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

An 800-Year Fire History

by Stanley G. Kitchen, Forest Service Rocky Mountain Research Station

Photo by Stan Kitchen, RMRS.

Smoke from Phillips Ranch fire rising over the South Snake Range in September 2000.

"Fire in the woods!" The words are a real heart stopper. Yet in spite of its capacity to destroy, fire plays an essential role in shaping plant communities. Knowledge of the patterns of fire over long time periods is critical for understanding this role. Trees often retain evidence of non-lethal fires in the form of injuries or scars in the annual growth rings of their trunks. Careful analysis of these injuries and of tree recruitment and death dates (also determined from tree rings) can reveal a lot about the size, frequency, season, and severity of fire events over several centuries.

Rocky Mountain Research Station researchers recently completed a tree ring-based fire history for Mill Creek and Burnt Mill Canyons located in Great Basin National Park. Evidence was collected across an elevational gradient from pinyon-juniper woodlands to limber pine-Engelmann spruce forests (7,760-10,600 ft elevation). Using standard techniques, 378 fire scars from 110 trees were dated with annual accuracy. This fire chronology revealed 99 years in which fire occurred in the study area with the earliest in the year 1267 and the latest in 1909. More than half of the fires (64%) were classified as small (< 25 acres). Large fires (≥ 247 acres) occurred in 16 years with the largest (≥ 1220 acres) dated to 1632, 1691, 1709, 1751, 1782, 1794, 1824, and 1835. The last large fire was in 1865, about the time the first Euro-Americans settled in the area. Although large fires were less frequent than small fires, they accounted for nearly 80% of the area burned.

Fires were most frequent in ponderosa pine stands with average time between fires as short as 8 to 12 years in some places. Fire-free intervals were longest in rocky areas and in stands of pine-spruce forest where they sometimes exceeded 100 years.

Although fires occurred throughout the growing season, early- and late-season peaks in fire activity suggest that fire was most common in spring and late summer or fall. This differs from the seasonal pattern of modern fires which peak in mid- to late-summer. This seasonal shift can be viewed as evidence that many historic fires were intentionally set by Native Americans when lightning-caused fires were less common. In addition, shorter fire-free intervals (higher fire frequency) in Burnt Mill Canyon

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Editor's Note: Welcome to our tenth edition of The Midden!

To celebrate the treasure trove of information that has been preserved in this publication, we have an expanded edition with some articles that look at how different programs in resource management have changed over the past decade, along with an assortment of articles about other projects.

In This Issue

An 800-Year Fire History (continued)

(10 years) than in similar parts of Mill Creek Canyon (27 years) could indicate differences in indigenous burning practices meant to improve hunting success of bighorn sheep. There is growing evidence that fire was a common tool used by Native Americans and that it served many purposes from driving game to improving the growth of useful plants.

Photo by Stan Kitchen, RMRS.

'Catface' on a ponderosa pine snag where scars in annual growth rings record multiple fire events.

Photo by Stan Kitchen, RMRS.

Cross sections of ponderosa pine showing injuries associated with multiple fires in relation to annual growth rings.

Fire severity is a measure of the impact a fire has on the ecosystem and is often measured by the percentage of mature trees killed. Low severity fires kill few mature trees. High severity fires leave few live trees. Moderate severity fire effects are intermediate. Severity often varies across the landscape. In such cases it is referred to as mixed. Evidence from this study suggests that mixed severity fire was common in mid-elevation, mixed-conifer stands resulting in a dynamic mosaic of different- and multi-aged stands of fir and pine. Fire also kept trees from establishing in large areas of mid-elevation shrub-grass steppe. During the last century these areas have been encroached by white fir, pinyon pine, and curlleaf mountain mahogany.

Without sufficient fire during the last 100+ years to periodically reduce dead and living fuels, this and similar landscapes have reached a point in which they are now at risk of large, high severity fires unlike anything recorded for several centuries. The high severity Phillips Ranch fire that burned 1,650 acres, including a major part of a large bristlecone pine stand on the west side of the Park in 2000 is an example of what can happen. The challenge for managers will be to restore fire resilient vegetation using appropriate combinations of natural processes and active management. A passive management strategy is not recommended. Priority should be given to aspen, mixed-conifer stands, and montane steppe where post-settlement vegetation change has been the greatest.

Past editions of The Midden can be found on the park website: www.nps.gov/grba

2010 Lint and Restoration Camp

by Ben Roberts, Natural Resource Program Manager

On Saturday, May 1st, 2010, Great Basin National Park hosted a combination Lint and Restoration Camp at Lehman Cave. A total of 19 volunteers from Nevada and Utah, representing several National Speleological Society grottos, as well as some non-affiliated cavers, traveled to the park to participate. This event was organized to introduce cavers to the park, train staff and cavers in lint and restoration techniques, and address a critical park need: to reduce the significant accumulations of lint throughout the cave.

Lint is introduced to the cave environment by the average 30,000 thousand visitors and staff who enter the cave each year. Lint is composed of fibers, hairs, skin cells, dust, and other foreign particles. Lint can become cemented into cave formations, causing discoloration or even dissolution of natural cave surfaces. Lint also acts as an artificial food source, potentially causing imbalances in cave biota communities. Lint also reduces the aesthetic appeal of the cave.

Volunteers removed nearly 100 pounds of material composed of sand, rocks, concrete, trash, and lint from two main locations in the cave, the Inscription Room and the Grand Palace. Sand was the primary component in both locations. Historic passages in the cave were artificially enlarged with explosives in the 1930s. Sandbags were used to contain the blasts, and sand can still be found coating the ceiling and walls of many passages. The first trails through the cave were also comprised of sand and gravel and many low lying areas next to the trail were filled with extra material.

Volunteers also contributed significant time and effort to remove 5-gallon buckets filled with cement, asphalt, sand, and gravel that the park staff have been filling as they remove the section of trail in the Sunken Gardens area. Park staff had previously filled 60 buckets, which the volunteers hauled nearly 1,500 feet. Volunteers also filled and hauled and additional 47 buckets, bringing the total to 107. At an average of 55 pounds apiece, that equals 5,885 pounds!

After the work was done, volunteers visited some of the parks' wild caves and had a special tour of Lehman Cave. The park thanks all of our hard-working volunteers and hopes that they return in the fall for another camp.

Photo by Ben Roberts, NPS.

Volunteers help remove old trail debris from Lehman Cave.

Photo by Ben Roberts, NPS.

Amount of dirt, lint, and other materials removed from one section.

Photo by Ben Roberts, NPS.

Area in the Inscription Room before cleaning.

Photo by Ben Roberts, NPS.

Area in the Inscription Room after cleaning.

Sticks and Stones, Bottles and Bones--Telling Time and Truths from the Trash

by Eva Jensen, Cultural Resource Program Manager

No one likes broken glass or rusty cans--no one except archaeologists. People using the high meadows and hill slopes of the South Snake Range for over 10,000 years have been leaving discarded broken tools, debris, and trash, creating *middens* that are a virtual newspaper of daily life. From the chipped stone and broken pottery of earliest native residents to the historic mining dumps, archaeologists learn about food, clothing, and habits of people from what they discard. This article is the first of a series for *The Midden* about telling time and truths from the trash.

Broken Glass is Not Just Trash

Historic bottles are just one class of artifacts collected and catalogued in the park museum collection. Glass and bottle making techniques came to the Americas in the early 1600s. Glass bottles provided a way to contain and transport liquids over long distances. Glass technology has changed over time, and the color, shape, manufacture technique, and finish of the bottles provide information about when and how people were using the various park resources.

The color of the glass is determined by the type of sand melted to create the molten glass. All silica sand has some iron impurity. Minerals were added to make the desired color.

This dark amber or brown bottle (Figure 1) from the park museum collection was used for a cough remedy and dates to about 1922. The color was produced by natural impurities in the sand or by adding nickel, sulfur, or carbon. Dark amber bottles protect the contents from light that would cause photochemical reactions with the contents. For this reason dark amber bottles are commonly used for beer and whiskey and some patent medicines.

Some glass colors provide a limited time span of manufacture. Amethyst or purple glass was manufactured from 1840 to 1917. The glass was originally intended to be clear or colorless. Manganese oxide was added to aqua (blue green) glass to produce clear glass. When exposed to sunlight, the manganese glass turns purple. After 1917 the preferred sand used to make this glass was not readily available in the United States. Substitute sand sources did not have the same chemistry and manganese clearing agents were not needed.

Makers marks found on the bottom of bottles often provide information about the location and date of manufacture. The Owens Illinois Glass company used a circle and diamond mark with numbers to identify the company, manufacturing plant location, and year the bottle was made (Figure 2).

The shapes of bottles also indicate the intended contents or use for the bottle. Both the makers mark (Figure 3) and the shape of this bottle (Figure 4) indicate the content of the bottle was probably an alcoholic beverage. Beer bottles with a slightly bulging neck were sometimes called 'export' bottles.

Manufacture technology and top closing methods provide information about the age of the bottle. In 1904

Photo by Eva Jensen, NPS.

Figure 1. A typical brown bottle found in the park.

Photo by Nicole Lohman, NPS.

Figure 2. This bottle mark gives us the following information - Plant Code 9 = Streator, Illinois; year code 3 = 1933. The 123 is a code for the particular bottle mold used (Toulouse, 1971, p. 403).

Photo by Nicole Lohman, NPS.

Figure 3. The makers mark helps to identify not only where the bottle was made, but also the contents.

Photo by Nicole Lohman, NPS.

Figure 4. "NBBG CO" was the mark for the North Baltimore Bottle Glass Company of Baltimore, Ohio. The company specialized and advertised the bottles as high quality liquor bottles. After the 18th Amendment was passed prohibiting alcoholic beverages the bottle company struggled and finally closed in 1933. Ironically prohibition was repealed the same year. http://www.fohbc.com/PDF_Files/NBaltGlassCo.pdf

Telling Time from the Trash (continued)

Photo by Eva Jensen, NPS.

Figure 5. This brown bottle also has an external thread screw top closure with side mold seams continuing through the top. These indicate it was probably made sometime after 1920.

automatic bottle machines produced bottles with side seams that are visible all the way to the top of the bottle (Figure 5).

Bottle finish and labeling employed a variety of techniques. Embossed bottles with raised lettering and design were made by carving bottle molds. Molten glass was then poured or blown into the mold. As early as 1809 medicine bottles were embossed to indicate brands and contents (Figure 1). Applied color (painted) labels were introduced in America in 1933 and continue today (Figure 6).

Photo by Brandi Roberts, NPS.

Figure 6. This 7 ounce soda pop bottle has an applied color label. Soda pop companies developed identifiable color combinations for labels of various products. This bottle probably contained Squirt a carbonated grapefruit flavored beverage. In 1938 during the Depression when sugar was in short supply this lightly sweetened grapefruit beverage that seemed to "squirt" into your mouth was developed. Ownership of the Squirt recipe and trade name has changed hands several times.

Most of the bottles that have been found in the park are beverage or medicine bottles. While this is a very small sample, it is consistent with the ranching, mining, and recreational history of the area. Other bottles found include containers for perfumes, toiletries, and cleaning supplies.

For more information, the standard text for identifying bottle maker marks is *Bottle Makers and Their Marks,* by Julian Harrison Toulouse, 1971, The Blackburn Press, New Jersey. The Society for Historic Archaeology also offers comprehensive information about historic bottles on their web page: http://www.sha.org/bottle/index.htm

The Growth of Cultural Resource Management

by Karla Jageman, Archeologist

Over the past 10 years the cultural resources management program at Great Basin National Park has grown substantially. Prior to 2002, the park had no cultural resources program. Today the program consists of five people: a program manager, archeologists, and archological technicians.

Over the years, the cultural resources staff has been able to expand the knowledge of the park by conducting archeological surveys of the area. Prior to 2000 the park had only 100 sites documented and recorded within the park. Today, the park has close to 200 sites documented and recorded. These documented sites are found within less than 5 percent of the park's 77,000 plus acres. This means that there is great potential for many more sites, and we will gradually be expanding survey areas to increase the percentage of the park surveyed.

Past surveys have included a variety of projects such as backcountry surveys, spring surveys, and general park improvement projects. Previous backcountry surveys included the survey of an entire watershed for archeological sites, documenting 14 previously unrecorded archeological sites (see the Winter 2004 *Midden* article). For the spring survey, 10 percent of the springs in the park were assessed for archeological sites, resulting in the discovery of 30

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Growth of Cultural Resource Management (continued)

previously unrecorded archeological sites (see the Winter 2005 *Midden* article).

These types of archeological surveys are important to improve our knowledge of the park's resources. However, the majority of new sites located within the park over the past 10 years have been documented because of a variety of proposed improvement projects. Section 106 of the National Historic Preservation Act (NHPA) mandates that all federal agencies or other agencies using federal funds must perform an archeological survey of the project area prior to work beginning. Some of these surveys have revealed new sites and improved the park's knowledge of cultural resources.


Photo by David Yubeta, NPS.

The Cultural Resource Team has grown from no positions prior to 2002 to five in 2010. It includes archeologists Karla Jageman, Eva Jensen, Nicole Lohman, and archeological technicians Melyssa Huston and Caleb Ferbrache.


Photo by Karla Jageman, NPS.

Fully documenting the Tilford Cabin is one of the many projects the Cultural Resource Team is working on this year.

In addition to archeological surveys, the cultural resource program has also undertaken other projects. One is the the stabilization of the buildings at the Johnson Lake Mine and Mill. This project took place in 1998 – 2000 and again in 2006 – 2007. These historic structures were built in 1916 and are important historic resources at the park. The stabilization will help these historic buildings persist longer in the future (see the Winter 2007 *Midden* article).

Cultural projects for this field season are varied. One of these projects is to re-record and fully document the Tilford Cabin Mining Camp. This cabin was built sometime after 1912 and is associated with the Bonita Mine, which was a tungsten mine in operation during the 1910s.

Another project is to re-record the Wheeler Peak Triangulation Station. This is located on the top of Wheeler Peak and was used to help map the western United States. We hope that by updating the documentation and performing historic research on these sites we will gain a better understanding of what activities took place at these sites.

An additional project is to perform archeological surveys in the backcountry of the park in areas where no cultural resource studies have been conducted.

The remaining projects this year will be in conjunction with construction projects that will be taking place in the park over the next few years. We look forward to expanding our knowledge about the cultural resources in the park in order to better understand how the park was utilized in the past.

Buckeyes Back in the Park

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

The Buckeyes return to the park in early August 2010 for the sixth annual Ohio State University (OSU) Geography department research excursion. Past OSU Geography research has focused on reconstructing Holocene thermal conditions in the park to better understand past climate conditions. Sediment cores recovered from Stella Lake and Baker Lake were analyzed for subfossil chironomid (Insecta: Diptera: Chironomidae) remains and organic-matter content (estimated by loss on ignition). Chronologies for the sediment cores, developed using ^{210}Pb, indicate the cores extend to the early 20th century. The midge communities present in the lakes experienced muted compositional change through much of the 20th century; however, the post-1980 AD interval is notable due to rapid lake-specific faunal turnover.

Application of a chironomid-based inference model for mean July air temperature (MJAT) provided a means to reconstruct the 20th century temperature regime for the region. Higher than average temperatures characterize 1920-1940 AD and the post-1975 AD interval. The increase in MJAT in the park during the post-1975 interval has been particularly dramatic and is representative of the increase in regional temperature that has been observed in much of the Inter-Mountain West during the last three decades. A recent publication in *Quaternary International* describes the results in greater detail (Porinchu et al. 2010).

A new two-year, multi-disciplinary scientific and education project in Great Basin National Park, supported by the Western National Park Association (WNPA), will begin in summer 2010. This new project is motivated by the need to develop a fuller understanding of how water resources and the hydrochemistry of alpine ecosystems in the western United States will respond to climate change and human-induced alterations to the biogeochemical cycle.

This study, featuring three components, will: 1) characterize the modern inputs of airborne mercury and trace metal contaminants to high elevation watersheds in the park; 2) provide a historical context for 20th century contaminant inputs; and 3) identify the source regions of the airborne pollutants to the park.

Supported by this new WNPA research grant, small teams of professors, graduate students, and research staff will obtain lake cores to measure the past century-plus of mercury deposition; maintain a network of 28 micro loggers distributed widely along trails within the park to observe elevation ranges of temperature and humidity; and continue to gather water chemistry samples to understand flows of spring and surface waters within the park. This research project will enable us to begin to assess the degree to which lakes in the park have been affected by the presence and inputs of anthropogenically produced chemicals and improve our understanding of how natural systems are impacted by and airborne contaminants found in air, snow and water.

Recent Publications about Great Basin National Park

Asch, T. H., and D. S. Sweetkind. 2010. Geophysical characterization of range-front faults, Snake Valley, Nevada. U.S. Geological Survey Open-File Report 2010-1016. 226 p. Available at: http://pubs.er.usgs.gov/usgspubs/ofr/ofr20101016

Baker, G. and M. Horner. 2010. Climate change monitoring and installation of GLORIA at Great Basin National Park, 89-92 *In* Weber, Samantha Ed. Rethinking protected areas in a changing world. Hancock, Michigan: The George Wright Society. Available at: http://www.georgewright.org/proceedings2009

Hamilton, B. T., and D. Richard. 2010. *Crotalus oreganus lutosus* (Great Basin rattlesnake) Elevation. Herpetological Review 41:90.

Hamilton, B. T., and E. M. Nowak. 2009. Relationships between insolation and rattlesnake hibernacula. Western North American Naturalist 69:319-328.

Hamilton, B. T., and M. Horner. 2010. Sagebrush & fuels management: Building the knowledge base. Final Report to Biological Resources Management Division:1-96.

Porinchu, D. F., S. Reinemann, B. M. Mark, J. E. Box, and N. Rolland. 2010. Application of a midge-based inference model for air temperature reveals evidence of late-20th century warming in sub-alpine lakes in the central Great Basin, United States. Quaternary International 215:15-26.

A Promising Future for Bonneville Cutthroat Trout

by Laura Belica, Fisheries Biologist

Surrounded by the semi-arid basins that typify the Great Basin region, Great Basin National Park is an oasis with over 400 springs, 6 alpine lakes, and nearly 40 miles of perennial streams that are home to hundreds of aquatic species ranging from tiny spring snails to trout.

Snake Valley, to the east of the Park, was once part of Lake Bonneville – an enormous lake that covered much of Utah and reached into parts of Idaho, Wyoming, and Nevada from about 30,000 years ago until it began draining approximately 15,000 years ago. As a result of their ancient connection to Lake Bonneville, streams draining the eastern slopes of Great Basin National Park and other mountains bounding Snake Valley to the north are within the native range of fishes, such as Bonneville cutthroat trout (BCT), that once occupied the lake and its tributary streams.

Throughout their native range, populations of Bonneville cutthroat trout had severely declined since settlement and development of the Intermountain West. By the late 1970s, only a handful of genetically pure populations were known to exist. Bonneville cutthroat trout were petitioned for listing as a threatened species under the Endangered Species Act in 1979 and again in 1992 and 1998.

In the 1990s several state and federal agencies signed conservation agreements for BCT which culminated with the signing in 2000 of the "Range-wide conservation agreement and strategy for Bonneville cutthroat trout" by agencies of four states, tribal agencies, federal agencies (including the Bureau of Land Management, Fish and Wildlife Service, Forest Service, and National Park Service), and non-profit organizations. The main objectives of the agreement were to manage and expand the existing conservation populations of BCT and to eliminate the threats to the species that may warrant its listing as a sensitive species by state and federal agencies or a threatened or endangered species under the Endangered Species Act.

Work to conserve and restore BCT populations on Forest Service and BLM lands in Snake Valley outside the park was undertaken with collaborative efforts between federal and state agencies beginning in the 1980s and 1990s. In Great Basin National Park, BCT restoration work began in 1999, with the development of a fisheries management plan that outlined the goal of reintroducing Bonneville cutthroat trout to several Park streams. Genetic analyses confirmed that a small park stream previously considered to have rainbow-cutthroat hybrids contained a pure population of Bonneville cutthroat trout.

Great Basin National Park Resource Management staff had determined approximately 24 miles of streams in the Park were within the historic range and contained suitable habitat for BCT. The Nevada Department of Wildlife had stopped stocking non-native trout in streams on the eastern slopes of the South Snake Range in the early 1980s when the land was still administered by the Forest Service (prior to the creation of the park), however naturalized populations of brook, brown and rainbow trout

NPS Photo

A Bonneville cutthroat trout caught during a fisheries survey is carefully measured and weighed to help determine their status. Native Bonneville cutthroat trout are found in five streams in Great Basin National Park: Strawberry, Upper Snake, South Fork Baker, South Fork Big Wash, and Mill creeks.

A Promising Future for Bonneville Cutthroat Trout (continued)

remained in most of the park streams with suitable habitat within the historic range of BCT. Because the presence of non-native trout could have impaired or prevented the successful re-establishment of pure populations of BCT through competition or hybridization, removal of non-native trout from Park streams targeted for restoration was necessary.

The two largest trout streams in the Park were left as non-native trout fisheries, and still contain naturalized brook, brown, and rainbow trout. Four smaller streams were selected for BCT restoration: South Fork Big Wash, Strawberry Creek, South Fork Baker Creek, and the upper section of Snake Creek. South Fork Big Wash was the first stream to be restored with the reintroduction of BCT in 2000. Historical records indicated South Fork Big Wash had contained Bonneville cutthroat as late as the 1940s, however the population had been extirpated in a series of flash floods in 1950's and 1960s and had remained devoid of fish for the next several decades.

The remaining three streams targeted for BCT restoration had naturalized populations of non-native trout. In collaboration with the Nevada Department of Wildlife, the National Park Service treated Strawberry Creek, upper Snake Creek and its tributaries, and Johnson Lake (which drains into Snake Creek during high flows) with piscicides to remove non-native trout in 2000, 2002, and 2004 respectively. Non-native trout were removed from South Fork Baker Creek with repeated electrofishing efforts from 2002 to 2005. After removal of non-native trout was verified, Bonneville cutthroat trout were reintroduced to Strawberry Creek in 2003 and 2005, upper Snake Creek in 2005 and 2008, and S.F. Baker Creek in 2005. Bonneville cutthroat trout from Mill Creek were reintroduced to Strawberry Creek and South Fork Baker Creek. Because of the multiple reintroductions occurring in 2005, an alternate source population of BCT from a nearby stream in the North Snake Range, Hendrys Creek, was used for the upper Snake Creek reintroductions.

Although the primary focus has been to restore Bonneville cutthroat trout, the Park's ultimate goal is to restore the complete native fish assemblage, which includes BCT and three species of non-game fishes; mottled sculpin, speckled dace, and redside shiner. Towards that end, the Park has worked with a local land owner and the Utah Division of Wildlife, to reintroduce native non-game fishes to South Fork Big Wash and Strawberry Creek. Reintroductions of native non-game fishes began in 2005 and have been ongoing.

The continuation and enhancement of BCT conservation and restoration efforts in Nevada was secured in 2009, when the National Park Service received funding from the Southern Nevada Public Lands Management Act to fully implement the Conservation Agreement and Conservation Strategy for Bonneville Cutthroat Trout in the State of Nevada. Great Basin National Park and the other federal agencies on the proposal (BLM, Forest Service, FWS) are working with the Nevada Department of Wildlife (NDOW) on project implementation through a Cooperative Agreement between the NPS and NDOW.

Some of the specific actions associated with the objectives include:

- Conducting standardized surveys to assess status and trends of BCT populations.
- Maintaining and expanding BCT distribution in Nevada through reintroductions as needed.
- Preserving the genetic integrity of the Snake Range BCT.
- Monitoring, maintaining and restoring habitat conditions in BCT streams.
- Controlling non-native species adversely affecting BCT.
- Monitoring BCT utilization (e.g. angling pressure).
- Developing information and educational material concerning BCT conservation and encouraging citizen engagement in BCT conservation.
- Evaluating the risks to BCT conservation populations and developing contingency plans for potential catastrophic losses of BCT populations associated with stochastic events.

NPS and NDOW fisheries crews began working on the project in 2009 with comprehensive surveys to assess BCT populations and habitat and to collect samples for genetic analysis to ensure the conservation populations have remained pure. Field work to assess the current status of BCT habitat and populations and collect genetic samples will be completed in 2010, allowing the information to be analyzed to inform future management actions, including potential reintroduction work.

Aerial Detection Surveys Reveal Major Changes in Park Forests

by Gretchen Baker, Ecologist

If you look at the forests of Great Basin National Park, you may be surprised to see large patches of trees that are dead or dying. This is due to a variety of native beetles that are causing widespread mortality. These outbreaks of native forest insects are natural events, caused by an abundance of larger-diameter trees in dense stands and periodic droughts. Some of the forests have been expanding due to anthropogenic impacts, such as climate change and fire suppression. In particular, white fir (*Abies concolor*) has been moving into quaking aspen (*Populus tremuloides*) areas, while pinyon pine (*Pinus monophylla*) has invaded sagebrush sites. The insects are in effect thinning out the forests by removing the larger trees and returning the forest to an earlier successional state, allowing for regeneration of other plant species.

Aerial detection surveys have been conducted over Great Basin National Park annually since 1999. These surveys involve a forester flying over the park and mapping what types of trees are being affected and the disease or insect agent. The forester maps an outline of the affected area and estimates the number of trees infected within that area. This data is converted into maps and has revealed the extent of the outbreaks, showing that every watershed in the park has been affected (Figure 1).

Numerous insects and diseases are affecting trees in the park, but this article will focus on the three principal agents of change in the park: white fir engraver beetle, mountain pine beetle, and pinyon pine defoliators.

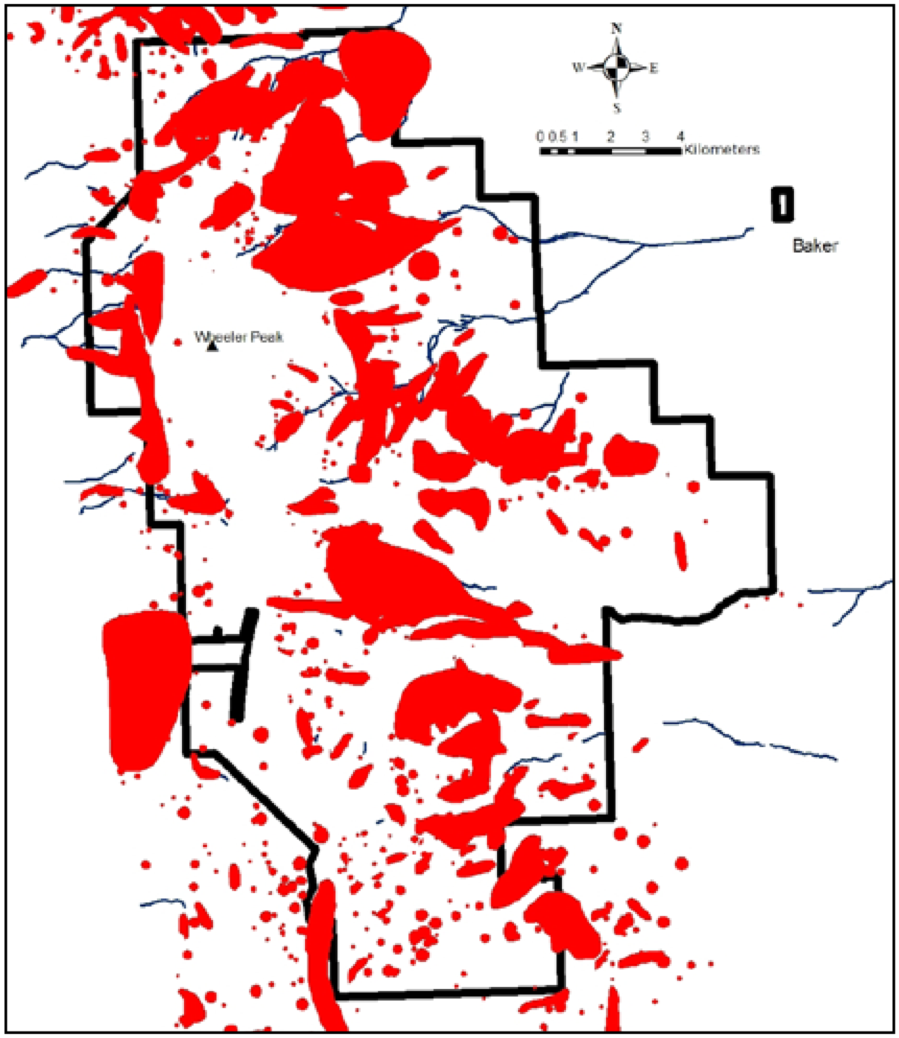

Figure 1. Extent of insect and disease outbreaks in the park. The red areas on the map indicate locations where damage or destruction due to insect or disease have been detected. They are a compilation of 11 years of aerial detection surveys and encompass nearly 20 percent of the park.

White Fir Engraver Beetle

The white fir engraver beetle (*Scolytus ventralis*) attacks white fir trees. The beetles usually start at the top of a tree, but quickly can move down through the rest of the tree. Attacked trees are generally 5 inches or greater in diameter. Over the last ten years, over 46,000 trees in the park have been estimated to have been infested. The peak infestation year was 2004, when over 9,000 acres were infected (Figure 2). As host material declined, so did the number of beetles, with no new infestations detected in 2009.

Mountain Pine Beetle

The first mountain pine beetle (*Dendroctonus ponderosae*) damage found in Great Basin National Park was in 2000, when an aerial detection survey detected six infected limber pines (*Pinus flexilis*). Since then, the mountain pine beetles have spread to bristlecone (*Pinus longaeva*) and ponderosa pines (*Pinus ponderosa*), increasing the numbers of infected acres every year, with a huge jump in 2009 to over 6,000 acres (Figure 2). To date, over 5,000 trees have been detected to have mountain pine beetle

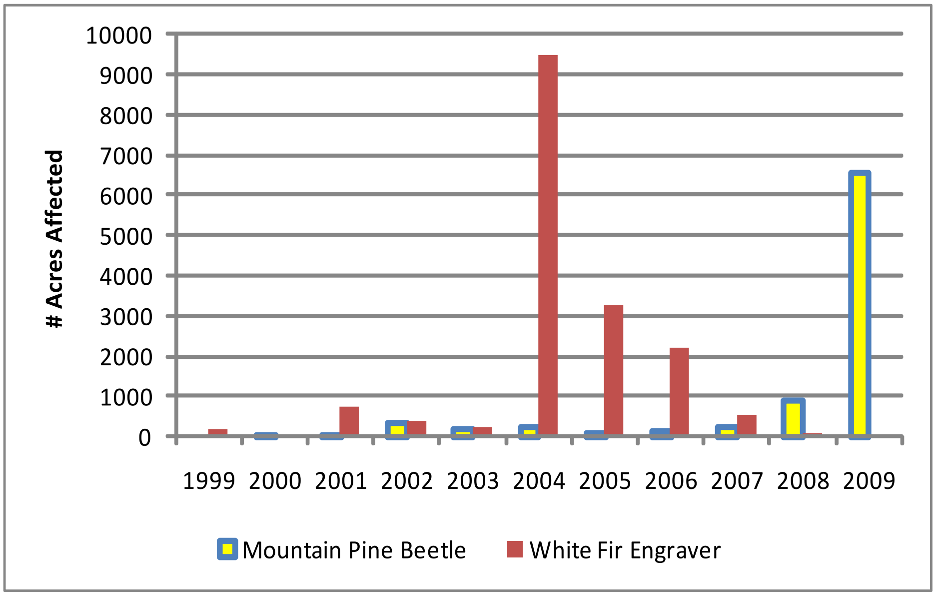

Figure 2. Number of acres affected by mountain pine beetle and white fir engraver. Mountain pine beetle was first detected in the park in 2000. It has remained at fairly low levels until 2009, when more than 6,000 acres were attacked. White fir engraver beetle attacked less than 1,000 acres per year until 2004, when more than 9,000 acres were attacked. Since then, host material has decreased, with a resulting decline in white fir engraver nfestations.

infestations. The mountain pine beetle has been responsible for massive infestations throughout the West. In fact, outbreaks of mountain pine beetle reaching epidemic levels have been recorded in the West since 1894. Outbreaks can last for as long as ten years.

Pinyon Pine Defoliators
Over 16,000 acres of sagebrush steppe have been invaded by pinyon pine and Utah juniper (*Juniperus osteosperma*) in the park. Many of these acres are showing a variety of problems, including infestations by mistletoe, the pinyon ips beetle, needle miner and pitch mast borer. The largest problems that pinyon pines are facing in other parts of Nevada are the defoliators: pinyon sawfly (*Neodiprion edulicolus*) and pinyon needle scale (*Matsucoccus acalyptus*). The pinyon sawfly larvae strip all old needles from tree, while the pinyon needle scale nymphs suck fluids from the needles causing premature death of foliage. These pine defoliators are just starting to arrive in the park, so although many trees may look okay now, by next year they may appear very different.

What Can We Do?
Great Basin National Park is working with the U.S. Forest Service Forest Health Protection Laboratory out of Ogden, Utah to monitor forest health and work to improve it. Lab personnel provided a training to park staff and other agencies in May. Their expertise out in the field was extremely helpful in better understanding and identifying the processes that are occurring.

Although the large number of dead and dying trees in every watershed in the park may appear startling, it is part of a natural process, and the National Park Service manages natural processes. Many of the white firs that have been killed were in areas that originally had higher aspen density, and now that the conifer encroachment has been reduced, aspen regeneration may result. The park will be observing if future pinyon pine defoliation will result in increases in shrub and herbaceous cover in areas that were previously sagebrush sites.

Trees that are in campgrounds, picnic areas, and along roads are being targeted for proactive treatments to keep them healthy so that they do not become hazard trees. The Forest Health Protection Lab has trained staff to apply antiaggregation pheromone patches to healthy trees this year in an attempt to protect them (Figure 3). Trees in high use areas that have already died are being removed from the park. In addition, the Forest Health Protection Lab will be conducting a biological evaluation this fall to help the park determine more effective remedies can be used, such as prescribed fire and insecticides.

Photo by Gretchen Baker, NPS.

Figure 3. Applying verbenone, an antiaggregation pheromone, to a ponderosa pine to protect it. The verbenone sends out a chemical signal telling the beetles that the tree is full and that they need to find another tree.

National Park Service
U.S. Department of the Interior

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:
Resource Management,
Great Basin National Park,
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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

Second Annual Bioblitz

by Gretchen Baker, Ecologist

On June 26 and 27, 2010, Great Basin National Park held its second annual Bioblitz, a short-term event to help discover the biodiversity of the park. For 2010, the Bioblitz focus was on Orthopteroids: crickets, grasshoppers, and related insects. The park previously had no documented species for orthopteroids. Twenty-four people attended, including representatives from the Nevada Department of Agriculture; Dixie State College in St. George, Utah; Southern Utah University in Cedar City, Utah; Utah Department of Natural Resources; and the Forest Service Forest Health Protection Laboratory in Ogden, Utah. Volunteers also came from California, Oregon, Utah, and Nevada to assist. Attendees spent 275 hours during the weekend to help inventory the park.

Photo by John Tesar

Dr. Andrew Barnum from Dixie State College provided an Orthopteroid workshop to kick off the Bioblitz weekend.

During the 24-hour collecting period, approximately 150 orthopteroids were collected, with roughly half of those adults. Dr. Andrew Barnum from Dixie State College provided identification of the specimens collected. Due to his expertise with orthopteroids, he was able to identify over 40 specimens at the event, providing nine species names and two family names. He will be undertaking further analysis of the specimens at his lab.

About 40 percent of the adult orthopteroids were speckle-winged rangeland grasshoppers (*Arphia conspersa*). Habitat was searched from 5,300 to 11,900 feet for orthopteroids, with the bulk of those caught between 5,300 and 8,500 feet. One species was only found over 10,000 feet elevation. Habitat data was collected at the same time as the orthopteroids, which will allow for further analysis of which conditions are most favorable to them.

The park would like to extend special thanks to Dr. Barnum for dedicating his time to help the park develop a baseline list of orthopteroids. The Southern Utah University entomology club and Nevada Department of Agriculture provided field equipment for the event. A Bioblitz for 2011 is currently being planned; please contact the park if you'd like to be involved.

Photo by Gretchen Baker, NPS.

One of the grasshoppers collected during the 2010 Orthopteroid Bioblitz at Great Basin National Park.