Park News

Great Basin National Park
National Park Service
U.S. Department of the Interior

The Midden

The Resource Management Newsletter of Great Basin National Park

Great Basin Begins Alpine Plant Monitoring

Photo by Meg Horner

In the foreground, vegetation on Bald Mountain. Jeff Davis and Wheeler peaks in the background.

by Meg Horner,
Biological Science Technician

The Global Observation Research Initiative in Alpine Environments (GLORIA) is an international research project to assess climate change impacts on vegetation in alpine environments worldwide.

The project is composed of a ground-based, long-term monitoring network. Alpine environments are sensitive to climate change due to their restricted land area, harsh climate, and limited growing season. The protocols serve to assess variations in biodiversity and the vulnerability of alpine environments to climate change across all continents and major life-zones.

The GLORIA protocols were established in Austria and are now implemented all over the world. Great Basin National Park is the newest member to the project and represents the Great Basin Target Region of the western U.S.

Park staff joined botanists and experienced GLORIA personnel to set up transects on Wheeler Peak, Bald Mountain, Buck Mountain, and Pyramid Peak in August of 2008. Four temperature dataloggers were buried on each mountain top, and a variety of vegetation data was collected. All four peaks will be re-visited every five years to detect any changes in vegetation and soil temperatures.

The park would especially like to thank Ann Dennis, Calflora; Catie and Jim Bishop, US Forest Service; Steve Caicco, US Fish and Wildlife Service; Glenn Clifton, Botanist; and Angie Evenden, Great Basin CESU coordinator for all their help and expertise.

Alpine paintbrush, *Castilleja nana*

New Park Projects

By Tod Williams,
Chief of Natural Resources

With the signing of the White Pine County Conservation, Recreation, and Development Act of 2006, Great Basin National Park became eligible for project funding under the Southern Nevada Public Lands Management Act (SNPLMA).

SNPLMA allows the Bureau of Land Management to sell public lands around Las Vegas, Nevada. The revenue derived from these sales is placed in an account and made available to Federal land management agencies for funding projects. The Resource Management Division at Great Basin is eligible to submit project proposals to two funding categories:

Conservation Initiatives - activities which promote conservation on federal lands including planning, implementation, monitoring, environmental impact statements, natural and cultural resource protection, recreation, habitat restoration, species management, environmental education, and site stewardship.

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New Park Projects (continued)

Eastern Nevada Landscape Restoration Project (ENLRP) - Activities which promote healthy ecosystems within the Great Basin including planning, implementation, and monitoring of fire management; fuels; forest, aspen and riparian communities; wildlife habitat; soils; and watersheds.

The following Resource Management projects have been approved for funding:

Fisheries Restoration in East Central Nevada.
This project implements the Conservation Agreement for Bonneville Cutthroat Trout (CA), which aims to prevent listing under the Endangered Species Act. Working cooperatively with the Nevada Department of Wildlife and other agencies, Great Basin National Park staff will complete all tasks within the CA. In addition, the park will continue to reintroduce three native fish species, speckled dace, mottled sculpin, and redside shiner, to additional stream locations.

Photo by Gretchen Baker, NPS

Buckets of sorted old cave trail are being taken out of the Talus Room to restore the cave to a more natural condition.

Restore Natural Processes and Cave Floor in Lehman Caves.
This project restores 4,700 square feet of cave floor in Lehman Caves to a pre-disturbance condition. Restoration will be accomplished by removing an abandoned electrical system and paved walkways. The physical deterioration and decomposition of these abandoned features are impacting natural resources and water quality in the cave.

Snake Valley Invasive Weeds: Inventory, Treatment, Restoration and Education.
This project is to strengthen cooperative weed management actions in Snake Valley across all land ownerships, and includes inventory, treatment, and education.

Landscape Level Vegetation Management Plan.
A century of fire suppression combined with other anthropogenic stressors has resulted in large scale conversion of native vegetative ecosystems in the park. The majority of wildlife classified as species of management concern can be traced back to habitat loss and degradation related to these plant community conversions. This project will complete the tasks necessary to develop a landscape level vegetation management plan. Five products will be completed:
1) Fire Regime Condition Class Map and Fuels Inventory,
2) Vegetation Mapping,
3) Wildlife Inventory for Species of Management Concern,
4) Aspen stand condition assessments, and
5) Vegetation Management Plan.

Groundwater Withdrawal: How will it affect small mammals?

by Bryan Hamilton, Wildlife Biologist

In the arid West, the interaction between human, biological, and hydrological resources is a significant issue. Increased groundwater pumping is planned in valleys adjacent to Great Basin National Park. This could reduce or eliminate streamflows by lowering valley aquifers.

Streams and their surrounding riparian areas are the most biologically diverse habitats in the Great Basin and predictions of groundwater withdrawal effects concern park managers tasked with protecting biodiversity. Reductions in stream flow would directly reduce aquatic diversity but the effects on upland species, such as small mammals, are less clear.

To address the potential effects of groundwater pumping on small mammals, I sampled and compared small mammal communities in three watersheds: Lehman, Snake, and Strawberry. Elliott et al. (2006) showed Lehman and Snake Creeks are susceptible to groundwater withdrawal while Strawberry Creek within the park is not.

Although communities in these three watersheds did not differ in abundance and species richness, susceptible small mammal communities were distinct from non-susceptible communities in evenness and species composition

Groundwater withdrawal effect on small mammals (continued)

(Figure 1). Evenness was higher in susceptible watersheds (Lehman and Snake) than the non-susceptible watershed (Strawberry). Susceptible watersheds differed by a single species while susceptible and non-susceptible differed by seven and eight species respectively. Similarity was significantly higher between susceptible watersheds than between susceptible and non-susceptible.

Differences in small mammal communities were likely a function of several factors. Susceptible watersheds were over 1,500 feet lower in elevation and were subsequently cooler and received less precipitation than the non-susceptible watershed.

These differences in climate create greater contrast between mesic (moderately wet) riparian vegetation and precipitation dependent xeric (dry) upland communities in the lower elevations of the park. Habitat heterogeneity is a key factor in explaining small mammal diversity. For example, in Lehman and Snake Creeks, western harvest mice and piñon mice segregated habitat, with harvest mice restricted to the riparian habitat and piñon mice in the upland and ecotone habitats. In Strawberry Creek differences between habitats were less distinct.

Reductions in streamflow would reduce abundance, productivity, and biomass of aquatic invertebrates and riparian plants, causing shifts in riparian vegetation and altering the riparian microclimate. Riparian communities would become increasingly unstable and variable and would become more similar to the xeric upland communities.

Although abundance would not decrease, susceptible small mammal community evenness and richness would decrease. Riparian dependent small mammals such as harvest mice and shrews (Figure 2) would decrease while xeric adapted species such as the desert woodrat and Great Basin pocket mice would increase.

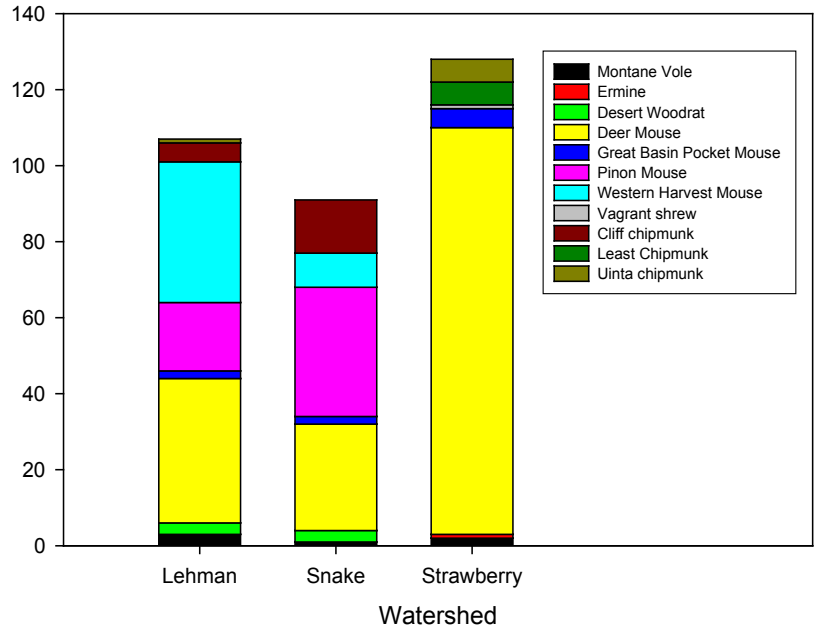

Figure 1. Small mammal species composition for three watersheds in Great Basin National Park. Watersheds were sampled in August 2007.

Figure 2. Western Harvest mice (*Reithrodontomys megalotis*) and vagrant shrews (*Sorex vagrans*) are riparian dependent small mammals. These species would be the first to show the effects of groundwater withdrawal.

This scenario is unlikely to happen quickly and assumes static conditions and community dynamics. Small mammal communities in the park have already responded to changing vegetation due to fire suppression and invasive annual grasses and are sensitive to variability in climate. Although assumptions of static conditions are unreasonable, it is important to form hypotheses about the effects of groundwater withdrawal on park resources. These hypotheses are important to develop monitoring programs.

Small mammal diversity in susceptible areas is maintained by the contrast between xeric uplands and mesic riparian habitats. If groundwater pumping reduces this heterogeneity, small mammal diversity will be lost.

Contemporary Climate History and Climate Change Impacts in GBNP

By David Porinchu, Bryan Mark, and Jason Box, Ohio State University

Understanding the magnitude and range of past climate variability is vital for predicting future water availability and secondary ecological responses to climate change.

We focused on three objectives: (1) maintain a multi-node meteorological network to assess contemporary climate variability throughout the park; (2) collect lake sediment cores to develop a longer-term climate history for the region; and (3) evaluate the potential impacts of changing climate on hydrology using hydrochemistry and temperature sampling of surface waters.

We installed a network of 27 temperature/relative humidity loggers covering the entire elevation range found in Great Basin National Park, from the Visitor Center in Baker to the top of Wheeler Peak. The hourly record spans 3 years (2005-2008) and provides insight into elevation patterns of near-surface microclimate variability. The annual cycle of monthly average changes in temperature and absolute humidity with elevation is illustrated in Figure 1.

Slope lapse rates in winter are small because temperatures are more uniform with elevation than in April-May, when valley temperatures increase while cold conditions persist in the high country. An August reduction in the temperature lapse rate is related to the increase in valley humidity presumably associated with the cooling/moistening effect of monsoon precipitation.

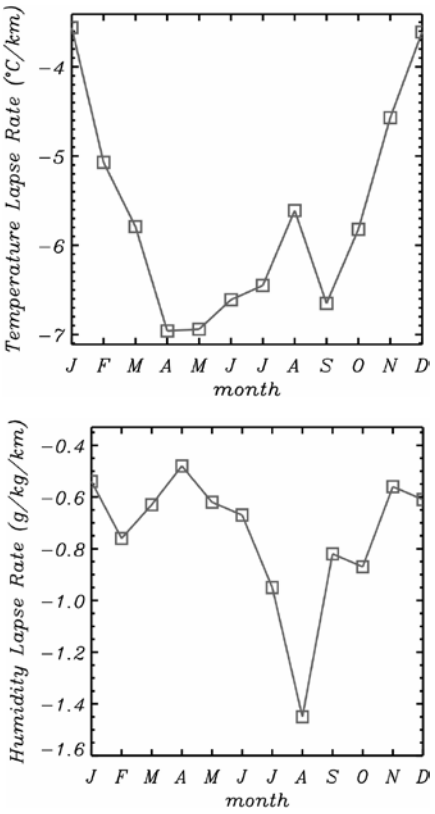

Figure 1 a,b: Monthly temperature (A) and absolute humidity (B) change with elevation in Great Basin National Park (Sep. 2005 – Jul. 2008).

The sensor network aids calibration of quantitative climate reconstructions from lake sediment cores recovered from Stella and Baker lakes. The lake cores are analyzed for sediment organic content, sub-fossil midge remains, and diatoms. Variations in these parameters have been used to develop high-resolution temperature reconstructions spanning the 20th century (Figure 2).

We will incorporate mid-Holocene sediments in our analyses to extend our paleoclimate reconstructions back about 7,000 years. This will enable us to put recent changes into context and increase our understanding of the linkage between these localized changes and larger scale climate dynamics.

During the summer of 2008, 25 water samples were collected from surface waters (streams, lakes and springs) and snow pack in the Lehman and Baker watersheds. These samples complement others taken in 2005, 2006, and 2007 and provide a means to characterize both the different surface water end-members and inter-annual variability using stable isotopes and dissolved ion concentrations. Our hydrochemical analyses document the influence of regional evaporation on meteoric waters and suggest that rock glacier melt contribution to seasonal streamflow is significant.

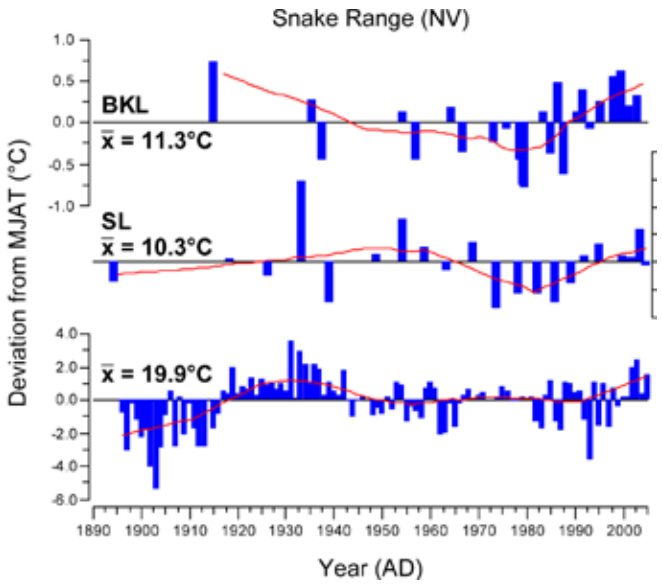

Figure 2 a,b: Monthly temperature (A) and absolute humidity (B) change with elevation in Great Basin National Park

Extirpated Species Recovery at GBNP Continues

by Laura Belica,
Biological Science Technician

At the time of Great Basin National Park's inception, all native fish species were thought to have been extirpated from park streams by historical land, water, and fisheries management practices.

Historical information indicated that park streams once contained four native species: Bonneville cutthroat trout (*Oncorhynchus clarki utah*), speckled dace (*Rhinichthys osculus*), mottled sculpin (*Cottus bairdi*), and redside shiner (*Richardsonius balteatus*). Fisheries surveys found that park streams contained suitable habitat for the native fishes, although only Mill Creek was found to contain any, with a small population of Bonneville cutthroat trout present.

In 2001, Resource Management staff initiated a multi-year program to restore all extirpated native fish species to selected stream systems. Over the past several years Bonneville cutthroat trout have been successfully reintroduced to four park streams; Strawberry Creek, the South Fork of Baker Creek, the upper stem of Snake Creek and South Fork Big Wash. Reproducing populations of Bonneville cutthroat trout are now present in five stream systems encompassing approximately 18 miles of stream.

The park's recent fish species recovery efforts have focused on restoring the complete native fish assemblage to streams by reintroducing native nongame fishes. The source populations of the three nongame species are found in a nearby stream on private land in Snake Valley which borders the eastern side of the park. The valley stream fish populations exhibit unique genetic variations resulting from their long isolation by the surrounding deserts from other fish populations in the Great Basin and may be at risk from proposed water development plans in the valley.

Photo by Meg Horner, NPS

In early October 2008, park, Nevada Department of Wildlife, and Utah Division of Wildlife Resources staff collected fish from Lake (Big Springs) Creek, Utah for reintroduction into a park stream.

In 2005-2006, two park streams, Strawberry Creek and South Fork Big Wash, received the first reintroductions of the three nongame fishes. Fisheries surveys in 2007 and 2008 indicated that the reintroduced populations of nongame fishes would benefit from supplementation. Strawberry Creek was selected to receive supplemental nongame fish in 2008.

In early October of this year, with the cooperation of a private landowner, Nevada Department of Wildlife, and Utah Division of Wildlife Resources, about two hundred fish of each species were collected from the valley and released into the stream.

If successful, the nongame fish reintroduction efforts will return the complete native fish assemblage to several park streams, restoring stream ecosystems. At the same time, refugia populations of these native fishes are being created in a region where many populations of native fishes were lost or reduced historically. These fishes continue to be vulnerable to extirpation from intensive land use and water development that threatens fish habitats in the neighboring valleys.

The recently published technical report *Bonneville Cutthroat Trout Restoration Project--Great Basin National Park* is now available at:
http://www.nature.nps.gov/water/FisheriesReports/FishTechRpt.cfm.

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The Midden is the Resource Management newsletter for Great Basin National Park.

A spring/summer and fall/winter issue are printed each year. *The Midden* is also available on the Park's website at www.nps.gov/grba.

We welcome submissions of articles or drawings relating to natural and cultural resource management and research in the park. They can be sent to:
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Baker, NV 89311
Or call us at: (775) 234-7331

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What's a midden?

A midden is a fancy name for a pile of trash, often left by pack rats. Pack rats leave middens near their nests, which may be continuously occupied for hundreds, or even thousands, of years. Each layer of trash contains twigs, seeds, animal bones and other material, which is cemented together by urine. Over time, the midden becomes a treasure trove of information for plant ecologists, climate change scientists and others who want to learn about past climatic conditions and vegetation patterns dating back as far as 25,000 years. Great Basin National Park contains numerous middens.

Great Basin National Park

New Cave Biota Report Released

By Gretchen Baker, Ecologist

Following two years of data collection and a year and a half of data analysis, the technical report *Cave Biota of Great Basin National Park, White Pine County, Nevada* by S. J. Taylor, J. K. Krejca, and M. E. Slay has been released. This new cave biota report is available on the park website at: http://www.nps.gov/grba/naturescience/cave-life.htm.

The objectives of this NPS-funded study were to conduct cave bioinventories in 15 caves in the park; develop species lists for inventoried caves; identify potential threats and management strategies; and create a biological database.

Field work occurred in 2006 and 2007, with a total of 64 cave visits to 19 caves. Troglobites, or species that do not exist outside of caves, were the main focus, but other invertebrates were also collected. The basic collection techniques included using forceps, an aspirator, a fine paintbrush, pitfall traps, and a baister for aquatic habitats. Microhabitat conditions, including soil and air temperature, humidity, and substrate were recorded in different areas of each cave.

Several new species were found during this project. A millipede and a globular springtail are currently being studied by taxonomic experts, while another cave millipede, *Idagona lehmanensis*, has been described and published (see the summer 2007 issue of *The Midden* for more details).

Alpine caves had more diversity than expected, and many contained numerous troglobites, despite harsh conditions like year-round temperatures below freezing. In addition, monthly sampling in

Photo by Jean Krejca, Zara Environmental

This *Arrhopalites* sp. springtail was found only in caves at lower elevations and in close association with water. It is a new species currently being studied by a taxonomic specialist.

Lehman Caves showed interesting trends. The most diversity was found near the entrance; pseudoscorpions and millipedes were most commonly found further from the trail; organic debris usually had more organisms living nearby. The park is continuing cave biota monitoring in Lehman Caves quarterly to help determine seasonal trends.

In addition, park staff look for cave species in other caves while traveling in them. In November 2008, an amphipod (freshwater shrimp or scud) was found in a remote pool in Model Cave. The tiny amphipod is all white and appears to be eyeless. It seems to only live in groundwater, and this is the first time it has been seen in the park. Several specimens were collected and sent to specialists to determine if it is a new species.

Photo by Steve Taylor, Illinois Natural History Survey

This apparently eyeless amphipod was recently discovered moving in a remote pool in Model Cave.