



Springs, Seeps, and Hanging Garden

Community Monitoring

2011

Importance

Springs, seeps, and hanging gardens provide essential water, food resources, and wildlife habitat, and are important oases of biodiversity and productivity in desert landscapes. Because of their inherent fragility, spring and seep ecosystems are sensitive to a variety of human activities that have reduced the ecological integrity of these ecosystems through recreation, groundwater diversion, and livestock grazing. Monitoring spring and seep ecosystems will enable a more thorough understanding of the impacts of human activities and climate change on these ecosystems.

Long-term Monitoring

The primary goal for long-term monitoring of springs, seeps, and hanging gardens is to assess trends in key indicators of spring and seep ecosystem health. In 2011, the Northern Colorado Plateau Network (NCPN) completed a final report summarizing an inventory of rare-plant populations at hanging gardens in Arches NP and Natural Bridges NM (see next page). Results from this inventory will be used for site selection during long-term monitoring. In addition, the NPS and the Bureau of Land Management/Utah State University BugLab completed a study to assess the chemical, physical, and biological condition of spring and seeps throughout the NCPN (also see next page).

The NPS Southeast Utah Group (SEUG) has been monitoring water quality at a small number of spring sites for over 10 years. The NCPN is working closely with SEUG staff to develop a long-term springs monitoring program that augments that sampling by adding information on site vegetation and disturbance at existing monitoring sites, increasing the frequency of flow sampling at some long-term sites, initiating flow sampling at additional sites, and including hanging gardens. SEUG staff has reviewed the NCPN's draft monitoring protocol, and site selection is currently underway. Given the fragile nature of springs and seeps, the monitoring design attempts to minimize observer impacts.

Monitoring Objectives

Preliminary objectives for springs and seeps monitoring are to:

1. Determine long-term trends in discharge;
2. Determine long-term trends in core and site-specific water-chemistry parameters;



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Hanging garden, Arches NP.

3. Determine long-term trends in habitat area; and
4. Determine long-term trends in vegetation composition, with particular emphasis on rare plants at hanging-garden sites.

Management Applications

Information gathered from NCPN monitoring of springs, seeps, and hanging gardens will be used to:

- Identify ecologically impaired sites;
- Identify priority restoration needs;
- Establish regional abundance and diversity of vegetation in Colorado Plateau springs, seeps, and hanging gardens; and
- Improve understanding of these ecosystems in parks.

Network park units where springs, seeps, and hanging gardens will be monitored:

Arches National Park
Canyonlands National Park
Hovenweep National Monument
Natural Bridges National Monument

Rare Plant Inventory

In 2009 and 2010, NCPN staff visited hanging gardens in Arches NP and Natural Bridges NM to search for six rare plant species: *Cymopterus trotteri* (Trotter's oreoxis), *Erigeron kachinensis* (kachina daisy), *Cirsium rydbergii* (Rydberg's thistle), *Perityle specuicola* (alcove rock-daisy), *Zigadenus vaginatus* (alcove death camas) and *Habenaria zothecina* (alcove bog-orchid). Sixty-four hanging gardens were visited at Arches NP, and 26 hanging gardens were surveyed at Natural Bridges NM. *Cymopterus trotteri* and *Perityle specuicola* were not found at either park. *Erigeron kachinensis* occurred only at Natural Bridges NM, and the remaining species were found at sites in both parks. A comparison to a subset of sites visited in 1984 and 1993 indicated that rare plant populations of 10 or fewer individuals may be vulnerable to extinction at Natural Bridges NM. This project was supported by a small parks grant, and the location information will be used to select a random sample of hanging gardens for long-term monitoring at these two parks. Additional inventory work will occur this year, at the Island in the Sky District of Canyonlands NP, to improve understanding of the population of hanging gardens there.



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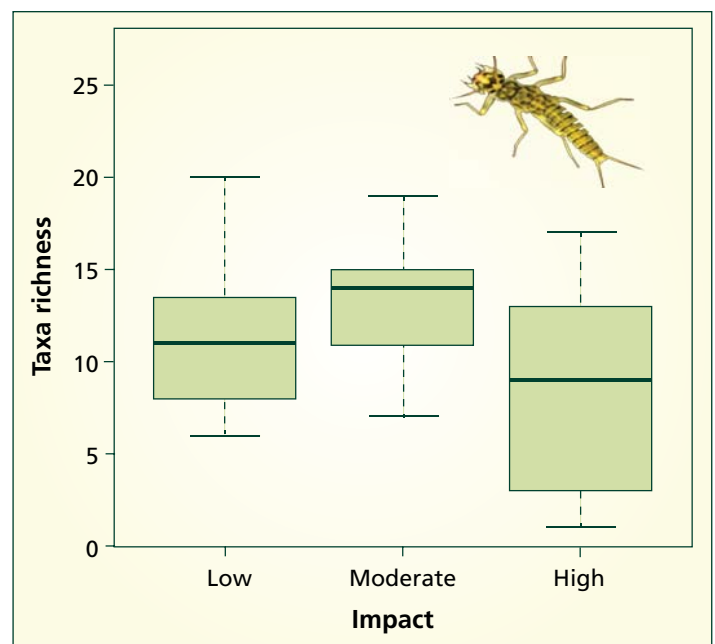
Kachina daisy (*Erigeron kachinensis*).

Disturbance Gradient Study

To effectively monitor, manage, and protect spring and seep ecosystems, we must first characterize their structure and function, as well as their responses to natural and anthropogenic environmental gradients. In 2008 and 2009, NCPN staff and ecologists from the Bureau of Land Management National Aquatic Monitoring Center visited 40 springs in southeastern Utah and southwestern Colorado to quantify relationships between anthropogenic disturbance, aquatic macroinvertebrate community species composition, and habitat variables at springs on the Colorado Plateau. Springs were divided into impact categories (low, medium, and high) based on visible disturbances and measures of soil and riparian-area integrity. Water quality and environmental variables were measured and invertebrates sampled.

Aquatic macroinvertebrate communities at springs with high disturbance levels differed from those at springs with low and moderate levels—most strongly at springs with both livestock and vehicle use. Taxa richness peaked at moderately disturbed sites (see figure), while the percent of taxa richness from non-insect taxa, dragonflies, and damselflies decreased with increasing disturbance. Vegetation cover also decreased with increasing disturbance, while the abundance of fecal indicator bacteria increased. Our data suggest that springs are resilient to—and perhaps even adapted to—moderate levels of disturbance, but there is a threshold beyond which negative impacts begin to accrue. NCPN staff and cooperators are currently preparing this study for publication in a peer-reviewed journal.

This study was undertaken, in part, to determine the utility of aquatic macroinvertebrates as an ecological indicator of spring and seep ecosystem health for NCPN's long-term monitoring



Taxa richness of aquatic macroinvertebrates was found to be highest at spring sites with moderate levels of disturbance.

program. While effects were observed, the types of disturbances most correlated with impacts do not generally occur at the springs we will monitor. NCPN and SEUG have decided that aquatic macroinvertebrate sampling will not be a core part of the long-term monitoring program at springs and seeps.

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