
Shannon diversity	1.761	0.195	
Evenness	0.540	0.095	
Ecological site			
Ecological site richness	45		
Beta diversity	1.788		

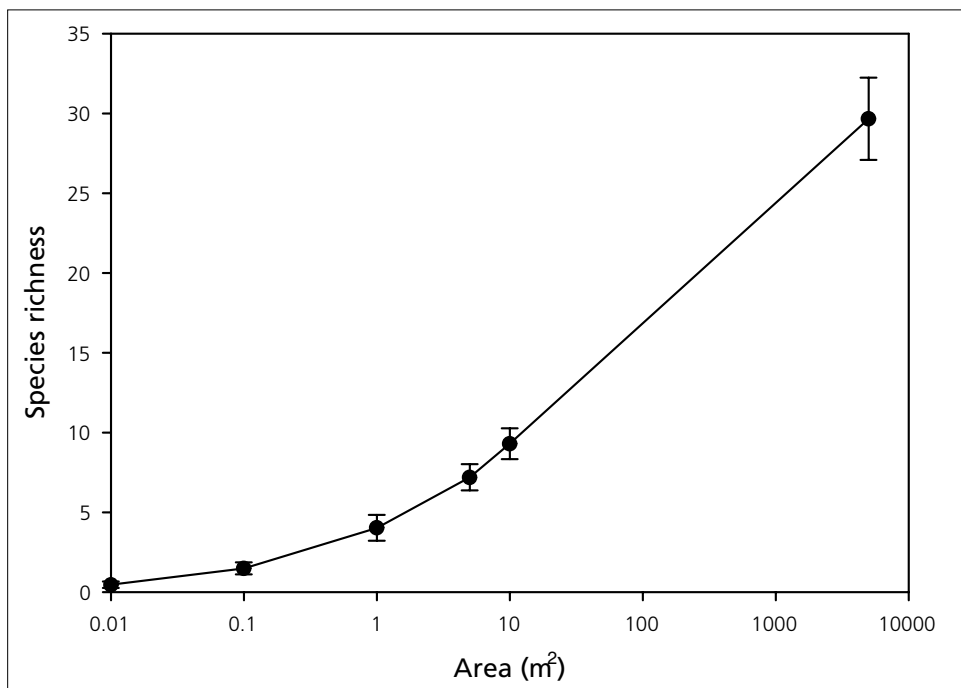


Figure 2. Species-area curve, with species richness at six spatial scales. Estimates are based on 10 plots with 15 quadrats each. The point at 5000 m² represents plot species richness. Error bars represent one standard deviation.

Trees

Only one tree species was found in the plots: *Juniperus osteosperma* (Utah juniper). Trees were in low abundance throughout the site. Table 4 and figure 3 show the density and basal area of *Juniperus osteosperma* by size class. Overstory density was 14.0 stems/ha; sapling density was 90.7 stems/ha; and the overstory basal area was 0.70 m²/ha. There were no seedlings and no snags (dead overstory stems). Overstory stems were all in the smaller size classes, with a mean drc of 22.7 cm. Saplings were more abundant than overstory trees. The large error bars, particularly prominent for the saplings, indicate that these densities were highly variable among plots.

Table 4. Density and basal area of living and standing dead trees.

Species	Seedling density (stems/ha)	Sapling density (stems/ha)	Overstory density (stems/ha)	Snag density (stems/ha)	Overstory basal area (m ² /ha)	Snag basal area (m ² /ha)	Mean drc (cm)
<i>Juniperus osteosperma</i>	0	90.7	14.0	0	0.70	0	22.7

Note: Seedlings have <2.5 cm diameter at root crown (drc), saplings have 2.5-14.9 cm drc, and overstory trees have ≥15 cm drc.

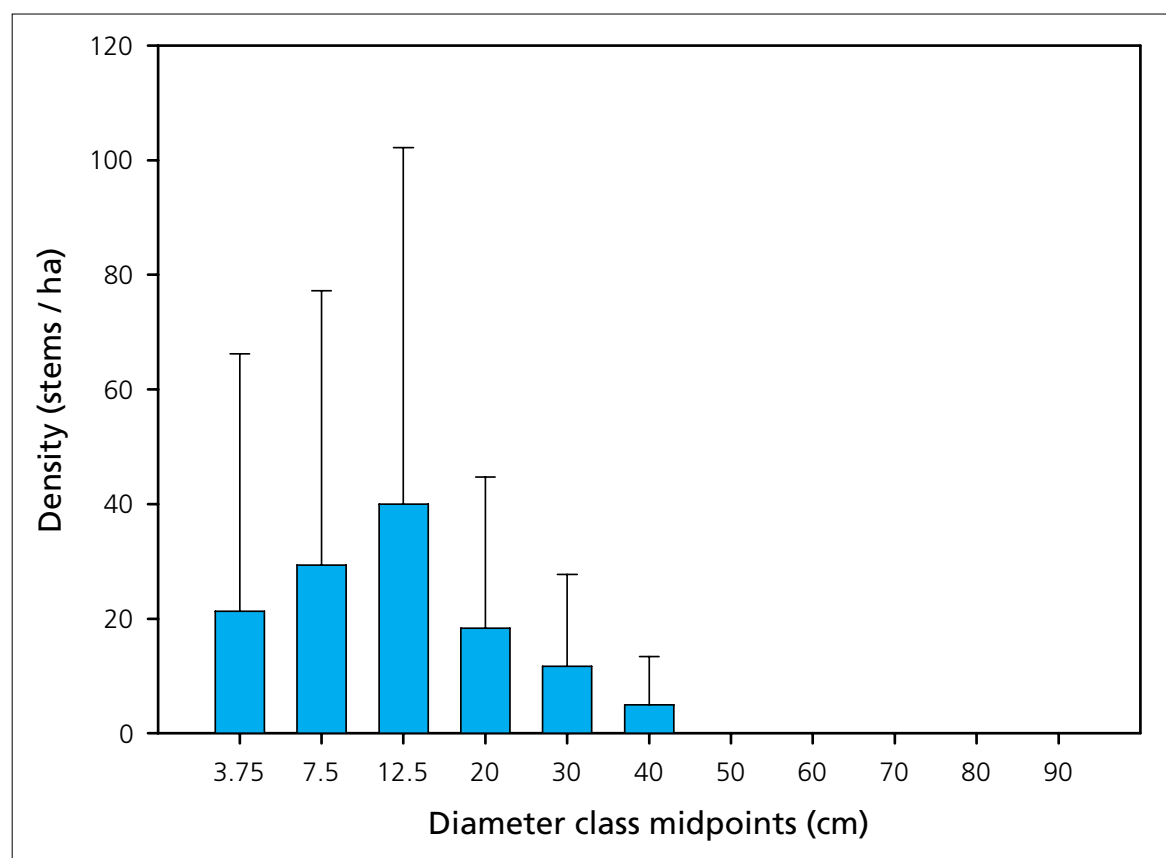


Figure 3. Size structure of overstory trees and saplings of *Juniperus osteosperma*. Overstory trees (≥15 cm drc) were measured in a 0.25 ha plot, while saplings (<15 cm drc) were measured in a 0.625 ha plot. Error bars represent one standard deviation.

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 basal gap intercepts. The dominant soil surface features were undifferentiated crust (60.04%), duff and litter (10.64%), and bare soil (10.58%) (table 5). Cover of live plant base, fine gravel, coarse gravel, and cobble each comprised between 1 and 5%. Dead herbaceous base, dead woody base, moss, cyanobacteria, stone, and woody debris each occupied less than 1% cover. Variability of surface features between plots was generally low, except for bare soil.

Table 5. Cover of ground surface features.

Surface feature	Cover (%)		
	Mean	SD	Range
Live plant base	3.13	1.43	1.74 - 5.40
Dead woody base	0.50	0.26	0.20 - 0.83
Dead herbaceous base	0.79	0.44	0.17 - 1.29
Bare soil	10.58	9.92	1.26 - 28.24
Duff and litter	10.64	4.31	4.28 - 14.22
Undifferentiated crust	60.04	6.60	51.93 - 68.50
Moss	0.25	0.37	0.00 - 0.88
Lichen	0.00	0.00	0.00 - 0.00
Cyanobacteria	0.33	0.36	0.00 - 0.91
Fine gravel (0.2 cm- 2cm)	3.48	3.34	0.31 - 7.29
Coarse gravel (2cm – 7.5 cm)	2.09	1.76	0.38 - 5.16
Cobble (7.5 cm – 25 cm)	2.05	1.29	0.55 - 3.57
Stone, bedrock (>25 cm)	0.78	0.89	0.00 - 2.05
Woody debris	0.19	0.18	0.00 - 0.48

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

The basal gap data (table 6) indicate that there were 126.0 gaps per plot with a median size of 64.8 cm. Of the total length of the transects, 96.8 % is gap; therefore 3.2% intersects plant bases. (Note the similarity between the amount of plant base in the basal gap data and in the surface feature data). The size distribution of gaps (fig. 4) demonstrates the predominance of large gaps: gaps greater than 50 cm composed 88.6% of the transect. These large gaps are the areas most susceptible to erosion.

Table 6. Number of basal gaps, mean gap size and percentage of total transect length comprised by gaps.

Metric	Mean	(SD)
Gap number	126.0	(33.9)
Median gap size (cm)	64.8	(13.8)
Percent of transect in gaps	96.8	(0.8)
Percent of transect in gaps ≥ 50 cm	88.6	(4.1)

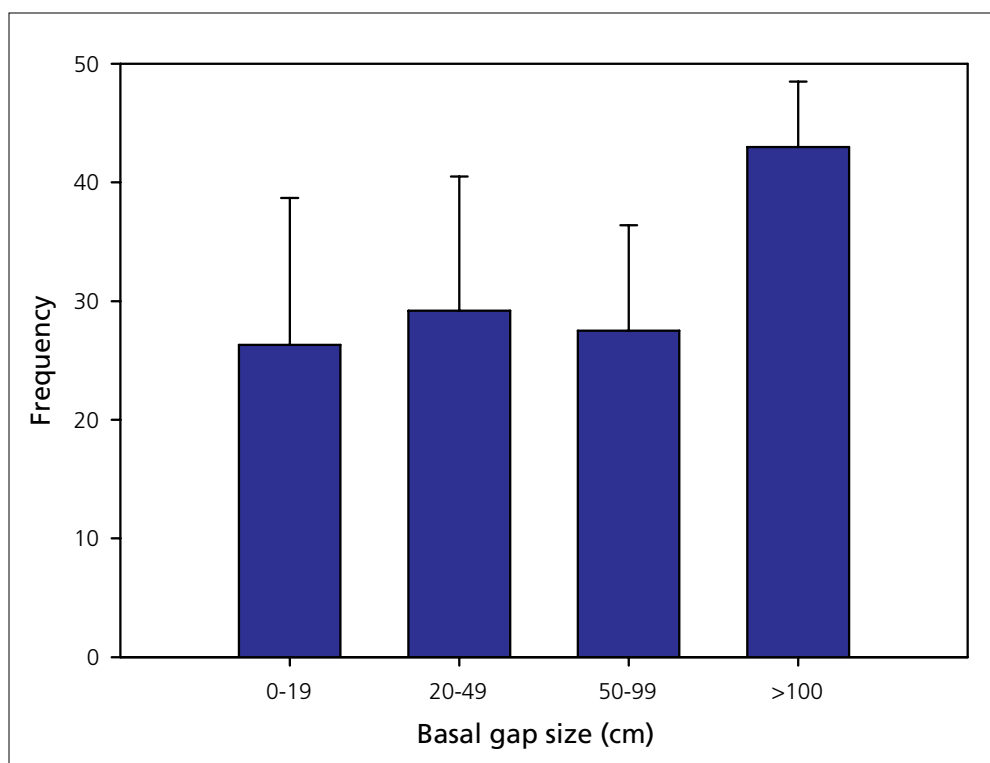


Figure 3. Frequency distribution of the basal gap sizes. Error bars represent one standard deviation.

Soil aggregate stability provides a measurement of the erodibility of the soil (table 7). The mean rating was 3.61, indicating moderate stability. Soil occurring under vegetative cover had a slightly higher aggregate stability rating than bare soil without cover: 4.10 compared to 3.49.

Table 7. Soil stability rating for samples with and without vegetative cover.

Metric	Mean	(SD)
With vegetative cover	4.10	(0.98)
Without vegetative cover	3.49	(0.52)
All samples	3.61	(0.56)

Note: A rating of 1 is the lowest stability and a rating of 6 is the highest stability.

Discussion

These data represent the first year baseline of sampling for the Limy ecological site at AZRU. The data indicate that the shrub/herbaceous layer consisted of a moderately diverse mixture of shrubs and grasses. Common shrubs included *Artemisia tridentata*, *Gutierrezia sarothrae*, *Ephedra* spp., and *Atriplex canescens*. Common grasses included *Pleuraphis jamesii*, *Sporobolus airoides*, and *Elymus elymoides*. The vegetation composition showed high variability. While high variability suggests differences in composition among plots, it is also undoubtedly an artifact of the small sample size. There were five nonnative species identified in the plots, but only two were common: *Bromus tectorum* and *Salsola tragus*. Species diversity at both the plot scale and landscape scale was moderate.

Trees were sparse, with low density and low basal area. *Juniperus osteosperma* was the only tree represented in the plots. Individuals ranged in size from saplings to small overstory trees. Trees were most abundant in the gullies (small areas of the plot which comprised a different ecological site).

Soil aggregate stability and the amount of exposed soil are measurements used to quantify the potential for soil erosion at a site. Even though the gap data demonstrated extensive areas occupied by large basal gaps, and the surface has little development of biological crusts (moss, lichen, and cyanobacteria), the potential for soil erosion is buffered by the moderate rating of soil aggregate stability.

The SCPN Integrated Upland crew will revisit these six plots at a regular interval (e.g. every 5-6 years). Each year's data will be compared to the previously collected data to assess changes through time in vegetation composition and structure and in soil stability and hydrologic function. More thorough trend analyses will be conducted once sufficient data have been collected.

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Appendix A

Complete species list with foliar cover and frequency values for herbaceous and shrub species and with overstory basal area and frequency for tree species.

Shrub and herbaceous species				
Species	Common name	Family	Foliar cover (%)	Plot frequency (%)
<i>Achnatherum hymenoides</i>	Indian ricegrass	Poaceae	0.024	66.67
<i>Arabis selbyi</i>	Selby's rockcress	Brassicaceae	0.001	16.67
<i>Aristida purpurea</i>	Fendler's threeawn	Poaceae	0.106	100.00
<i>Artemisia tridentata</i>	basin big sagebrush	Asteraceae	3.368	100.00
<i>Astragalus</i> sp.	milkvetch	Fabaceae	0.001	33.33
<i>Atriplex canescens</i>	fourwing saltbush	Chenopodiaceae	0.079	83.33
<i>Atriplex obovata</i>	mound saltbush	Chenopodiaceae	0.001	16.67
<i>Atriplex saccaria</i>	sack saltbush	Chenopodiaceae	0.013	50.00
<i>Bouteloua gracilis</i>	blue grama	Poaceae	0.002	33.33
<i>Bromus tectorum</i> ^a	cheatgrass	Poaceae	0.311	100.00
<i>Chaetopappa ericoides</i>	rose heath	Asteraceae	0.058	100.00
<i>Chamaesaracha coronopus</i>	greenleaf five eyes	Solanaceae	0.043	100.00
<i>Chamaescyce</i> spp.	annual sandmats	Euphorbiaceae	0.030	33.33
<i>Chamaescyce fendleri</i>	Fendler's sandmat	Euphorbiaceae	0.741	83.33
<i>Chenopodium</i> sp.	goosefoot	Chenopodiaceae	0.001	16.67
<i>Chenopodium fremontii</i>	Fremont's goosefoot	Chenopodiaceae	0.003	16.67
<i>Cirsium</i> sp.	thistle	Asteraceae	0.001	16.67
<i>Cryptantha</i> sp.	cryptantha	Boraginaceae	0.031	100.00
<i>Elymus elymoides</i>	squirreltail	Poaceae	0.169	100.00
<i>Ephedra torreyana</i>	Torrey's jointfir	Ephedraceae	0.146	50.00
<i>Ephedra viridis</i>	mormon tea	Ephedraceae	0.407	66.67
<i>Eriastrum diffusum</i> ^b	miniature woollystar	Polemoniaceae	0.014	66.67
<i>Eriogonum ovalifolium</i>	cushion buckwheat	Polygonaceae	0.001	16.67
<i>Erioneuron pilosum</i>	hairy woollygrass	Poaceae	0.008	16.67
<i>Erodium cicutarium</i> ^a	stork's bill	Geraniaceae	0.015	50.00
<i>Evolvulus nuttallianus</i>	shaggy dwarf morning-glory	Convolvulaceae	0.007	16.67
<i>Gutierrezia sarothrae</i>	broom snakeweed	Asteraceae	1.198	100.00
<i>Hesperostipa comata</i>	needle and thread	Poaceae	0.016	33.33
<i>Kallstroemia parviflora</i> ^b	warty caltrop	Zygophyllaceae	0.007	50.00
<i>Lactuca serriola</i> ^a	prickly lettuce	Asteraceae	0.004	33.33
<i>Lappula occidentalis</i>	flatspine stickseed	Boraginaceae	0.033	100.00
<i>Lepidium</i> sp.	pepperweed	Brassicaceae	0.011	50.00
<i>Leptodactylon pungens</i>	granite prickly phlox	Polemoniaceae	0.017	16.67
<i>Mentzelia multiflora</i>	Adonis blazingstar	Loasaceae	0.059	83.33

Appendix A, continued.

Species	Common name	Family	Foliar cover (%)	Plot frequency (%)
<i>Mirabilis linearis</i>	narrowleaf four o'clock	Nyctaginaceae	0.003	16.67
<i>Mirabilis multiflora</i>	Colorado four o'clock	Nyctaginaceae	0.044	50.00
<i>Monroa squarrosa</i> ^b	false buffalograss	Poaceae	0.033	83.33
<i>Opuntia</i> spp.	prickly pear	Cactaceae	0.304	100.00
<i>Packera multilobata</i>	lobeleaf groundsel	Asteraceae	0.012	50.00
<i>Pleuraphis jamesii</i>	James' galleta	Poaceae	2.076	100.00
<i>Purshia tridentata</i>	antelope bitterbrush	Rosaceae	0.039	16.67
<i>Rumex</i> sp.	dock	Polygonaceae	0.002	33.33
<i>Salsola tragus</i> ^a	prickly Russian thistle	Chenopodiaceae	0.245	100.00
<i>Senecio flaccidus</i>	threadleaf ragwort	Asteraceae	0.001	16.67
<i>Sisymbrium altissimum</i> ^a	tumblemustard	Brassicaceae	0.043	66.67
<i>Sphaeralcea coccinea</i>	scarlet globemallow	Malvaceae	0.042	100.00
<i>Sporobolus airoides</i>	alkali sacaton	Poaceae	0.379	66.67
<i>Sporobolus cryptandrus</i>	sand dropseed	Poaceae	0.044	83.33
<i>Stephanomeria pauciflora</i>	brownplume wirelettuce	Asteraceae	0.024	83.33
Unknown 2008Oct7-1			0.008	83.33

^a Nonnative species

^b Species found in the plots that are not included on the park's species list

Tree species

Species	Common name	Family	Basal area	Plot frequency (%)
<i>Juniperus osteosperma</i>	Utah juniper	Cupressaceae	0.70	66.67