Appendix D: Natural Resource Assessments

Overview

Scoping identified several concerns about potential impacts of climbing and canyoneering activities on natural resources in the park. Issues that were identified included potential impacts to soils and biological soil crusts, vegetation, wildlife (especially raptors and desert bighorn sheep), water resources, and geologic features. To evaluate potential impacts and inform preparation of this EA, park staff conducted field-based natural resource assessments of all known canyoneering routes and the most heavily used climbing routes in the park. Objectives were to –

1. Become familiar with park resources and current climbing and canyoneering activities;
2. Assess current resource conditions and evidence of impacts attributable to climbing, canyoneering, and other park uses;
3. Assess the potential for future resource impacts under different management scenarios; and
4. Identify needs and priorities for management actions necessary for mitigating current resource impacts; and
5. Initiate an adaptive-management process that relies on the iterative collection and evaluation of data to inform management decision making

Soil, vegetation, and hydrologic conditions along each route were evaluated through use of a protocol that assesses the status of three attributes of rangeland health – soil / site stability, hydrologic function, and biotic integrity (Table E1; Pyke et al. 2002, Pellant et al. 2005, Miller 2008). The protocol is designed specifically for use in rangeland ecosystems including arid grasslands, shrublands, and woodlands characteristic of Arches National Park. Attributes are assessed on the basis of 17 qualitative indicators that are rated according to field observations and professional judgment of the assessment team (Table E2).

Table E1. Three attributes of rangeland health, and their definitions (from Pyke et al. 2002, Pellant et al. 2005).

Attribute	Definition
Soil / site stability	The capacity of a site to limit redistribution and loss of soil resources (including nutrients and organic matter) by wind and water.
Hydrologic function	The capacity of a site to capture, store, and safely release water from rainfall, run-on, and snowmelt (where relevant), to resist a reduction in this capacity, and to recover this capacity following degradation.
Biotic integrity	Capacity of a site to support characteristic functional and structural communities in the context of normal variability, to resist loss of this function and structure due to a disturbance, and to recover following such disturbance.

Table E2. Brief description of 17 indicators of rangeland health and their applicability to three rangeland health attributes (S = soil/site stability, H = hydrologic function, B = biotic integrity).

Indicator and brief description	Attributes		
	S	H	B
1. Rills – frequency and spatial distribution of linear erosional rivulets.	X	X	
2. Water flow patterns – amount and distribution of overland flow paths that are identified by litter distribution and visual evidence of soil and gravel movement.	X	X	
3. Pedestals and/or terracettes – frequency and distribution of rocks or plants where soil has been eroded from their base (pedestals), and/or occurrence of erosional terracettes.	X	X	
4. Bare ground – size and connectivity among areas of soil not protected by vegetation, biological soil crusts, litter, standing dead vegetation, gravel or rocks.	X	X	
5. Gullies – amount of channels cut into the soil and the amount and distribution of vegetation in the channel	X	X	
6. Wind-scoured, blowouts, and/or deposition areas – frequency of areas where soil is removed from under physical or biological soil crust or around vegetation OR frequency of accumulation areas of soil associated with large structural objects, often woody plants	X		
7. Litter movement – frequency and size of litter displaced by wind and overland flow of water	X		
8. Soil surface resistance to erosion – ability of soils to resist erosion through the incorporation of organic material into soil aggregates.	X	X	X
9. Soil surface loss or degradation – frequency and size of areas missing all or portions of the upper soil horizons that normally contain the majority of organic material of the site.	X	X	X
10. Plant community composition and distribution relative to infiltration and runoff – the community composition or distribution of species that restrict the infiltration of water on the site.		X	
11. Compaction layer – thickness and distribution of the structure of the soil near the soil surface (<= 15 cm)	X	X	X
12. Functional / structural groups – the number of groups, the number of species within groups, or the rank of order of dominance of groups.			X
13. Plant mortality / decadence – frequency of dead or moribund (dying) plants			X
14. Litter amount – deviation in the amount of litter		X	X
15. Annual aboveground production – amount relative to the potential for that year based upon recent climatic conditions			X
16. Invasive plants – abundance and distribution of invasive plants regardless if they are noxious weeds, exotic species, or native plants whose dominance greatly exceeds that expected for the ecological site.			X
17. Reproductive capability of perennial plants – evidence of the inflorescences or of vegetative tiller production relative to the potential for that year based upon recent climatic conditions.			X

Prior to conducting resource assessments in the field, existing resource information including digital aerial imagery, digital geologic maps (Doelling 2001), digital soil maps (Scott 2009), digital vegetation maps (Coles et al. 2009). Ten canyoneering routes and 143 rock climbing routes were mapped on GIS from ground observations, guide books, and on-line websites. Historic data on the distribution of special status species and documented cultural sites were compiled and reviewed by park staff. Because substrate (soil and geology) properties are important for determining susceptibility to impacts from climbing and canyoneering activities, aerial imagery and digital maps of soil, geology, and vegetation were used by park staff to subdivide routes into different segments that were predicted to vary in the type and degree of impacts. Designations of route segments were adjusted as necessary when assessments were conducted in the field, and indicators and attributes of rangeland health were assessed separately for each route segment. During each assessment, the team also recorded observations of fixed-gear installations and condition, evidence of impacts to geologic features, the presence and characteristics of water resources, wildlife occupancy, and the presence of cultural resources. On-line route descriptions were also reviewed for accuracy to denote other potential resource and visitor conflicts.

In addition to route assessments, additional work was conducted to evaluate potential impacts on water resources because traversal of the Dragonfly canyoneering route typically requires that users wade or swim through several ephemeral rock pools (Fig. E1). To examine the potential for canyoneering use to accelerate the depletion of these water resources, park staff estimated the amount of water withdrawn from a pool by typical clothing and gear worn by canyoneers. Ten dry sets of clothing and gear were weighed, immersed in water, then weighed again. For these 10 replicates, amounts of water withdrawn by immersion ranged from 0.27 gal (1.0 liter) to 1.29 gal (4.9 liters), with an average of .58 gal (2.2 liters). With current levels of canyoneering use, periodic replenishment of these water resources by precipitation, and the restriction of these impacts to a small number of pools found along a single route, depletion effects were judged to be negligible to minor.

Figure E1. Canyoneers in an ephemeral rock pool in Dragonfly Canyon, Arches National Park (NPS photo).

Other assessments include climbing and analyzing two routes (Industrial Disease and Bubo) which have had historic seasonal closures to assess raptor nest condition and survey work for the presence of Mexican spotted owls. Potential habitat for the Mexican spotted owl exist in the Lost Springs area and two year's worth of survey data was collected by the park wildlife technician through a permit with the U.S. Fish and Wildlife Service utilizing survey protocols established in the Mexican spotted owl Recovery Plan (USFWS 1995). No owls were detected during these surveys and habitat conditions were judged to be marginal.

Literature Cited

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