



Springs, Seeps, and Hanging Garden Community Monitoring

2012

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. The National Park Service Southeast Utah Group (SEUG) has been monitoring water quality at a small number of spring sites for over 10 years. The Northern Colorado Plateau Network (NCPN) has worked 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, initiating flow sampling at additional sites, and including hanging gardens.

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.

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;
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.



NATIONAL PARK SERVICE

Hanging garden, Arches National Park.

Status and Trends

In 2012, the NCPN completed a final report summarizing the proposed long-term monitoring sampling design for springs at four NCPN parks (see page 2). In addition, results from a study to assess the sensitivity of aquatic macroinvertebrates to anthropogenic disturbances at springs will be published in *Western North American Naturalist*. The study was conducted by the National Park Service (NPS) and the Bureau of Land Management/Utah State University BugLab.

Springs monitoring has begun at sites in all four parks, and a study of proposed vegetation methods is underway. Given the fragile nature of springs and seeps, the monitoring design attempts to minimize observer impacts.

Contact

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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

Proposed Springs Sampling Design Released

The proposed sampling design for NCPN springs and hanging gardens was completed in 2012. A summary is provided below.

Springs

Although three indicators have been selected for springs monitoring, pilot data were only available for monthly flow measurements. As such, the current sampling design is built around our ability to detect trend in flow; other indicators will be evaluated as data become available. The design was based on a power analysis whose purpose was to quantify the confidence with which a sampling scenario can detect a specified change in flow, given that the change actually exists. Power analyses assess the impact of natural and sampling-based variability on our ability to detect trends and can be used to tailor sample sizes and frequencies to meet monitoring objectives within cost limitations.

Based on more than three years of monthly data collected by SEUG staff at nine different springs, five different temporal sampling scenarios were modeled and tested:

- 1) monthly,
- 2) monthly with no winter sampling (Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov),
- 3) bimonthly (Feb, Apr, Jun, Aug, Oct, Dec),
- 4) quarterly (Mar, Jun, Sep, Dec), and
- 5) capturing the low flow time period when evapotranspiration is highest (Jun, Jul, Aug, Sep).

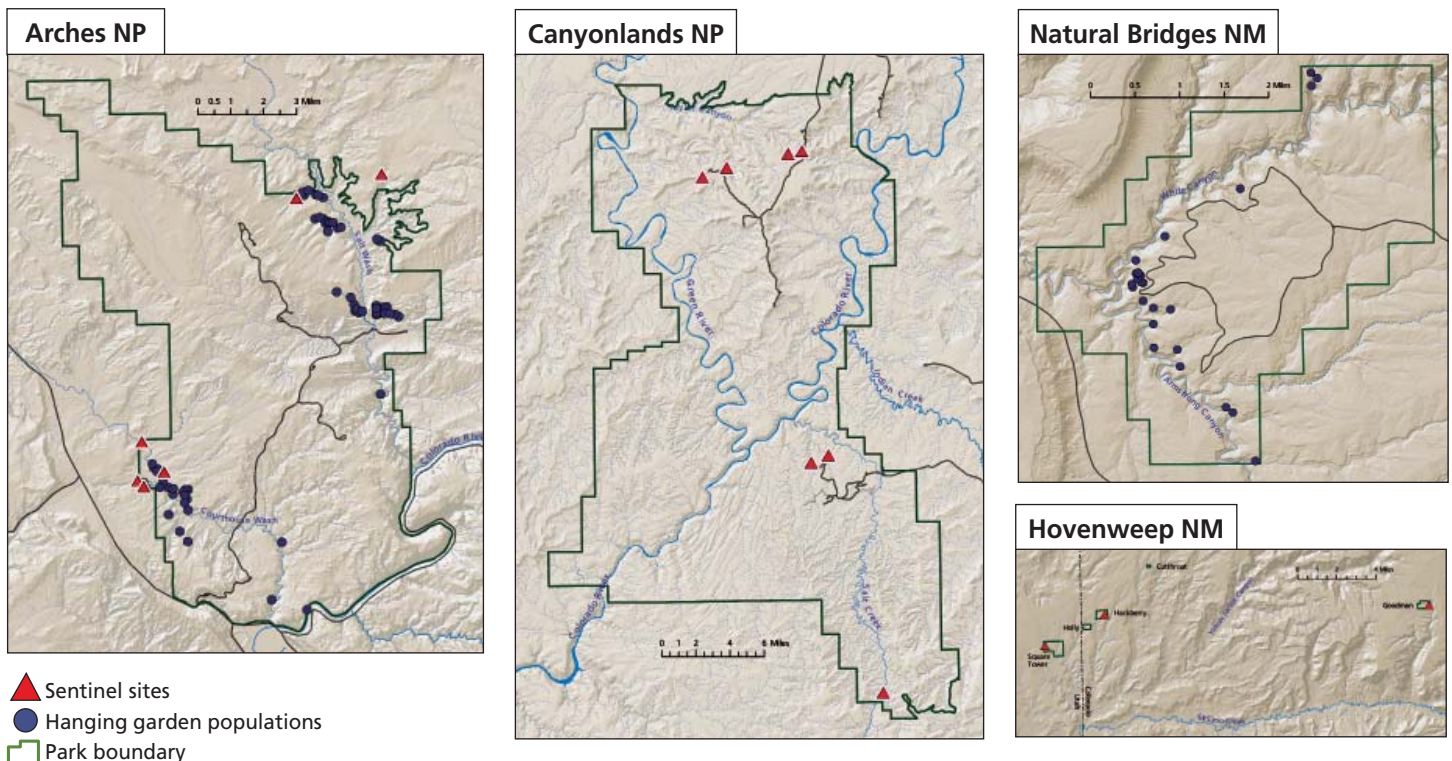
Because the no-winter sampling (Option 2) would generally detect the desired amount of change (5%) in less time than Options 3–5 while minimizing missed samples due to winter weather conditions, this option was chosen for the proposed design.

Because the objective of NCPN springs monitoring is to determine status and trends at specific sites, rather than to make inference to other sites, a series of sentinel sites were chosen for monitoring by Southeast Utah Group (SEUG) staff, according to management priority (see maps below). Due to the number of sites selected, not every site can be sampled every year. A subset of sites will be monitored annually to detect impacts of unusual or cyclical events that might otherwise be missed. The remaining sites will be visited for two years, then rested for two years.

SEUG staff initiated monthly water quality sampling in the early 1980s and added reliable water quantity measurements at several spring sites in the early 2000s. Under this sampling design, SEUG staff will continue monthly flow monitoring at five sites previously established for their springs and water quality monitoring program. The network will provide support for flow monitoring at the remaining sites and perform site and vegetation characterization once every four years.

Hanging Gardens

In contrast to springs, hanging gardens will be randomly sampled. Because of trampling concerns in these fragile areas, hanging gardens will not be sampled annually. They will be sampled for two consecutive years and then rested for four years. A rotating panel design will be used to increase the overall sample size and provide a better estimate of the status of the population. Sites will be added in random order until the allocated effort is reached. We will evaluate our ability to detect trends with the available sample size after several years of data collection.



Internet: <http://science.nature.nps.gov/im/units/ncpn/>

Intranet: <http://www1.nrintra.nps.gov/im/units/ncpn/>