



Resource Management 2010

Inside:

MONITORING

- Shenandoah's very own salamander 2
- Rare plant monitoring 4
- Ozone 6
- Climate change buzz 8
- Conceptual basis for vital signs 8
- Air quality 9
- Odd year of electrofishing 9
- Berries and acorns 10

STEWARDING

- 18-park co-op fights invasive plants 11
- Rock outcrop management-next steps 13
- Keeping track of the past 14



photo: Eric Vorodi, <http://woodypests.ces.psu.edu/>

PESTS

- Watch out for these weeds 16
- Chronic wasting disease 17
- Emerald ash borer 18
- Aquatic invasives 20
- Fall webworm 21



<http://www.free-pet-wallpapers.com/Terranistic-free-wallpapers/Salamander/Shenandoah-Salamander-Flathead-shenandoah.html>

RESTORATION

- Rapidan Camp and Big Meadows 24
- Trail crew summary 24
- Windowsill propagation 26

RESEARCH

- Archeology program 27
- American Electric Power settlement 28

PEOPLE

- Christina Harman 29
- Roger Dovel and CT Campbell 30

Shenandoah's Very Own Salamander

By Jennifer Sevin, Biodiversity Conservation Specialist, Smithsonian Conservation Biology Institute and Jeb Wofford, Fish and Wildlife Biologist

Although many animals in Shenandoah are easily observed, some of the most common are cryptic and well hidden from even the most inquisitive eyes. One such group of animals are the salamanders. These small amphibians make a living under leaves, stones, and downed wood in both aquatic and terrestrial environments. Salamanders can be extraordinarily important to forest and headwater ecosystems, simply because many species are so abundant. For instance, previous work has shown that in forests of the southern Appalachians, the biomass (or weight) of salamanders per acre can be greater than all other vertebrates combined (Hairston, 1987).

Salamanders are a diverse group of animals, and the Appalachian Mountains provide a "hotspot" of this diversity, containing nearly 15% of the world's species. Although many of these species are widespread and abundant, some are extremely rare and are found in very few locations. One such rare species is the Shenandoah salamander (*Plethodon shenandoah*). This animal is only found in Shenandoah National Park and is listed as a federal and state endangered species. Once believed to be more widely distributed, the Shenandoah salamander can now be found in small populations at the higher elevations of Pinnacles, Stony Man and Hawksbill Mountains. This unique salamander lives on these mountaintops, under rocks and debris for most of the year, only venturing out onto the forest floor during moist nights to feed on small insects and other invertebrates.

Most of what we know about the Shenandoah salamander was learned by herpetologist Bob Jaeger in the 1970s and park volunteers Bill Witt and Lester Via in the late 1980s and early 1990s. The species was listed as

federally endangered in 1988 and, in 1994, the U.S. Fish and Wildlife Service published the species Recovery Plan which outlined multiple tasks to address the study and management of this endangered species (available at http://ecos.fws.gov/docs/recovery_plan/940929a.pdf). Following the initial work in the 1970s and 80s, little additional information had been collected about the Shenandoah salamander until 2007, when multiple



Shenandoah salamanders can be either either striped or unstriped (see above) and in many ways, look very similar to their close competitor, the red-backed salamander. Shenandoah salamanders tend to have a narrower and shorter stripe, and the underside of the salamander is very dark with fewer light markings than observed on red-backed salamanders (photo courtesy of J. Sevin).

government agencies, including the National Park Service, US Geological Survey, Smithsonian Institution, US Fish and Wildlife Service and the Virginia Department of Game and Inland Fisheries (VDGIF), joined together and dedicated funds and in-kind services to conduct new research. This research is not only leading to a greater understanding of the species we know

little about, but the development of a long-term monitoring and management plan.

The current research is focusing on factors affecting with the distribution of the Shenandoah salamander, including habitat use, competition, and dispersal. In 2007, a pilot study was initiated to investigate the optimal survey method for this species. Salamanders can be difficult to accurately sample in the field, and data were needed to assist researchers and managers in determining how and when to sample for Shenandoah salamanders. This information is used to obtain the best probability of detection during surveys and to understand the variability in the probability of a particular site being occupied by salamanders. We can now better address the size and shape of the needed sampling area, the time of day and season to sample, under what environmental conditions to sample, and the number of sites and repeated visits needed to address a variety of studies. Genetic studies using tail tips were also undertaken to confirm the ability of researchers to properly distinguish the identification of the Shenandoah salamander from its close relative and potential competitor, the red-backed salamander (*Plethodon cinereus*).

Historic documentation indicated that all known Shenandoah salamander populations were within talus (rocky) habitats with a north-facing aspect at an elevation above 800 m (USFWS, 1994). Based on this information, Shenandoah National Park and the VDGIF developed maps depicting areas of known Shenandoah salamander occupancy (historic locations), potential occupancy (areas where there is suitable habitat, but searches for salamanders had not been undertaken), and unsuitable habitat (areas where occupancy is not expected). These maps, in conjunction with the

2007 pilot results, were used to establish a sampling design that investigated the distribution of the species within and between Pinnacles, Stony Man and Hawksbill Mountains and to determine the habitat characteristics influencing its distribution. Over 120 sample sites were established using a stratified random design. A 32x2 m transect at each site was searched up to three times in the spring, summer and fall in 2008 and 2009 (to investigate seasonal and annual differences in both the presence of salamanders in particular habitats and researchers ability to find them). Habitat variables, such as elevation, aspect, canopy cover, tree species, rock cover, leaf litter depth and more, were collected at each site to use in habitat models and approximately 50 data loggers measuring humidity and temperature were deployed throughout the area.

The leading hypothesis explaining the current restricted distribution of the Shenandoah salamander relates to competition with another salamander, the red-backed salamander. It is thought that the much more abundant and widely distributed red-backed salamander out-competes and therefore excludes the Shenandoah salamander from the better soil environment, essentially forcing it to reside in the rocky talus slopes (Jaeger, 1970). In addition to studying the seasonal and annual extinction and colonization of the existing sites, additional transects running perpendicular to the contact zones of these species were established to study the competitive interaction. While competition is a plausible hypothesis, there has been one documented occurrence of the two species hybridizing along a contact zone on Hawksbill Mountain (Highton, unpublished data) and further morphological evidence has indicated potential hybridization in other areas. To better understand the extent of localized hybridization, the study collected numerous tail tips from Shenandoah, red backed, and potential hybrids along the contact zones. Additionally, tail tips of salamanders across the landscape were collected to examine the potential of natural and human-caused barriers (e.g., south

facing slopes, trails, roads, etc.) to limit gene flow.

While this is an ongoing study and much data still needs to be analyzed, new information has already been acquired. Results to date indicate that Shenandoah salamanders still occupy much of their historic range. In addition, a small number of new sites within the area of potential habitat (mostly those on the periphery of historic habitat) have been documented to be occupied by Shenandoah salamanders. Some sites that used to be occupied by Shenandoah salamanders now appear to be exclusively occupied by red-backed salamanders. In contrast, 20 percent of the sites searched were occupied by both Shenandoah salamanders and red-backed salamanders during at least one season. The most remarkable findings to date have been on the life history of this animal. In 2008, the first documented nest site for Shenandoah salamanders was discovered in the wild (see picture below) and pregnant females have been found in both the spring and fall seasons.

Data from this study will be used to develop monitoring and management plans for the Shenandoah salamander. Once a monitoring plan is estab-

lished, the park plans on implementing monitoring of these salamanders on a long-term basis. Although short term results from this study have already provided a wealth of new information on the species distribution and life history, long-term monitoring will provide additional data that will help managers assess current and future threats to the animal, such as climate change, acid deposition, and competition with other salamander species. This study will also provide park managers and salamander researchers with a predictive model that may help identify other suitable mountaintop habitats for Shenandoah salamanders. Once those locations are identified, these additional sites can be surveyed for this rare and unique animal.

Hairston, N.G. 1987. Community ecology and salamander guilds. Cambridge University Press, New York.

Jaeger, R.G. 1970. Potential extinction through competition between two species of terrestrial salamanders. *Evolution* 24:632-642.

US Fish and Wildlife Service. 1994. Shenandoah salamander (*Plethodon shenandoah*) Recovery Plan. Region Five. Hadley, Massachusetts. 36 pages.



In August of 2008, Sevin and her crew documented the first known nest site for Shenandoah salamanders in the wild. In the photo above, the female's upper body and head can be seen in the lower right, with a collection of eggs in the upper right of the photo. Female Shenandoah salamanders will guard the nest site until the eggs have hatched, likely about 6 weeks after they are deposited (photo courtesy of J. Sevin).



Figure 1. State rare three-toothed cinquefoil (*Sibbaldiopsis tridentata*) on a rock outcrop on Hawksbill Mountain.

Overview of the Park-wide Rare Plant Monitoring Program

By Wendy Hochstedler, Lead Biological Technician, Vegetation Monitoring Program

As you drive beneath the chestnut oak and red oak trees that line so much of Skyline Drive it may seem hard to imagine that the park contains 1413 plant species, and even more surprising to discover that over 62 of these species (4%) are rare in the state of Virginia. Where are all these rare plants? Though not always obvious, rare plants occur throughout the park, often concentrated in wetland and rock outcrop areas. Wetland rare plant species are mostly concentrated in the Big Meadows area of the Park, while rock outcrop rare plant species are more widely distributed, occurring primarily in high elevation areas. (figs. 1 and 2).

Rare plant survival in Shenandoah National Park (SHEN) is threatened by a variety of sources. Human trampling is a major factor in high elevation rock outcrops popular with park visitors, while being overrun by invasive plants is one of the greatest threats to rare wetland plant species. Certain areas such as the Big Meadows swamp are also showing evidence of impact from herbivory (Hochstedler, 2009). In addition, global evidence of climate change has sparked concerns about the ability of rare plants to survive.

This is of particular concern for many high elevation and rock outcrop rare plant species that may be surviving in SHEN at the southern tip of their global range. In such cases, a warming climate will likely result in a loss of suitable habitat within SHEN as the range shifts northward.

The park botany program conducts rare plant monitoring throughout the park. The primary purpose of this monitoring is to document the location, size and health of rare plant populations. Current monitoring efforts have identified 564 rare plant populations within the park. GPS location and general abundance data have been gathered for about half of these populations, focused on the rarest species and for those in close proximity to areas of human use. Additionally, in response to the large number of threats faced by the rare plant populations in the park, the plant monitoring program also collects information on the abundance and proximity of invasive plants to rare plant populations. Together this information has been used to document the continued survival of rare plants in the park, assist park managers with mitigating potential damage caused by construction

projects, and to determine which populations are actively threatened by invasive species and are therefore of highest management priority.

While the current data is helpful for protecting rare plants and for describing overall trends in rare plant status, it is not adequate to document subtle trends in population size. The ability to detect subtle changes is of interest because it would allow detection of the initial phase of impact to rare plants caused by disturbances such as trampling, invasive plants, and environmental changes including acid deposition and climate change. Early detection of these changes will give park managers more time to respond to them in a way that decreases the impact directly, or in cases where that is not possible, decrease other concurrent stressors, ultimately leading to improved long-term survival.

In an effort to address this need, the park's rare plant monitoring program has begun to install detailed long-term monitoring sampling transects at rare plant locations that contain particularly rare or vulnerable species. The first area where this was done was the summit of Old Rag Mountain. In 2009

four permanent monitoring transects were installed to monitor populations of the mountain sandwort, *Minuartia groenlandica* (fig. 3). This small herb grows on thin gravelly soil and in rock crevices on the summit of Old Rag, and is classified as critically imperiled in Virginia (fig. 4). Monitoring involved tallying the coverage of mountain sandwort in increments of one square centimeter along a two meter wide transect line, and taking detailed photographs of each transect section (fig.

5). We anticipate repeating this sampling every 2-4 years.

Efforts are currently underway to secure funding through the George Melendez Wright Climate Change Fellowship to support a graduate student in the summer of 2010 to design protocols and perform field testing for additional rare plant monitoring at high elevation areas within the park. Regardless of whether this funding is received, NPS staff will continue to work

on the design and installation of monitoring protocols for other high elevation areas. However, if we are successful, the student will be able to carry the program forward more rapidly.

Reference:

Hochstedler, W. W. 2009. Rare wetland plants – tasty snack and rare resource. In Shenandoah National Park Resource Management Newsletter.

Figure 2. (right) Monitoring rare plant coverage in the Big Meadows Swamp.

Figure 3. (below) The state rare mountain sandwort (*Minuartia groenlandica*) growing on the summit of Old Rag.



Figure 4. (left) Mountain sandwort (*Minuartia groenlandica*) growing along a monitoring transect on the summit of Old Rag mountain.

Figure 5. (right) NPS technician monitors the coverage of mountain sandwort along a belt transect. Note that the plot frame is being used to determine the proper width of the belt and to help the technician keep track of which plants have already been counted.



Ozone Monitoring in 2008

By Liz Garcia, Physical Science Technician

In 2008, the National Ambient Air Quality Standards (NAAQS) set forth by the U.S. Environmental Protection Agency (EPA) for ozone changed from 0.08 ppm (85 ppb equivalent) over an 8-hour period to 0.075 ppm (76 ppb equivalent). The NAAQS regulates ground-level ozone and sulfur dioxide and defines the national targets for acceptable concentrations of each pollutant. As part of the Gaseous Pollutant Monitoring Program (GPMP), Shenandoah monitors the status and trends of ambient air quality conditions including ozone and meteorological data.

An exceedance of the ozone standard occurs when the 8-hour ozone concentration is greater than or equal to 76 ppb. An exceedance is not the same as a violation. A violation occurs when the 3-year average of the fourth highest daily maximum 8-hour average ozone concentration equals or exceeds 76 ppb. When ozone averages

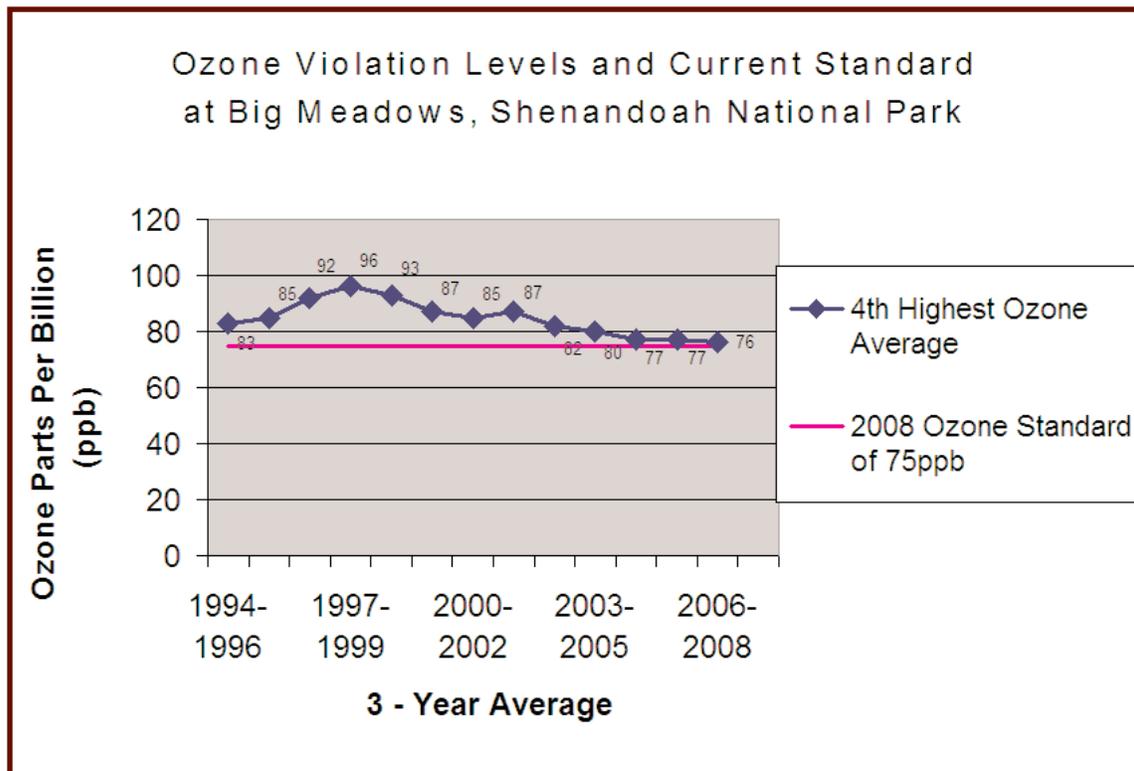
are between 0-75 ppb conditions are classified as good or moderate.

The highest ozone level was 81 ppb up from 76 ppb in 2007. The 4th highest ozone level was 78 ppb, which helped decrease the 3-year average to 76 ppb from 77 ppb. Although there was a decrease in the 3-year average, it still falls above 75 ppb and puts us at risk for violation of the 2008 NAAQS standards in 2010, once the 3-year requirement has been met.

Park visitors and employees should consider the possibility of adverse health effects during times of poor air quality, especially if they are sensitive to respiratory stresses. High concentrations of ozone can cause irritation and inflammation of the respiratory tract, affect lung function and can worsen asthma symptoms especially during heavy physical activity. Some individuals may be more sensitive and

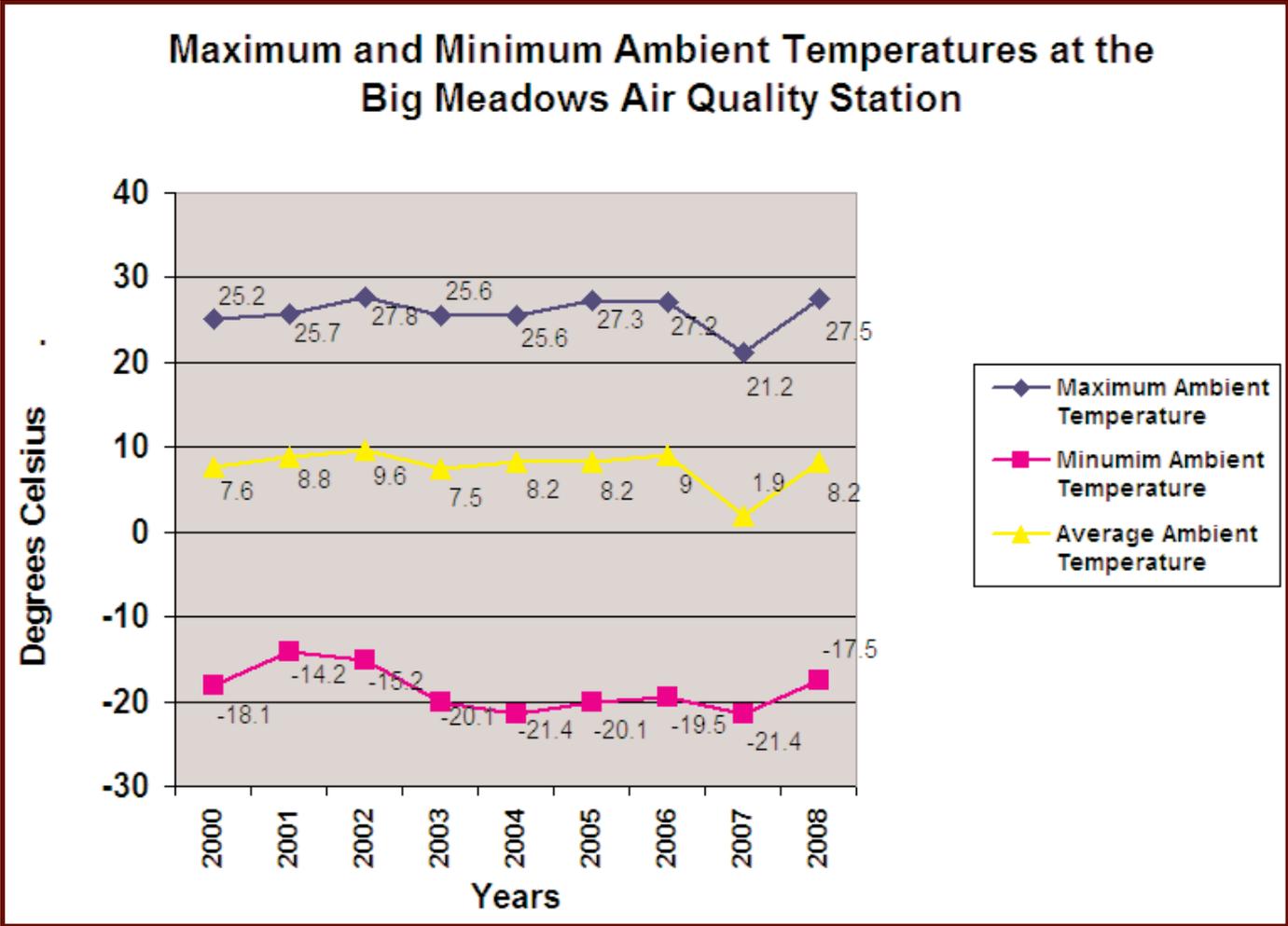
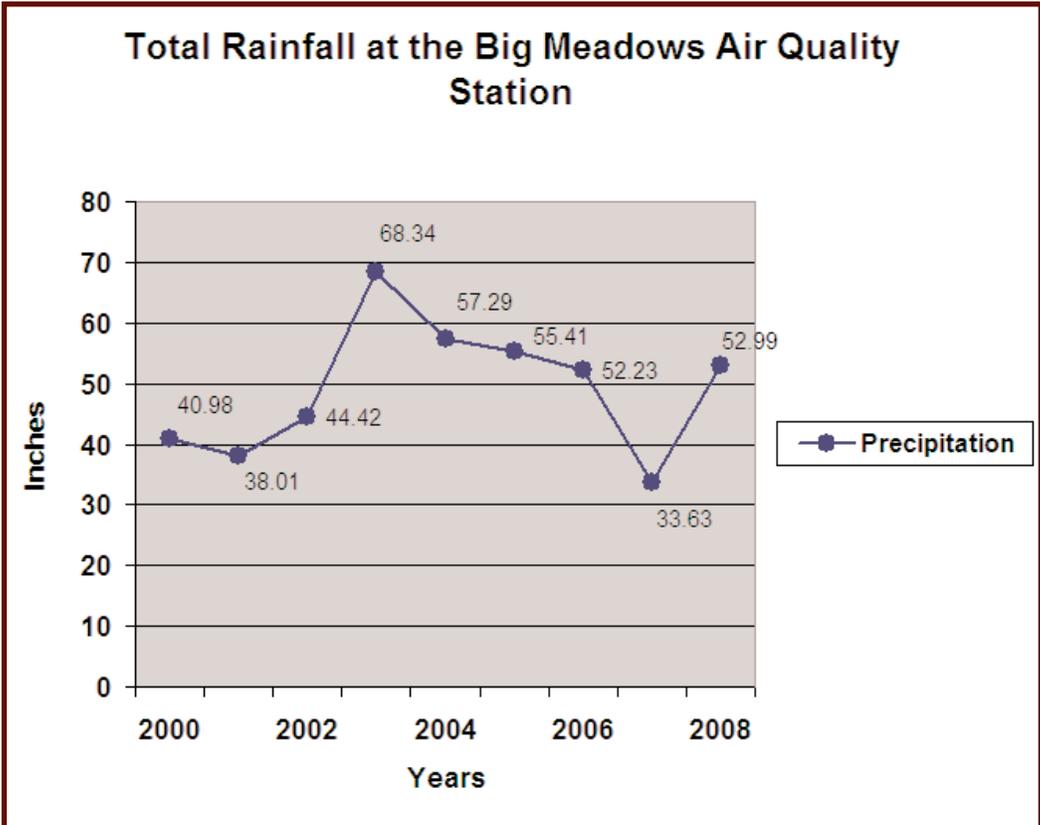
at risk to the effects of ozone than others due to previous medical conditions, inherent sensitivity and exposure conditions. Sensitive groups can include children, individuals who regularly engage in outdoor activities and people with pre-existing respiratory disease. Symptoms of ozone exposure may include pain when taking a deep breath, coughing, throat irritation, and breathing difficulties.

To find out the current level of ozone in the park please call (540) 999-3500 and press option 6 for the ozone advisory or contact a park ranger to determine if an advisory is in effect for that day. The ozone advisory will be updated by 8:00 am and will also be posted at the entrance stations, visitor centers and campgrounds. Park staff supervisors and visitors should take note of the ozone advisory and change work plans as necessary to avoid prolonged exposure. When



ozone levels are high it is prudent to reduce activities that would contribute to high ozone levels such as reducing the amount of vehicle use, use of other small engine equipment, painting, and the burning of brush or campfires.

Ray, J. D. 2009. Annual data summary 2008: Gaseous pollutant monitoring program. Natural Resource Data Series NPS/NRPC/ARD / NRDS—2009/011. National Park Service, Denver, Colorado.



Climate Change--All the Buzz

Gordon Olson, Division Chief, Natural and Cultural Resources

2009 marked the beginning of Shenandoah National Park seriously involving itself in the global climate change issue. The President's new Executive Order to Federal Agencies and the new Department of Interior Secretarial Order to Interior bureaus on climate change stress the importance (and requirements) of this topic. Regardless of where individuals stand on this issue, it is clear new opportunities, expectations, and challenges are presenting themselves related to climate change and park operations and management. We're working to gather more information specific to our region and better understand and communicate park issues as they relate to climate change.

For several years, the National Park Service (NPS) has supported a program called Climate Friendly Parks. The intent of this program is for parks to identify their contribution to greenhouse gases, make plans to reduce that contribution, and actually implement corrective actions. A Climate Friendly Parks component involves outreach and education – working with park supporters to pledge to “Do Your Part” for the park. Entry into the program results from self-nomination and acceptance by the Washington Office. Shenandoah has now pledged to become a Climate Friendly Park and is working on the early stages of documenting our emissions.

In addition, as agency (state and federal) emphasis on this issue has ramped up, many working groups have been formed to help guide planning and response. Jim Schaberl, Park Ecologist, was invited to sit on a group that was dealing with wildlife response to climate change within the state of Virginia. That group has now developed some climate change response guidance for species of conservation need. Jim is also working on one of several NPS task forces fo-

cused on multiple aspects of climate change. These groups have drafted a Servicewide Climate Change Response Plan with emphasis on Science, Adaptation, Mitigation, and Education. The final plan is anticipated to be released in 2010. Finally, Martha Bogle, the park Superintendent, sits on a Regional working group charged with addressing climate

change within the Northeast Region of the NPS.

Within the Fiscal Year 2010 appropriation, the NPS was given a substantial amount of funding to address climate change related science and management. Shenandoah submitted two complete project proposals to one program in hopes of obtaining some of

A Conceptual Basis for Monitoring Vital Signs

Gordon Olson

Shenandoah National Park has been in the business of monitoring natural resource conditions for as much as three decades. While we have significant quantities of data and a great deal of understanding about the condition of park resources, one of the shortcomings of the monitoring program has been the lack of documentation that explains how we selected the specific environmental parameters that we measure. During 2009, park staff members have been working to develop that documentation in the form of a Conceptual Design document.

In more recent years, as the National Park Service developed and implemented the Vital Signs Monitoring Program, planning efforts specifically called for preparation of a three phased set of documents that included descriptions of natural resources, ecological models, and justifications for selection of Vital Signs. Those reports also explained the decision-making process for determining which Vital Signs were the highest priorities. Shenandoah National Park was included in this developmental stage of the Mid-Atlantic Inventory and Monitoring Network. Network documents specifically include information about Shenandoah. This represented an important milestone but park staff felt it was important to highlight Shenandoah and to prepare more detailed information that is park specific. This is evolving into a document titled “A Conceptual Basis for Monitoring Vital Signs: Shenandoah National Park.”

This publication is specifically designed to be based on sound science but readily understood by the general public. The publication will include many photographs and, most importantly, graphic images that portray natural resource conditions and threats to those resources. It is our hope that those images will be readily reused in other publications and media. As of the end of 2009, several drafts have been prepared and reviewed but further editing and development is needed. This project should be completed in 2010.

the funding. Our projects focused on climate change impacts and adaptive management for the brook trout and Shenandoah salamander. Although 148 NPS proposals were submitted to this funding source, both projects were rated in the top 25%. The Shenan-

doah salamander project was approved and planning for that three-year project is in the works.

Finally, the George Wright Society and the Washington Office announced a joint venture to provide grants to grad-

uate students who were interested in working in parks on climate change topics. Shenandoah endorsed several projects but none of these were granted.

Air Quality Station Self Guided Trail and Interpretive Kiosk Funded

Liz Garcia, Physical Science Technician

Air pollution is a chronic, long-standing impairment issue at Shenandoah National Park. The National Park Service has collected a wealth of scientific data in a monitoring program running for three decades. An array of metrics are

monitored to better understand atmospheric deposition, sulfur dioxide and other gases, visibility, ozone, contaminants, and weather. This significant investment in equipment, knowledge and data provides scientific understanding of the issues for park man-

agers and scientists and is often used to inform regulatory agencies when considering applications and environmental protection.

The park's primary air quality monitoring station is located in one of the most visited destinations of the park yet this wealth of information is seldom shared with the public. The station is located away from some visitor facilities yet is visible from or adjacent to a series of trails/roads in the Big Meadows complex – the station's chain-link fence is bordered on one side by a nature trail and on another side by a horse/multiuse trail. The station is prominent but remains a mystery to visitors– no interpretive signs/messages currently exist.

The Shenandoah National Park Trust recently approved funding to establish an interactive learning station for the air monitoring site. Although we will conduct planning for the site in a few months, we have conceptual ideas for the site. An interpretive self-guided trail will surround the site with fixed exhibit displays. Exhibit panels will describe air quality issues, the history of the monitoring program, diagram and describe the visible instruments in front of them, and demonstrate how these data make a difference in protecting park resources and visitors. One location will host a small open shelter with an interactive, touch screen monitor with real-time display of meteorological data, ozone, and other instrument readings. Screen options will include video or podcasts of technicians collecting air and water data, various visibility conditions, and park officials describing how data are applied to protect the environment.

An Odd Year of Electrofishing

David Demarest, Biological Technician

2009 found us with a new Wildlife and Fisheries Biologist and a change in programmatic operations. Since 2005, the lead technicians in the Inventory and Monitoring Program have been sharing responsibilities for fisheries, vegetation, and exotic plant management. As of spring 2009, workloads of the lead technicians were switched such that they now spend most of their time in their own specialties. On "odd" years, such as 2009, a small fish monitoring crew was hired. On "even" years, such as 2010, a large fisheries crew is hired to complete fish population monitoring across the park. In addition, aquatic macroinvertebrate monitoring will now be occurring every year.

This being an "odd" year with a small crew, the decision was made to look at smaller streams that had never been electrofished by park staff. Using GIS, 187 drainages were identified that exit the park or flow along its boundary. From this list, we ranked those watersheds by size and assessed 49 of them. Drainages ranged in size from 2,033 acres at the sample location to about 100 acres. Since these were all small streams, most had no boundary

access. A great deal of time was spent looking for the closest landowner and gaining permission to go through their land to the park boundary. Of the 49 streams assessed, some were dry, but 20 had fish present. Seven of those streams had "new" populations of brook trout, and one had no fish present inside the park but brook trout present within 30 feet of the boundary. Tissue samples were collected from all eight populations of brook trout found and will be processed as part of an ongoing USGS brook trout genetics project.

In addition to our stream electrofishing surveys, we sampled 34 sites on 24 streams for aquatic macroinvertebrates, provided two demonstrations to the Trout Unlimited Tri-State Youth Fishing Camp, assessed five large streams for fish populations with help from other work groups and Virginia Department of Game and Inland Fisheries, conducted exotic trout removals on seven miles of park waters, broke up numerous bear jams, and assisted with nuisance wildlife captures.

Who cares About Berries and Acorns?

By David Demarest, Biological Technician

Wildlife biologists routinely keep records of acorn and berry (hard and soft mast) production. These records can help explain trends in wildlife populations or their movements as both mast types are extremely important food sources for most mammals. Although information on hard mast had been collected in the 1980's, no data was collected during the 1990's. After the Mid Appalachian Bear Study Group (MABSG) formed in 2000, Shenandoah started mast surveys again as a way to assess nuisance animal problems and provide more information to the group. The MABSG consists of state and federal black bear and general wildlife biologists, as well as academia, Department of Transportation personnel, and wildlife rehabilitators from New Jersey, Pennsylvania, West Virginia, Ohio, Kentucky, Tennessee, and Virginia.

From 1982 to 1989, district law enforcement rangers conducted a hard mast survey using wire baskets to

catch acorns. The acorns were then counted in an attempt to capture mast decline due to gypsy moth. It took three people over a day to set the cone shaped traps under certain trees, then collect the traps and count the acorns that had fallen in each trap.

The current subjective method occurs in late August or early September and has been implemented since 2002. This method looks at individual trees and rates their production as Failure, Poor, Fair, Good, and Excellent. It takes one person a day and a half to cover the entire park at all elevations. Soft mast and apples are noted throughout the summer during routine work.

Our normal reporting looks at low, middle, and high elevation sites. Many years there are substantial differences at varying elevations and sometimes by districts. This is most likely due to frost or rain/fog events during flowering. We opted to split

chestnut oak out of the white oak group because chestnut oak comprises 15.1 percent of the tree stem density in the park. The following table summarizes park-wide mast data since 2002 for all mast types. In 2005, no data was collected due to shifting monitoring priorities.

In the next two years, we plan to transition from our subjective method to a more quantitative method using the same areas and groups of trees. This will better conform to the method Virginia Department of Game and Inland Fisheries (VDGIF) and Virginia Department of Forestry use to conduct their surveys.

Note: If you've ever wondered about the six inch high red and white numbers painted on the trees in the Rapidan Wildlife Management Area and on the Fork Mountain Road, these are VDGIF's mast survey trees. The red numbered trees are red oaks and the white numbered trees are white oaks.

Year	Red/Black Oak	White Oak	Chestnut Oak	Hickory (all species)	Grape	Dogwood	Black Gum	Sassafras	Apple	Cherry	Berries (all species)
2002	Good	Fair	Good	Fair	Fair	Fair	Fair	Fair	Excellent	Good	N/A
2003	Fair	Poor	Failure	Good	Poor	Good	Good	Good	Fair	Good	Excellent
2004	Good	Fair	Excellent	Good	Good	Fair	Fair	Fair	Good	Fair	Excellent
2005	No Data	Not Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
2006	Fair	Fair	Good	Fair	Good	Good	Good	Good	Good	Excellent	Excellent
2007	Good	Good	Good	Fair	Fair	Fair	Fair	Excellent	Excellent	Fair	Excellent
2008	Fair	Excellent	Poor	Fair	Good	Good	Fair	Fair	Excellent	Excellent	Excellent
2009	Poor	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Good	Good	Good

Figure 1. Shenandoah National Park mast survey data averaged for park-wide production 2002 -2009.

Shenandoah is Part of an 18-Park Cooperative to Fight Invasive Plants

James Åkerson, Director, Mid-Atlantic Exotic Plant Management Team



High school students help control fall invasives such as Oriental lady's thumb, mullein, and Japanese stiltgrass.

Shenandoah National Park is part of an 18-park cooperative focusing on ecological restoration and invasive plant management in the Mid-Atlantic area. Shenandoah can be proud that its staff helped create the cooperative and hosts the invasive treatment team.

In this article, we'll look at ways the cooperative benefits the Park.

Park Priorities. Shenandoah has an excellent staff of botanical and invasives technology experts that really know their resource. They are the best

ones to set the direction of treatment priorities. Through the years, James Åkerson, Director of the Mid-Atlantic Exotic Plant Management Team, has worked closely with Jake Hughes and Wendy Cass to understand the park's priorities and set up fieldwork schedules that best serve the need. (Not all parks are blessed with expertise in invasives management. For them, the team provides additional help in assessing invasive threats and creating strategic plans for treatments.)



Members of the Mid-Atlantic Exotic Plant Management Team pose at the Shenandoah Upper NCR office backyard. Included are (l-to-r): Craig Bentley, Field Leader; Robert Jennings; Eugene Kobayashi, SCA; Nathan Wender; and James Åkerson, Director.

The discovery of mile-a-minute vine earlier, and now wavyleaf basketgrass, put those species very high on the treatment priority list at Shenandoah. The team has devoted many weeks here to mile-a-minute control, helping the park program catch up to the onslaught. Shenandoah's invasive plant challenges loom large. Both the team and park programs need increased funding to effectively manage the load.

Professional Insight and Breadth.

The benefits of the cooperative are definitely a two-way street. Shenandoah staff expertise is a boon to all 18 parks. Their early work with wavyleaf basketgrass, new to the region, is one example. At the same time, the team and cooperative provide a breadth of experience and perspective that one park alone does not contain. The cooperative gives a portal into what's going on around the region. It keeps the park from getting caught up short. The exotic plant management team has technical expertise treating 65 invasive species and identifying another 20 species for early detection and rapid response. The benefit of shared knowledge and resources is very important in these days of flat budgets and limited staffing.

Proximity of Staff. Shenandoah has hosted the exotic plant management team, and an earlier Virginia team, since 2000. The proximity of offices allows the staff easy communications for strategic and project planning. In times of weather events elsewhere in the four-state area, Shenandoah also benefits by receiving additional work days when the team cannot travel or work at other parks.

Volunteers. Volunteers are a powerful way to grow a citizen base of support and get work done in the field. Starting with youngsters, the short-term volunteer program helps instill an association of adventure with making a difference in natural resource protection. Children become involved through school outings and along with their parents on weekend visits. This is a powerful antidote to the decreasing time kids have outside in nature. Volunteer programs offer a way to "Leave no child inside"¹. Adults get involved through open public events and interest groups such as National Audubon Society and Defenders of Wildlife who set up appointments for service projects at the Park.

The Mid-Atlantic exotic plant management team began developing the short-term volunteer program at



Mile-a-minute vine covers flowers, shrubs, and trees. It can expand into shady areas and explode into sunny openings.

Shenandoah in 2005 after obtaining a grant through the National Park Foundation. It operates with an open public event in the spring and again in the fall, and events by appointment spring, summer and fall. Shenandoah took over the program reins in 2008, freeing the team to fledge a similar program for the Appalachian Trail. The volunteer program helps exotic plant management with thousands of volunteer hours and hundreds of personal contacts every year.



The Future. It is not likely the National Park Service will have enough funding any time soon to control all invasive species threats on its 84.4 million acres of park lands. Partnerships and collaboration are the best approach for increasing fieldwork potential. These efforts create leverage to meet the challenges of new and existing invasives. Partnerships increase the potential expertise and work that can be accomplished while broadening the thinking that goes into decision-making. Thinking broadly and out of the box is essential to be nimble in the war against weeds.

¹ "Leave no child inside" was made famous in Rich Louv's book *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder*, Algonquin Paperbacks, 2005.

The beauty of this native orange conk fungus was discovered while looking for invasive plants in the North District near Beahms Gap.



A heavily trampled area on the summit of Old Rag Mountain, 2009.

Status of Rock Outcrop Management Project Environmental Assessment – Next Steps

Wendy Cass, Botanist

Over a year has passed since December 2008 when the public review of the 2008 Rock Outcrop Management Project (ROMP) Environmental Assessment / Assessment of Effect (EA) was completed, yet no final decision document has been issued. What is causing this delay? A variety of things have affected our ability to complete the project. Primary among them are the need to find ways to adequately address concerns related to potential impacts to the federally endangered Shenandoah Salamander, and complications related to the processing of public comments in the NPS electronic environmental compliance tracking system (PEPC). Fortunately, these items have now been addressed, and the

ROMP EA is very close to final completion. The park expects to receive a final Finding of No Significant Impact (FONSI) from the regional office in March 2010.

Once signed, the FONSI will allow the park to implement management actions within the selected alternative. The first project scheduled to be undertaken is a restoration effort on the summit of Old Rag. This project will involve the use of low barriers, signs, minor trail re-location, public education, and native re-vegetation. Together, these actions will mitigate human impacts to rare plant species, while improving the visitor experience.

Bottles, Nails and Spear Points: Keeping Track of the Past

Kandace Muller, Museum Specialist, with Sara Elliot, Archeological Technician and Research Assistant, JMU, and Carole Nash, Adjunct Faculty, JMU

The role of archeology within the park is an important one. Archeology tells us how humans lived and operated within the boundaries of the park during pre-historic and historic times. Archeological projects occur for two reasons, one in response to legal requirements and secondly for intentional studies of specific areas or cultures. Legal requirements direct work done in response to projects like new construction where an area is surveyed ahead of time to make sure the construction will not adversely impact significant cultural resources. Much of the work in the park has been driven by compliance.

From the mid 1990s through the early 2000s the park and a partner, The Colonial Williamsburg Foundation (CW), were involved in the second type, a scientific study, "Survey of Rural Mountain Settlements." The intent of the project leader, Audrey Horning, contrasted the existing written perception of "the mountain people" against that shown by material objects from an archeological field project. A study was made of settlements in several hollows within the park undisturbed since the early 1940s. The results indicated that the people who lived in the mountain hollows were not isolated hillbillies, as characterized in earlier writings, but had a lifestyle similar to other rural peoples across the country.

Archeological artifacts and associated material and documentation are permanently maintained by the National Park Service. However, with the completion of the "Survey of Rural Mountain Settlements" project, project artifacts were returned to be housed at the park. This particular collection provides a good example of the importance of timely and thorough documentation of museum collections and

how documentation impacts the management and use of archeological collections.

At the time of the study, the National Park Service (NPS) was in the process of changing the museum collection software used to document its museum collections. Unfortunately, because of the timing, the material from this study was not documented in the new system. The artifacts themselves were processed and described at the CW and then transported to the park for permanent retention. Staff members both at the park and at CW moved on by Sep-

tember of 2007. As new staff began working with the collection there began an analysis of documentation and archeological storage needs in the park. Some discoveries occurred regarding the documentation of this particular collection that might apply to others within the park museum collection. Some things now done as routine were lacking: standardized box labeling, NPS catalog numbers on objects, entry of descriptive data in the NPS museum software. The containers used to store the artifacts were not archival, an important part of long term preservation storage. Undoubtedly, plans existed to address these points but were not implemented before the staff changed. The collection had a good inventory with descriptions which proved invaluable. Catalog numbers had been assigned but the correlation to the correct item was not immediately obvious. The staff at CW had cataloging software from the same company the NPS ended up using but not the NPS version.



A shoe found at Corbin Hollow, one of three hollows in the study.

This "33 Repeater" toy ray gun was found at the former home of Wesley and Adaline Corbin. It was produced by the All Metal Products company of Wyandotte, Michigan in the 1930s. It was originally painted red.



For long term management of collections, identification of artifacts and linking them to the data entered in the collection software is critical, as is getting the data entered into the computer so items can be accessed for accountability and research. Labeling of storage bags and boxes aids in locating individual items serving as part of data access. Consistency of information and its format are very important features. Due to the amount of material associated with this study, its potential value to other archeologists, and the need to track and account for it, the park made it a priority to finish documenting these artifacts and to use them as a guide to other collections both old and new. Fortunately, the park can still access previous park staff and the archeologist in charge of the project for CW, and a cooperative agreement exists with James Madison University (JMU) for assistance with archeology projects. The park and JMU decided to work with this collection, using it as a way to standardize our work across projects. As part of the project, early in 2008 we upgraded the museum collections software at JMU to a newer NPS version. The software used by the NPS provides a legacy and has gone through several iterations since its adoption, and with each upgrade, opportunities for more systematic and detailed cataloging arose. The archeologists were able to comment on the new fields and make suggestions for "tweaking" to suit the needs of other archeology researchers. Park museum staff and the cooperator archeologist chose a data entry format they felt would meet collection management needs and work best for archeologists doing research using this or other park archeological material. Since then most of the material in this collection has been described and entered in the park master database.

We found it important to develop a consistent format of data entry. We worked out standard labeling of ob-



These artifacts were found at the Wesley and Adaline Corbin home site and include a muffin tin, utensils, ceramics, tin cup, and salt shaker lid, some of the types of items found during this study.

jects, bags, and boxes, and box lists. We will use all of these when processing other archeological collections. Consistent data entry will allow for better use of the data. Items can be found by staff when needed. Prior to this project, it was virtually impossible to find these items with any efficiency, something discovered when the park performed its annual inventory of museum property. Finding items without identifying numbers during the inventory is very difficult when numbers are not applied to items and data entered in the NPS collections software. Numbers and descriptions were difficult to cross-reference between the database and the object, if not impossible. The items were re-stored in archival containers using a storage method that will improve access of the collection. Unfortunately, the documentation indicates that we have not yet found all of the items. The original project archeologist could direct us to some of the items and recently we found another unlabelled box of artifacts in a different location within the storage room. The fact that we have a better identification of what is still unaccounted for will assist in finding it.

As anyone with scientific training knows, organization of data is key for its use and analysis. It is important

that all containers be identified, preferably by the accession number associated with it. It helps if an accession folder exists with receipts identifying how much material, the source of the material and contact information. Without this, it becomes harder to tell if a collection is complete and the important collection location information. Identifying artifacts with the NPS number and provenience information helps maintain associative information. Information about the artifacts needs to be entered into the museum

collections software for accountability and to allow for efficient access for research. Until an item is described and can be found it is very difficult to make it accessible for research.

We were very fortunate in our continued access to past players involved with this collection. As time passes people retire and move on with their lives making documentation much tougher. This project allowed students at JMU to learn the collections software used throughout the NPS and see the value not only of field work, but the important work done after the material leaves the field. JMU staff's work with previous park staff and their familiarity with archeology in the park allowed JMU to assist new park museum staff to process this collection. While some work remains, this project has formed a good basis for working out issues with other material that requires further documentation, and for new collections. In time researchers will have useable information about previous projects to compare with materials collected in new studies. This particular study added significantly to our knowledge of nineteenth and twentieth century material culture in the Blue Ridge and the same will occur with complete documentation of the prehistoric material.

Watch out for these Weeds!

Jake Hughes, Biological Science Technician

Invasive plant profiles posted on Shenandoah NP website. The old adage 'an ounce of prevention is worth a pound of cure' is as true for exotic plant management as it is for healthcare. The most effective means of controlling invasive plants is to prevent their establishment in the first place. Once they've appeared, however, it's far more efficient and effective to adopt a strategy of 'Early Detection and Rapid Response' (EDRR)—being vigilant and taking action quickly, while populations are small. Both of these strategies require lots of eyes.

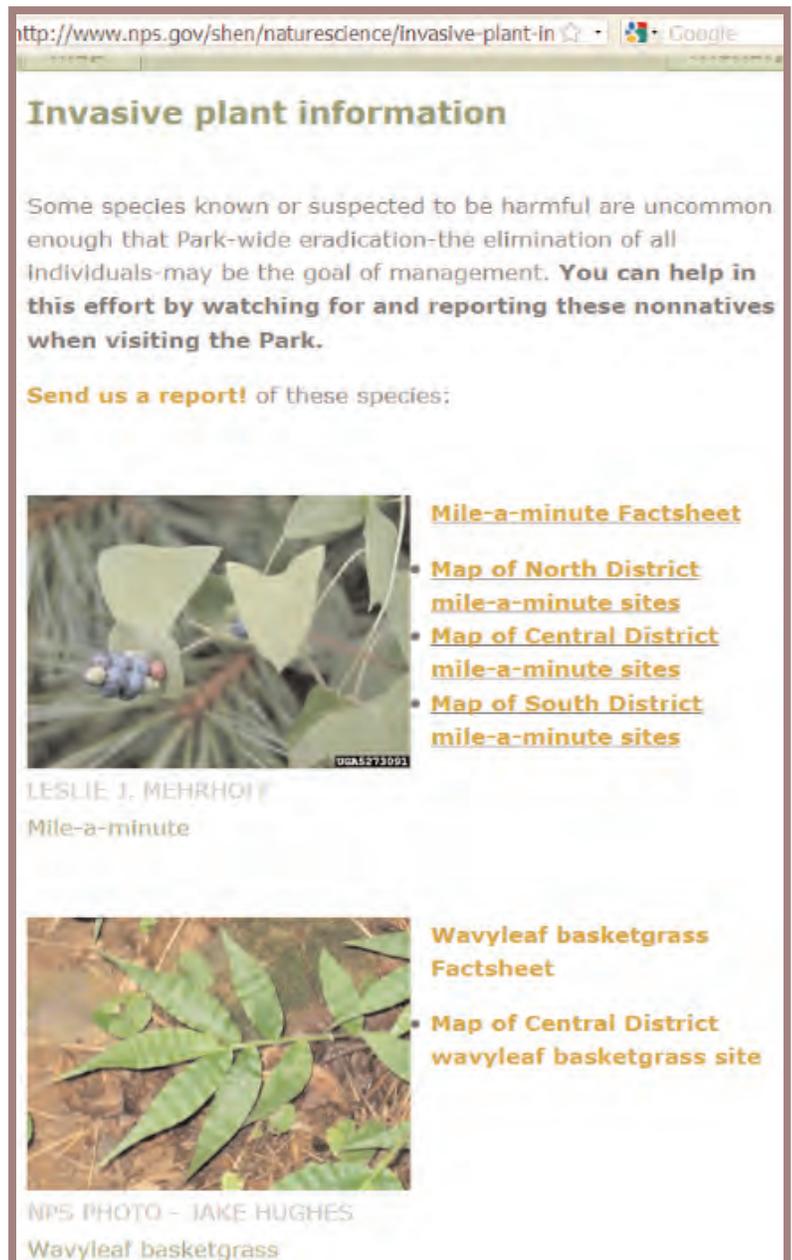
For the small staff attempting to track and control invasive plants in the nearly 200,000-acre Shenandoah National Park, detecting new invasions is often easier in theory than in reality. Our chance of detecting a species before it's entered the Park, let alone being in a position to do anything about it, may be even smaller. But if even a small fraction of park visitors—an estimated 1.1 million per year—and park neighbors—about 300,000 in surrounding counties—are made aware of invasive plants and some of the species with which we're most concerned, our prospects are greatly improved. Increasing public awareness is a critical component of prevention and EDRR.

In an attempt to increase public knowledge about emerging invasive plant problems, as well as to increase the pool of potential invasive plant spotters visiting the park, we've begun using the park website to profile some of these least wanted weeds (see figure at right). For each featured species, links take viewers to a factsheet, as well as one or more park-wide distribution maps. This will enable those spotting a targeted invasive to determine if their infestation has been previously reported. Another link allows viewers to report new sightings. Reports are sent directly to the park exotic plant management program. Though reporting in-Park infestations is the primary reason for posting this information, it's also hoped that people encountering these species on their own property will be encouraged to remove them.

Currently, there are two species profiled on the site—wavyleaf basketgrass and mile-a-minute. More will be added in the near future. We plan to expand this to include species that occur in the region but that haven't yet been found in the park—so-called 'watchlist' species.

Can this help? Without a doubt! In fact, observant and knowledgeable park visitors have already alerted us to a number of infestations, including new populations of invasives known to be present, as well as species not previously recorded from Shenandoah.

Links to factsheets, maps and the reporting link can be found at <http://www.nps.gov/shen/naturescience/invasive-plant-information.htm>



A portion of the Invasive Plant web page

Chronic Wasting Disease Update

Rolf Gubler, Biologist

On January 19, 2010, the Virginia Department of Game and Inland Fisheries (VDGIF) confirmed that a white-tailed deer tested positive for chronic wasting disease (CWD) in Virginia. This was the first confirmed case of CWD in the Commonwealth. The hunter-killed deer was taken in Frederick County six miles south of Gore, Virginia (less than a mile from West Virginia's border). Virginia now joins 17 other states and Canadian provinces with CWD.

Between 2005 and 2009, CWD has been detected in 62 deer in Hampshire County, West Virginia. Most of these deer were taken from the Slanesville, WV area (the current CWD endemic area). In December 2007, a positive deer was found further south in Yellow Spring, WV,

roughly 25 miles from the Park's northern boundary.

Staff continues working on the Park's CWD Environmental Assessment (EA) that will address CWD initial detection and disease prevalence monitoring. The EA is currently being reviewed internally.

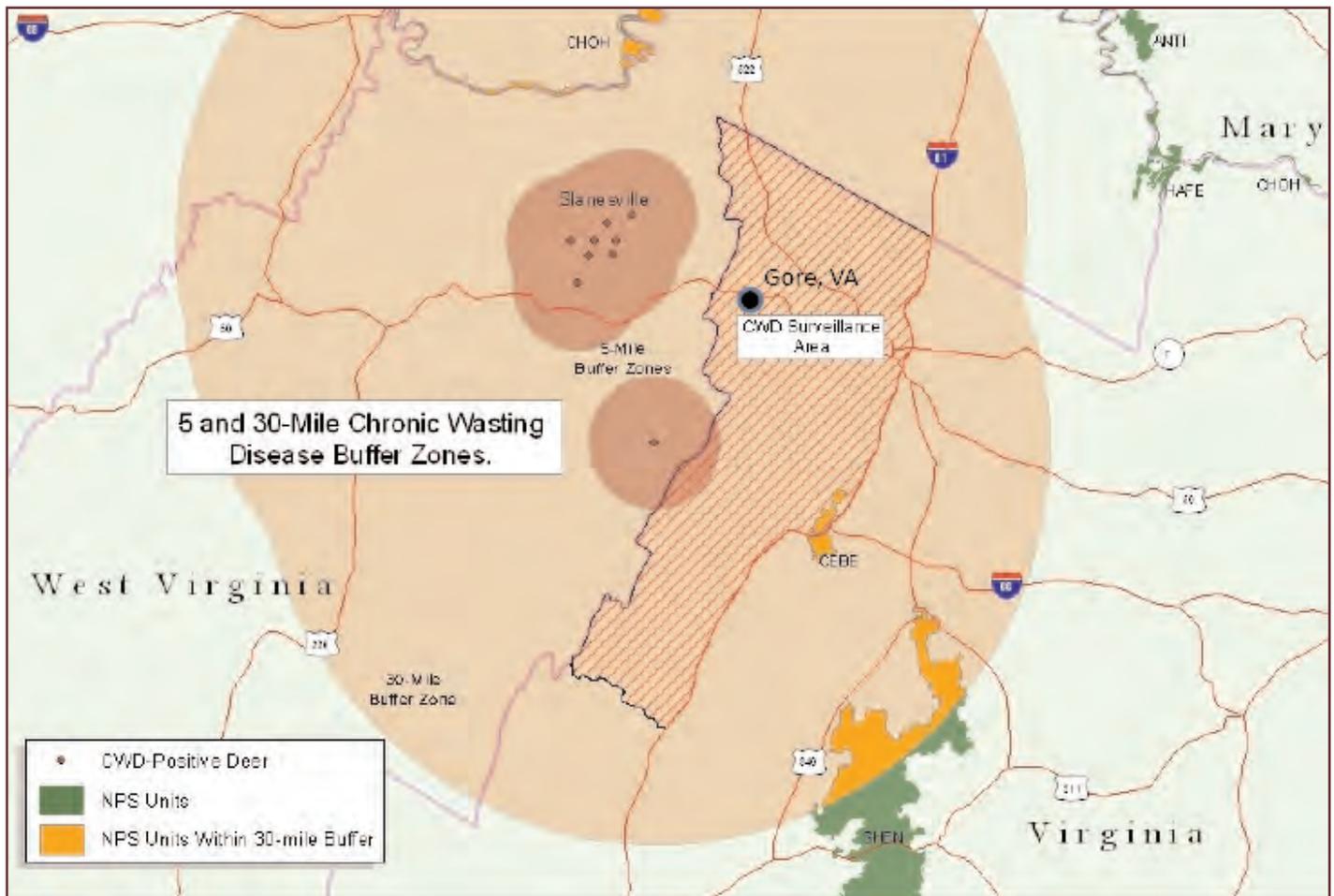
Staff has begun working with the Denver Service Center and other NPS staff on the planning and preparation of a CWD Environmental Impact Statement (EIS). This EIS will address long-term monitoring and management of CWD once it gets established in the Park.

Natural Resources staff continues to conduct CWD Opportunistic and Targeted Surveillance in the Park. Oppor-

tunistic surveillance deals with collecting diagnostic samples from Park deer that have been killed by vehicles or other means. To date, the Park has sampled 52 deer by this method (all negative for CWD). Targeted surveillance involves Park staff actively looking for sick deer that exhibit CWD symptoms (e.g., emaciated condition, drooping head, lethargy, attracted to water, and drinking excessively).

How You Can Help

If you find a road-killed deer or observe a sick deer fitting some of the symptoms above, please call one of these Natural Resources employees: Rolf Gubler, Jeb Wofford, David Demarest, Dale Meyerhoeffer, or Sharon Henry.



NPS map showing proximity of finds of diseased deer to NPS units

Emerald Ash Borer, Ash Trees, and the Park's Firewood Ban

Rolf Gubler, Biologist

Over the last 25 years, there have been an increasing number of nonnative insects and diseases that have impacted Shenandoah's forests. These include gypsy moth, hemlock woolly adelgid, and dogwood anthracnose. Some pests such as the gypsy moth have caused moderate longterm changes to the park's forest composition (by reducing the percentage of oaks by 10-25% in many areas). Other non-natives such as the hemlock woolly adelgid (HWA) and dogwood anthracnose have caused major longterm impacts to the park's forest composition. An example of this would be the loss of 95% of the park's Eastern hemlocks in the last 20 years due to HWA. Another non-native pest that has the same potential to cause widespread mortality of a single park species (white ash) is the emerald ash borer (*Agrilus planipennis*).

The emerald ash borer (EAB) is a small wood-boring beetle native to Asia. It was first discovered near Detroit, Michigan in 2002. It is believed to have arrived in the U.S. on infested wood packing material. Nationwide, the emerald ash borer is responsible for the death of over 30 million ash trees (*Fraxinus* spp.). Most of this tree mortality has occurred in Michigan, Ohio, Indiana, and Illinois. Within the last three years, EAB has spread to West Virginia (2007), Pennsylvania (2007), Virginia (2008), Missouri (2008), Wisconsin (2008), Minnesota

(2009), Kentucky (2009), and New York (2009). The rapid spread of this forest pest is greatly aided by people – especially campers. Under natural conditions, the adult beetle can only spread about one mile per year. However, it is the movement of infested firewood (and other wood products)

vae bore tunnels through the bark and into the cambium where they feed on the phloem. As they feed, they create serpentine galleries in the outer sapwood disrupting the trees' ability to transport nutrients. In most cases, this disruption (tree girdling) results in tree death within 3-5 years. In the park, the



predominate ash species is white ash. White ash trees comprise roughly 4% of the park's overall forest (that's eight times the number of hemlocks present in the park prior to HWA!). Additionally, white ash is present in 16 forest communities in the park. These ecologically important areas make up 65% of the park's acreage. Given what is known about EAB infestations, an outbreak in the park would lead to the loss of white ash in Shenandoah

and surrounding areas. Currently, there are no known native predators to control EAB, and there are no effective chemical treatments to control EAB in forest settings. Recently, the park implemented a comprehensive program aimed at educating the public about EAB, the risk to our ash trees, and our 2010 firewood ban. In this program, we are using a variety of media to get the word out to campers, picnickers, and backcountry cabin users. These media include our website, park newspaper, posters, signs, 1610 radio message, camp-

that has allowed this pest to spread hundreds of miles per year. Currently, the EAB is located only 55 miles from the park's northern boundary in Fairfax County, Virginia! Land managers throughout the East are working diligently to control the spread of this destructive insect through bans and public education. Additionally, regulatory agencies are restricting the outward movement of firewood from EAB infested areas through state and federal quarantines.

The larvae of the EAB feed on ash trees with devastating results. The lar-

ground registration alerts, brochure mailings, and presentations to cooperators, camping groups, and the public. Our primary goal is to inform and educate our visitors before they enter the park (with their firewood).

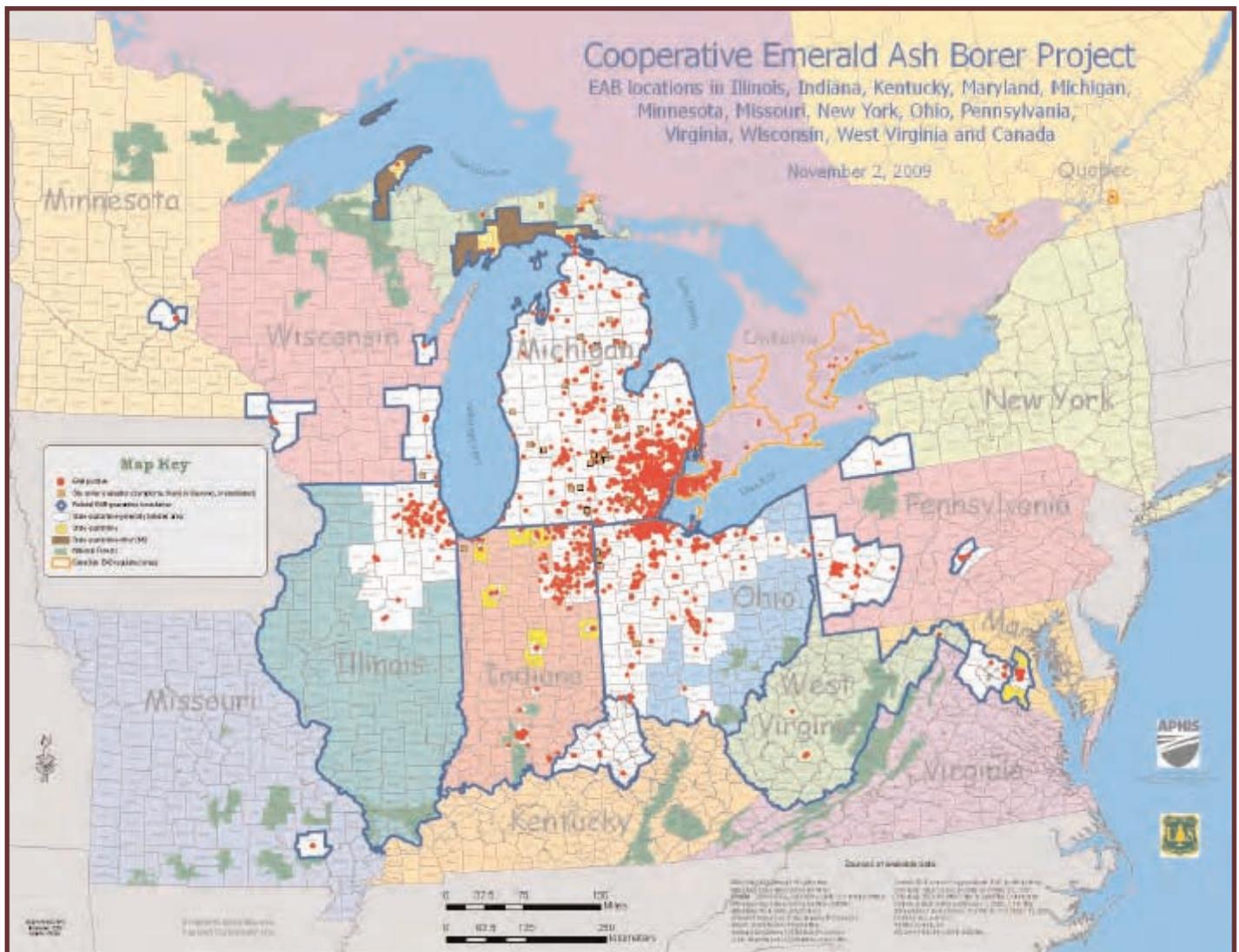
On March 1, 2010, the park implemented a ban on all outside firewood and wood scraps. It is important to note that visitors may still gather dead and down wood within the park, bring charcoal from home, and/or purchase firewood at camp stores and campgrounds located in the park. This program is intended to reduce the transport of potentially infested firewood into the park and help to minimize the introduction of the destructive EAB and other non-native pests such as the Asian long-horned beetle.

If visitors accidentally bring firewood into the park, they will have two choices. They will be allowed to burn their wood immediately at their campsite or alternatively, they may double-bag their wood with plastic trash bags, return it to their vehicle, and take it home. Visitors are encouraged not to move firewood under any circumstances and should not plan on bringing firewood into the park on future visits. Park staff will be monitoring incoming visitors in campgrounds and picnic areas for apparent outside firewood.

At Shenandoah and many other areas throughout the East, campgrounds represent the highest risk sites for EAB introduction. As such, park campgrounds are receiving the greatest level of public education, firewood

monitoring, and EAB early detection monitoring. These measures are in place to minimize EAB introduction into the park.

As we did in 2009, park staff will be conducting early detection monitoring (trapping) for EAB. Park staff will deploy 19 sticky traps in nine high risk areas (campgrounds and picnic areas) this May. Additionally, the park will be working with the Virginia Department of Agriculture and Consumer Services to deploy an additional 35 EAB traps along portions of Skyline Drive. These traps will be placed at least 100 feet from the road edge and may be somewhat visible to visitors and staff. The sticky traps are pyramidal in shape and use a visual lure (purple) and a scent lure (manuka oil) to attract adult EAB. They are suspended 15'-20' high



from white ash trees. Traps will be inspected twice a year – once in late spring and once before removal in early August. Any beetles resembling EAB will be sent to the Insect Identification Lab at Virginia Tech.

Our firewood ban along with our public education and monitoring efforts will likely delay the arrival of EAB by as much as 10-15 years. Slowing the spread of EAB is important so as to allow researchers more time to discover an effective biocontrol and refine better treatment options for our ecologically important white ash trees. It will also allow time for the park's forest to recover from the back-to-back impacts of the gypsy moth and hemlock woolly adelgid. And lastly, the park's mission mandates that we protect natural resources and leave them unimpaired for future generations.

For more information on EAB, quarantine areas, and firewood movement, please visit these websites.

http://www.nps.gov/shen/planyourvisit/firewood_eab.htm

<http://www.emeraldashborer.info/index.cfm>

<http://www.dontmovefirewood.org/>



A sticky trap used to monitor the presence of the emerald ash borer

Aquatic Invasives Update

David Demarest, Biological Technician

In 2008's newsletter I wrote about the aquatic exotic species Viral Hemorrhagic Septicemia (VHS) and didymo. VHS is a coldwater viral disease that can kill large portions of fish populations and has been found to infect over 50 species of fish including brook trout. Didymo is a highly invasive cold water loving algae that can literally smother the life out of streams.

In the past two years, VHS's range has expanded to include all five Great Lakes, a reservoir in Ohio, a lake in Michigan, and a chain of lakes in Wisconsin. In New York, VHS has now been found in two rivers, two lakes, a canal, and a private pond.

Closer to home, didymo has now been identified from the Pound River in Virginia (in addition to the Smith and Jackson Rivers), Glady Fork, Gandy Creek, and Seneca Creek in West Virginia (in addition to the Elk River), and the Gunpowder and Savage Rivers in Maryland. In the past, it was believed that didymo was a product of constant temperatures and stream flows and would only be found in rivers and streams with regulated flows, such as tailwaters, which comprise most of this list. However, in the past year, the West Virginia Department of Natural

Resources documented didymo in Glady Fork, Gandy Creek, and Seneca Creek which are free flowing coldwater streams in the eastern part of the state (Shingleton, 2010). These "new" cases prove that there is reason for concern for protecting our aquatic resources here at Shenandoah from didymo introductions.



Didymo
Didymosphenia geminata

Other species on our watch list are New Zealand mud snails, zebra mussels, and quagga mussels.

Understanding that we can move between as many as ten streams within the park in a four day week, Shenandoah's fisheries crew will be assessing new types of feltless waders and a new gear disinfection protocol between watersheds. In the meantime, please surf the web to find out about these invasives, how to identify them, and how you can limit their spread.

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West Virginia Department of Natural Resources <http://www.wvdnr.gov/Fishing/didymo.shtm>



The following article is taken, with permission, from *Forest Health Review*, November 2009, a publication of the Virginia Department of Forestry.

Fall Webworm

Outbreak in Shenandoah National Park

Chris Asaro, Forest Health Specialist, Virginia Department of Forestry

The fall webworm (*Hyphantria cunea*) is a species of moth and a common late summer defoliator, primarily of pecans, hickories and walnuts. Typically, by August, it is common to see large webs scattered about the tree canopy, enveloping the foliage around the outer portion of a branch. Most feeding occurs within the web and damage to the tree is limited. Sometimes damage is more extensive and webbing can envelope the entire tree.

In general, however, long-term damage is minimal with late-season defoliators because the tree does not try to replace lost leaves by tapping into its energy reserves. Late spring and early summer defoliators can have far greater impacts because, so early in the season, the tree is forced to refoliate and draw on starch reserves normally saved up to get through the winter months.

Therefore, I was quite surprised when I witnessed a massive outbreak of fall webworm in Shenandoah National Park this past September. A very large area along Skyline Drive near Big Meadows was heavily defoliated (see map on page 22). Many trees, most of which were black cherry, were completely defoliated.

So excessive was the defoliation in places that, except for the large webs in the trees and the time of year, it looked similar to what one sees with major gypsy moth outbreaks. I was also surprised to see that the majority of the trees defoliated were black cherry. Although fall webworm is reported to feed on over a hundred species of trees and shrubs and host preference can vary by region, black cherry is not listed among its favorites. In the areas I inspected, other species such as oaks, hickories and walnuts seemed much less impacted, if at all.

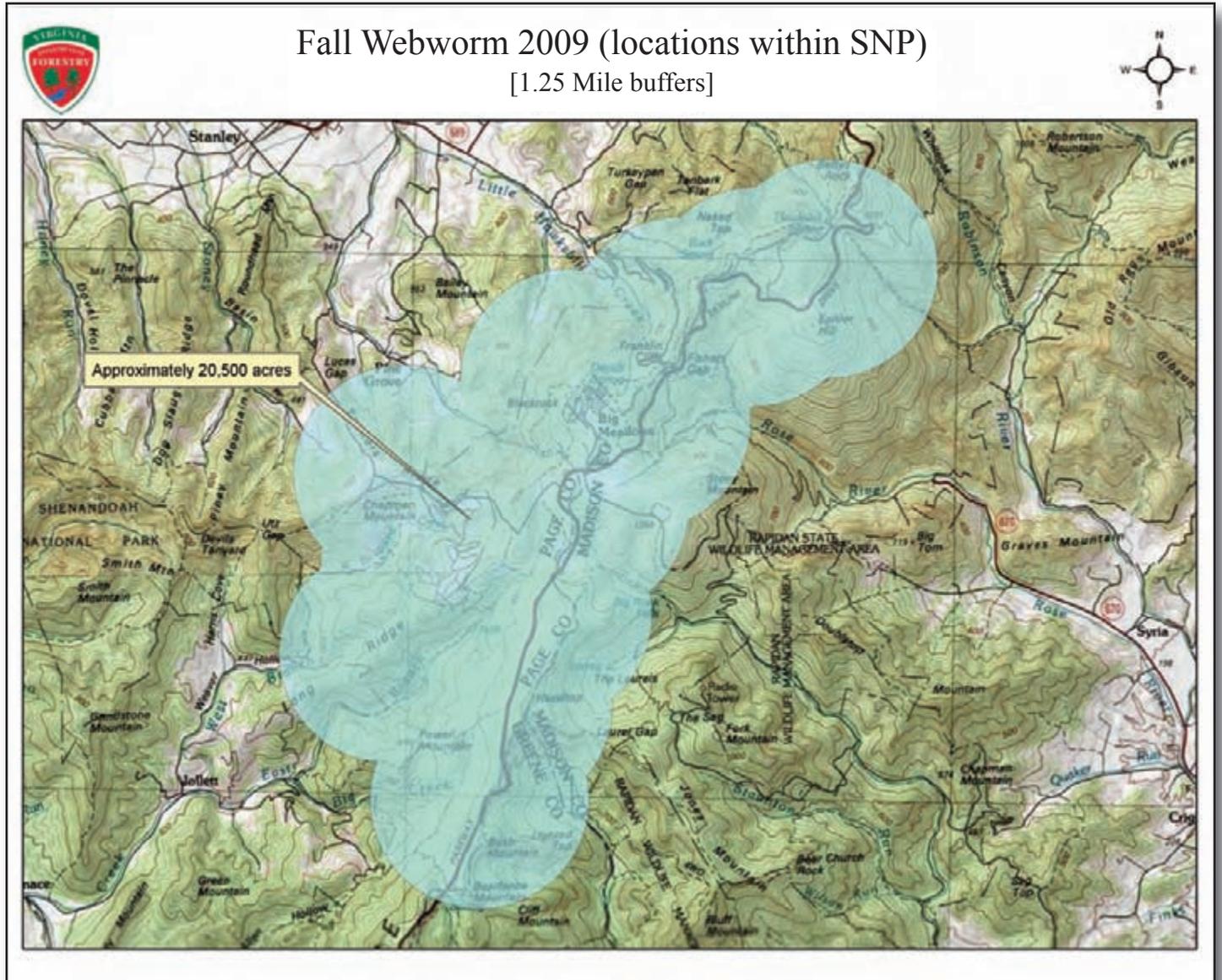
At one point, I began to wonder if I was seeing a species other than fall webworm, but examination of the larvae confirmed it as such. Interestingly, many of those areas along Skyline Drive near Big Meadows consisted of forest re-growth following widespread farm abandonment in the early part of the 20th Century. The trees that colonized these sites were made up primarily of black cherry and black locust.

Certainly, these two species dominated most of the stands in the vicinity. Black locust, while not impacted by fall webworm, was impacted heavily by locust leaf miner. Although brown locust trees in late summer are an annual event in Virginia due to locust leaf miner, these trees seemed particularly hard hit this year. The combination of locust leaf miner and fall webworm on cherry created a very impressive landscape of brown trees as viewed from some of the overlooks.

I shared my observations with Rolf Gubler, the park biologist, who scouted around other areas that I did not have access to and which were a bit further removed from Skyline Drive. He reported that there were indeed a variety of other tree species that were heavily impacted by fall webworm, including oaks, hickories, walnuts and ash. These hosts were much more abundant where he was, while black cherry was much less so. I still find it curious that, where black cherry was abundant but other species such as oak and hickory were also present, they fed almost exclusively on cherry. That suggests a strong host preference for the latter. Not only was this the first time I can remember seeing fall webworm feeding on black cherry, but it was also the first time I've witnessed a full-blown outbreak of this pest in a natural forest setting and on such a scale. While I don't think the forest will suffer any severe impacts due to some of the reasons stated above, multiple years of defoliation at this level would likely impact some trees. Natural enemies usually keep populations in check, so it will be interesting to see what happens in this location next year.

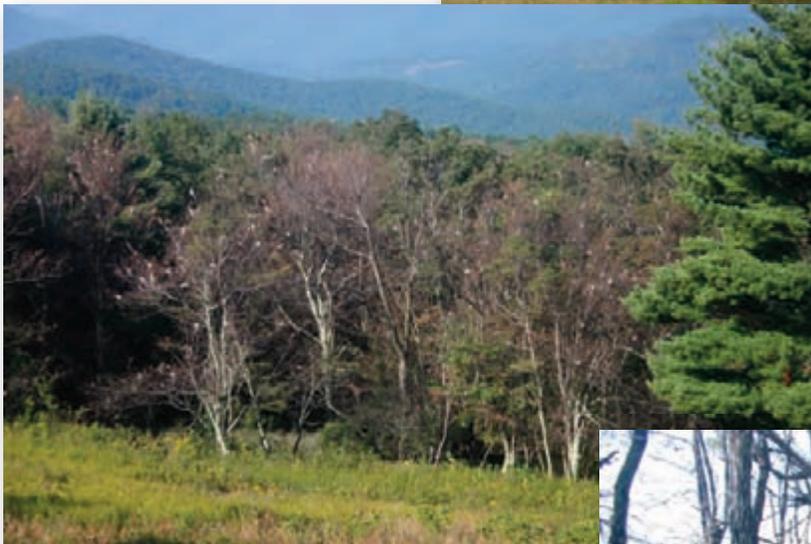


This picture and those on page 23 are images of a fall webworm outbreak along Skyline Drive near Big Meadows, Shenandoah National Park. Most of the defoliated trees in the images are black cherry.





Fall webworm along Skyline Drive



Cultural Landscape Restoration At Rapidan Camp and Big Meadows

Ann Kain, Cultural Resource Specialist

Big changes were underway at Rapidan Camp in 2009. When President and Mrs. Hoover were at Rapidan Camp eighty years ago, the Camp had a much different feel and look than it does today. Back then the tall hemlock trees shaded the Camp offering a cool respite from the summer heat of Washington. However the hemlocks have largely disappeared and the few remaining do little to shade the site. As a result of abundant sunlight now flooding the Camp a brushy understory of briars and other undesirable shrubs have grown up, obscuring the openness of the Camp the Hoover's enjoyed. In an effort to restore the cultural landscape of the Camp, park staff members have started removing the undergrowth and selectively removing trees. Other trees were left in place and some may be planted to re-establish the upper canopy to provide shade for the Camp once again.

In addition, all the trails in the Camp compound were removed and replaced. Erosion was occurring in several locations and the park trails crew determined that using a product called Gravel Pave as the base for the trails would address the erosion problems. Gravel Pave is a plastic waffle-shaped fabric which holds the gravel surface of the trail in place, preventing erosion and trail shifting. Rocks lining the trails were replaced and where rocks were missing new ones were added.

Currently a new site map and camp information panels are being developed with the interpretive staff to replace the large wood map at the Camp.

The Big Meadows cultural Landscape is also getting some much needed attention. Black Locust has been en-

croaching on the openness of the Meadow for quite some time. About a half acre of Black Locust was removed from the southeast end and the east side of the Meadow.

The CCC Camp in Big Meadows was re-staked by Cultural Resource Specialist Ann Kain and Archeologist Carole Nash. The park trails crew installed new, more attractive stakes, that replace the metal fence stakes. Trees were removed from the interior of the building outlines. Interpretive signage is being prepared for each building, including building photographs where available and identifying descriptions.

[Rapidan Camp after the second thinning of briars and other undesirable shrubs](#)



2009 Trail Crew Summary

Melissa Rudacille, Trails Maintenance Worker and Don Harvey, Trails Supervisor

National Park Service trail crews accomplished a great deal of work at Shenandoah National Park, using a combination of permanent supervisors and work leaders, temporary work leaders and laborers, Youth Conservation Corp students, and volunteers. Crews had primary maintenance responsibility for over 162 miles of trails. In addition, crews provided assistance to the Potomac Appalachian Trail Club

(PATC) volunteers, and worked administrative roads as needed for horse and hiking use, adding another 270 miles of trails and 92 miles of administrative roads. Trail crews kept these trails and roads open for use by cutting 1,649 fallen trees, clearing over 3,000 water control structures to prevent erosion, and cutting back encroaching vegetation.

Much of the trails project work this year focused on non-wilderness trails. Limberlost Trail was completely resurfaced with greenstone gravel (fig.1) in May of 2009, which temporarily brought the trail much closer to accessibility standards. Crews added "gravel pave" to trail surfaces to stabilize the President's Cabin trail system at Rapidan Camp. They also lined the President's Cabin trails with suitable



Figure 1. Adding gravel to trail surfaces.

rocks to replicate the historic look of the trails. Crews relocated a portion of Rocky Mountain Run Trail where the stream had undercut the bank and was endangering hiker safety. Rocky Mountain Run Trail is in designated Wilderness, and all of this work was completed with traditional, non-motorized tools. A new section of trail was constructed on Skyland Stables Trail to provide a more gradual incline for the horses and riders. Crews removed much of the deteriorated pavement on Story of the Forest Trail and then rehabilitated the trail. In addition, crews constructed 59 new water control structures, 114 new steps, and 322 feet of additional lateral drain on various wilderness and non-wilderness trails, both to prevent erosion and provide a more stable surface for visitors.



Figure 2. Setting new steps.

Overgrown and rutted administrative roads that serve as horse trails or that are used to access back-country structures continue to be a maintenance problem. Crews attempted to repair some of the heavily eroded sections of roads using hand tools, a “walk-behind” Bobcat and a Utility Terrain Vehicle. After spending extraordinary time and effort to open the overgrown roads with hand-held string trimmers and a walk-behind mower, the trails organization purchased a small tractor with mowing attachment. This equipment will enable the crews to work more efficiently to mow roads used as trails in the future.

The Trails Program is in a challenging time of transition as retirements and funding cuts have resulted in a reorganizational move from three crews each with a supervisor to a two-crew system. Both permanent and temporary trails leaders have admirably risen to the occasion to make up the organizational and funding deficits. In 2010, along with our PATC volunteer trails partners, the trail crews will assess and repair storm damage resulting from the severe winter weather. The crews also plan to repair or replace over 200 deteriorating water control structures, primarily on horse trails and high use hiking trails. Crew members experienced in stone masonry will begin reconstructing deteriorating retaining walls on the popular Dark Hollow Falls Trail. Finally, crews hope to complete the pavement removal and trail rehabilitation on Story of the Forest Trail.

The Windowsill Propagation Program

Jake Hughes, Biological Science Technician

Volunteers (VIPs) have played an important role in the invasive plant management effort at Shenandoah National Park for quite some time. Scout groups, environmental clubs and interested individuals have spent thousands of hours pulling garlic mustard from Park forests and freeing burdened trees of Oriental bittersweet. While plenty of people are willing to don gloves, get on their knees and pull plants for several hours, this isn't for everyone.

Growing native plants has a different, and perhaps broader, appeal than maiming and killing weeds. It's slower paced, not as strenuous and—for those without the botanically murderous heart to leave pulled weeds to wither in the sun—closer to the true point of exotic plant management: the protection and, where necessary, restoration of native plant communities.

In 2007, a small project was initiated within the park exotic plant management program to grow (propagate) a number of native species for revegetation of sites being treated for heavy infestations of exotic plants (see article in the 2008 NCR Newsletter). Through 2008, several thousand seedlings of eleven species were propagated from locally native seed and planted at several small restoration sites.

In 2009, we began offering native plant propagation as a VIP task. One hope was that this would enable individuals who are unwilling or unable to participate in exotic plant management tasks another means of participation in the ef-

fort to restore plant communities. Participants were set up with a propagation kit, including seed starter mix (soil), one or more clear plastic deli-trays—the type you find at grocery store salad bars (fig. 1), a spray bottle and seeds of one or more native species. The kits are used to start seedlings in a bright spot such as a sunlit windowsill. After about two months, the seedlings are returned to the park for transplanting to larger containers (fig. 2) and eventual planting at a restoration site.

In the first year, twelve volunteer propagators, several of whom were new volunteers, produced approximately 4,000 seedlings and helped with transplanting and planting. This enabled us to triple production over the previous year without losing any critical exotic plant control time.



Figure 1. Butterflyweed (*Asclepias tuberosa*) seedlings started in a windowsill propagation container.

For 2010, we've received a small amount of funding to acquire supplies to continue and expand the program. Several new VIPs have contacted us and expressed interest in participating in the program, including an elementary school teacher who wants to start seedlings with her class.

To date, most of the plants from this program have been planted at Hogwallow Flats Overlook and in the powerline right-of-way at Thornton Gap. Though the work is long term, we're beginning to see some payoff. Native grasses are starting to flourish and set seed in areas where nasty weeds like mile-a-minute and Japanese knotweed once dominated.



Figure 2. Greenhouse bench with seedlings: several thousand seedlings were propagated with the help of volunteers in 2009. Shown here are little bluestem (*Schizachyrium scoparium*) and Indiangrass (*Sorghastrum nutans*) plants.

Shenandoah's Archeology Program

Ann Kain, Cultural Resource Manager

Until the 1970s very little archeological investigation took place within Shenandoah National Park. From 1971-73 William Gardner, who became a well known and respected Mid-Atlantic archeologist, investigated the Flint Run complex, just outside the park boundary. This site produced clear evidence of the extensive exploitation of stone tools during the Paleo-Indian period, the earliest known period of human occupation in North America. This and subsequent investigations by Gardner and his colleagues would have a significant impact on our understanding of the pre-history of the Blue Ridge.

By the mid-1970s archeologists from the University of Virginia (UVA) under the direction of Michael Hoffman began somewhat small scale archeological work in the park. Survey work in 1976 by the UVA team identified 76 pre-historic sites in Shenandoah dating from the Middle and Late Archaic periods (8000 – 2000 Before Present [BP]), representing a hunter/gatherer society. The park was then broken down into four areas of concentration: northern, north-central, central, and southern which were surveyed over the next few years. The work done by UVA provided a baseline understanding of prehistoric use of the Blue Ridge region and was the first professional attempt to manage the archeological resources in the park.

Archeological activity in the 1980s and 1990s was driven by survey work required under the National Historic Preservation Act of 1966 (NHPA). This "compliance" archeology was specific to locations where a project or activity was to occur. While no systematic survey would be developed or implemented, NPS Project Archeologist Paul Inashima was able to investigate over 50 sites and produced 29 reports between 1983 and 1997. Through Inashima's work it was clear that evidence of

human activity could be found at high elevations, not just in the low lying, level areas near water sources where UVA had concentrated their efforts.

Since 1999 the Archeology Program at Shenandoah has operated through a cooperative program the park developed with James Madison University (JMU), Geographic Science Program of the Department of Integrated Science and Technology, with Carole Nash as the principle investigator. Originally initiated as a program to do archeological compliance, the activities have expanded to include broader survey work and cataloging archeological artifacts collected from past survey and excavation work this past year. Although survey work is still, for the most part, driven by what we are required to do, we are moving toward some general survey work including the developed areas of the park such as Big Meadows and Dickey Ridge,

much more extensive work at Mt. Vernon Furnace, with plans to survey areas in the park that may offer an abundance of information, giving staff a much broader sense of the archeological record.

Recently an Archeological Overview and Assessment (O&A) was prepared for the park by Audrey Horning, formerly at the College of William and Mary. This is a baseline report required for every park unit which includes both pre-historic and historic sites. In addition to describing and assessing the known archeological resources in the park area, the study also contains a narrative history of the park area. The overview reviews and summarizes existing archeological data; the assessment section of the report evaluates the data. Past archeological work is analyzed to determine the need for and the design of future studies. Recommendations for further

(continued on next page)



This is an old wall at the Belmont-Buck site, once a plantation. The plantation house, no longer standing, was built in 1845. During the Civil War, official records of the town of Front Royal were kept at the house to protect them.

American Electric Power Settlement Update

Jim Schaberl, Ecologist

Much of 2009 was spent working out how to spend the settlement funds that the National Park Service (NPS) has received. The Air Resources Division of the NPS manages these funds and helps determine how they support needs at Eastern National Parks. Emphasis was placed on developing and reviewing a multi-park study aimed at documenting atmospheric deposition effects (i.e., acid rain) along a corridor centered on nearly the entire Appalachian Trail. A large group of scientists from organizations like the USGS, the Hubbard

Brook Experimental Forest, the U.S. Forest Service, various Universities, and the National Park Service will come together to work on this project. Details regarding study implementation at Shenandoah National Park are in their final stages. Fieldwork for this study begins this summer.

In addition to this large project, Shenandoah is also expecting to receive funding to support a study aimed at merging water quality and aquatic biota (fish and invertebrates) monitoring information that has been collected for many years. This study

will attempt to develop relationships between water quality and biological information and should result in much improved monitoring programs. Since this funding focuses on efforts at understanding how to restore areas from air quality impacts, this study will also look at how acid rain's impact on water quality impairs aquatic life in the park.

Both studies are complex and will involve substantial staff time in terms of reviewing progress and making recommendations related to end products.

(Archeology-from previous page)

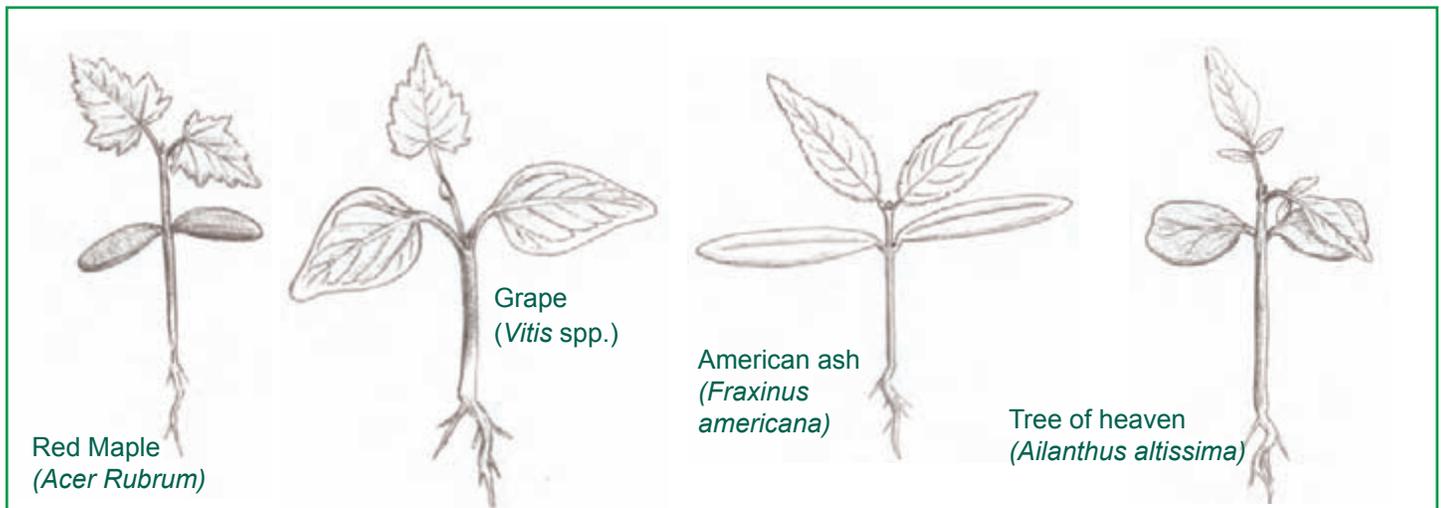
research include the need to relocate, reevaluate, and assess the condition of the sites originally identified by UVA. The process of determining site location coordinates in the 1970s was not very accurate, making it very difficult to find these sites. Better site information needs to be collected and new location information needs to be done with GPS technology.

The O&A also recommends much more extensive research be done on upland areas of the park. This work, begun by Inishima, should be completed in a more organized fashion rather than the compliance survey method used in the past. The park

may gain a better understanding about human use of these areas than is currently known.

Horning also recommends moving on to our historical archeological sites that represent industry. There are areas of the park where mining occurred, saw mill sites, and others, and of course Mt. Vernon Furnace. Nash and her students have done and are continuing to do extensive work at the Furnace site. The Belmont Plantation was a significant winery which needs survey, mapping, and research. Another significant site, Black Rock Springs Resort, representing early tourism also needs to be surveyed, mapped and researched.

Much work is yet to be done in the archeology program at Shenandoah. In addition to the projects already mentioned, the Archeological Sites Management Information System database (ASMIS), which contains well over 500 records, continually needs to be updated with the most current condition information. The cultural resource map layer in ArcGIS developed from a 1924 USGS map needs to be ground truthed and additional site information needs to be included so that the layer can be useful in a variety of ways. Through the use of ASMIS and ArcGIS the archeological resources in Shenandoah can be managed much more effectively.



Christina Harman--Forest Monitor and Artist

Wendy Hochstedler, Lead Biological Science Technician Vegetation Monitoring Program

Christina Harman has served as a key member of the Forest Vegetation Monitoring Program in the Natural and Cultural Resource Division at Shenandoah for the past three summers. Christina began working at Shenandoah in 2007 as a Student Conservation Association (SCA) intern after her freshman year of college, and then returned as a Biological Science Technician in summers of 2008 and 2009. As an environmental science major at Eastern Mennonite University (EMU), Christina initially heard about the SCA internship from Professor Jim Yoder. During the following three years of college, Christina worked with Yoder on a research project to map and analyze the spread and impacts of exotic plants in Big Meadows Swamp using geographic information systems (GIS).

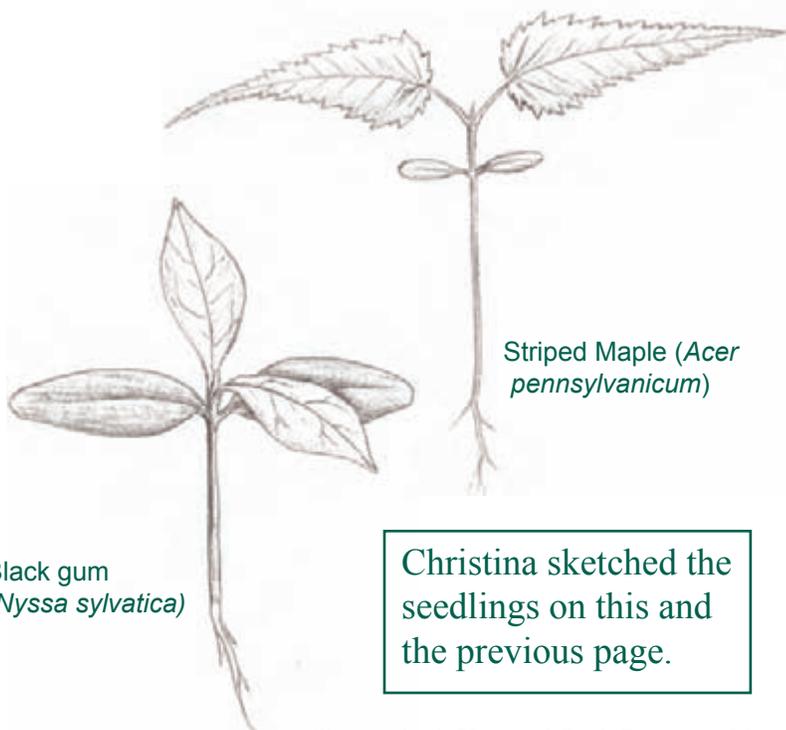
As Christina honed her plant identification skills while working on the park's forest monitoring crew, she also gained an appreciation for the place of native plants in Shenandoah valley's ecosystems, threats exotic species pose to the landscape, and her role in this dynamic interplay in the places she works and calls home. Christina's long-term goals are to continue playing an active role in the family's dairy farm operation near Singers Glen in Rockingham County, VA, a county neighboring the central district of the park. Christina envisions planting more native grass species in pastures, working to preserve forest ecosystems on the farm, and minimizing the need for non-native plantings in the agricultural system. She desires to play a long-term role in moving the farm toward more environmentally sustainable practices, including diversifying the dairy operation to include grass-fed beef and free-range laying hens.

In addition to forest monitoring work at Shenandoah, Christina assisted with rare plant monitoring and helped finalize and write proto-



cols for monitoring the park's rare high-elevation balsam fir (*Abies balsamea*) populations. Christina also gained skills in teaching and giving leadership to lower graded employees, and in map and compass orienteering. While a senior at EMU, Christina is coupling what she learned about GIS while working as a Biological Technician and in classes to assist the Admissions Department in spatial strategizing for recruitment activities.

Christina will be graduating with a Bachelor of Arts from EMU in May 2010. After a 3-week post-graduation backpacking trip in West Virginia, she hopes to return to Shenandoah to work for the summer. In the future she plans to integrate her GIS knowledge into a GIS technician position for a local government or organization, and continue working on the family farm.



Christina sketched the seedlings on this and the previous page.

Happy New Trails for Roger Dovel and CT Campbell!

Steve Bair, Back Country Wilderness and Trails Manager

Roger and CT have been two-thirds of the Shenandoah National Park Trails program's supervisory staff since 1998; Roger recently retired in December 2008 and CT retired even more recently in January 2010. Roger and CT combined for a total of more than 65 years of Shenandoah National Park (SHEN) backcountry and trails experience and institutional knowledge, adding to the recent loss of yet another more than 30 years of Trails experience with the retirement of Trails Coordinator Shawn Green in June of 2008.

These combined retirements within an 18-month period amount to the loss of nearly 100 years of backcountry and trails management knowledge and experience from the SHEN Backcountry, Wilderness and Trails program. These guys are sorely missed, but we also celebrate their retirements and the new paths they are travelling!

It's very interesting how Roger and CT's careers have fairly closely paralleled one another at SHEN. CT began his career as a temporary employee in the Maintenance Division in North District in May 1973, achieved permanent subject-to-furlough status in 1978, then full-time permanent in 1990.

CT's career in the park coincided with the development of the Piney River seasonal housing and office space "trailer court." That beehive of activity of eight house trailers which composed the Piney River residence area, District Interpretive Office, and District Ranger Office have all been removed within the past several years.

Roger began his career as a temporary employee in the Maintenance Division in the South District in May 1980, achieved permanent subject-to-

furlough status in 1985, and became a full-time permanent employee in 1990.

Both CT and Roger were employed by the Maintenance Division until 1994 when the Trails program was absorbed by the Ranger Activities Division (the Resource Management and Visitor Protection Division at the time); until that time, both CT and Roger participated in seasonal trail work tasks among other assigned duties within the Maintenance Division. It was with the transition of the park's Trails program to Ranger Activities that their duties became dedicated entirely to Trails maintenance supervision in their respective administrative Districts. By 1998 upon park-wide structural reorganization the Trails program had again transitioned to another Division, the Natural and Cultural Resources Division (the Center for Resources at the time) and CT and Roger continued to supervise their respective Trails operations in the North and South Districts. They maintained those supervisory roles until their recent retirements.

Essentially, to follow CT's and Roger's careers is a history lesson in the park's modern Trails program over the past three decades.

Both Roger and CT were involved in helping to manage a massive \$750,000 park Trails contract in 1987. They both recall the old Fire Foot Trail system which converted to the present system of horse and foot trails, along with numerous trail abandonments, in 1980. CT participated in extensive backcountry work performed to remove culverts from trails and removal of other developments from backcountry areas which were designated as wilderness in 1976. Roger recalls his active participation in the park's soft-

ball team which was organized in the 1980's and competed with the local George Washington National Forest USFS team, local community teams, and other NPS softball teams. (Roger says that SHEN won most of their games.) Of some of their most memorable park events during their careers, both CT and Roger participated in a very difficult and dangerous rescue of an injured hiker on the Appalachian Trail on Marys Rock in March 1994; the Trail was extremely ice-covered requiring dozens of rescuers roped in to trees and using Pulaski tools to chop through thick ice to get footholds to carry out the hiker in a stokes litter. CT recalls the October 10, 1979 two-foot deep snowstorm which toppled thousands of leafed trees and stranded scores of park visitors and employee residents. There was the catastrophic meteorological event of a stalled front and storm cells in the North and Central Districts in June 1995, which dumped more than 20 inches of rain in some areas in less than 24 hours causing major mountainside debris flows and had severe impact on some trails and roads areas. There were Hurricane Fran in 1996 and Tropical Storm Isabelle in 2003 which seriously damaged some trail areas. There was the "snowstorm of the century" with accumulation of nearly three feet of snow in March 1993.

Roger was extensively involved in the park's Fire program for many years and served as a crew boss, crew liaison or representative, chainsaw operator, and other duties on many fires, worked several western U.S. fires, and worked more than 30 fires in his career. He worked as a Firepro employee in the park's Fire Program in 1983. CT was also an active firefighter and served as a chainsaw op-



CT Campbell and Roger Dovel

erator on several wildfires. Both Roger and CT, along with the third Trails supervisor, Don Harvey (who hasn't yet retired, but he's close...), served as chainsaw operation and safety instructors to the Potomac Appalachian Trail Club (PATC) volunteers for several years and coordinated and conducted numerous chainsaw certification workshops. They were also instrumental in working with the PATC to develop the volunteers' confidence and skills in using equipment such as the "gripchoist" and cabling techniques along with crosscut saw and other traditional handtools skills especially important to appropriately managing trails in designated wilderness. Their years of leadership helped to bring the trails maintenance skill levels of both the park crew operation and the volunteers of the PATC to a very high standard of competence and expertise.

Presently, Roger is working seasonally with the Park's concessioner, ARAMARK, to deliver goods to the various ARA-

MARK facilities on the Skyline Drive. He's been working on remodeling his house. He and his wife recently took a "western Caribbean cruise" and they intend to enjoy more ocean cruises and do more travelling.

CT refers to himself as a "gym rat" and spends much free time staying in shape at the local gym in Luray. He puts in about 100 miles each week riding his bicycle, attends a lot of UVA sporting events (sometimes accompanied by Roger), and spends many waking hours taking his young daughter Monica to and from dance class. CT has been developing his professional fishing guide service for several years and is now dedicated to operating that business full-time (see his website, pagevalleyflyfishing.com).

Our best wishes to Roger and CT as they blaze new trails in their retirements!

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