



Resource Management 2008

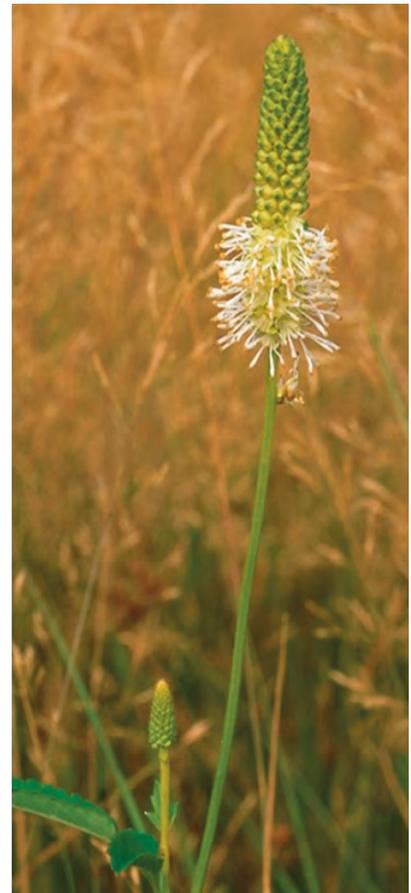
Rare Plant Community Protection at Big Meadows Swamp

By Wendy Cass

Invasive exotic plants such as garlic mustard (*Alliaria petiolata*), tree of heaven (*Ailanthus altissima*), and Japanese stilt grass (*Microstegium vimineum*) are becoming a more noticeable component of plant communities in many areas of the park. Deciding on a strategy to deal with these aggressive invaders presents a formidable challenge because controlling their spread is far more work than can be done with the time and money available. One key strategy being employed by the Park is to focus invasive plant control activities in areas that contain high value natural communities and rare plants.

One such high-value area, the Big Meadows Swamp (BMS, or Swamp), is a 20 acre wetland located between the Big Meadows Campground and Skyline drive. Officially termed a “fen”, the Big Meadows Swamp (BMS) is a wetland fed by groundwater rich in calcium and iron. The nutrient rich waters of the BMS combine with other site characteristics such as the geology, elevation, and environmental conditions to form an environment that supports the extremely rare Northern Blue Ridge Mafic Fen plant community. This vegetation community contains the highest concentration of rare plants per unit area within the entire park, and is found nowhere else in the world besides Big Meadows. As the sole stewards of this plant community, recognizing the Big Meadows swamp as a high value area for resource protection was easy. However, figuring out how best to approach the problem of invasive plants encroaching on rare plant communities was not.

The mafic fen community in the BMS is surrounded by encroaching non-native species on three sides and has areas of invasive species establishment within its interior. Three invasive herbs: Japanese stilt grass, garlic mustard, and oriental lady’s thumb (*Polygonum caespitosum*), appeared to be causing the greatest threats to the BMS plant communities (Figure 1). These species are identified as three of the most highly invasive species in Virginia. All three species spread rapidly through annual seed production, and form dense understory layers of vegetation which choke out native wildflowers and other herbaceous plants. Despite this knowledge, it was difficult to envision the full extent of each invasive plant population, and to determine how close they were to the numerous rare plant populations. Addressing these questions and embarking on the challenge of controlling the invasive plants within the Swamp has been the focus of a special project funded by the Natural Resources Preservation Program (NRPP).



Sanguisorba canadensis, one of the rare plants found in Big Meadows Swamp.



Figure 1. Three invasive herbs; Japanese stilt grass (*Microstegium vimineum*), garlic mustard (*Alliaria petolaria*), and oriental lady's thumb (*Polygonum caespitosum*), appeared to be causing the greatest threats to the BMS plant communities.

The project was undertaken cooperatively with Dr. Jim Yoder from Eastern Mennonite University, and involved using student interns and NPS technicians to map the extent of rare and invasive plant species within the wetland. Plant distribution mapping was accomplished in the summer of 2006 by placing a sampling plot at each of 1176 sampling points arranged on a 10 x 10 meter grid overlain on the wetland. The data from these plots was then used to display the proximity of rare plants and invasive plants throughout the wetland using GIS (Figure 2). More detailed maps of target invasive distributions were also created using Inverse Distance Weighted (IDW) interpolation. This technique mathematically predicts unknown data values within a landscape from limited sample points. IDW interpolation averages the values of neighboring sample points, with greater influence upon closer points. (Figure 3).

Displaying the data in these ways made it easy to see which rare plant populations were being threatened by invasive plant encroachment, but had not yet been overrun. These areas were determined to be the very highest priority for protection, because the soil had not yet been contaminated by long-lived weed seed.

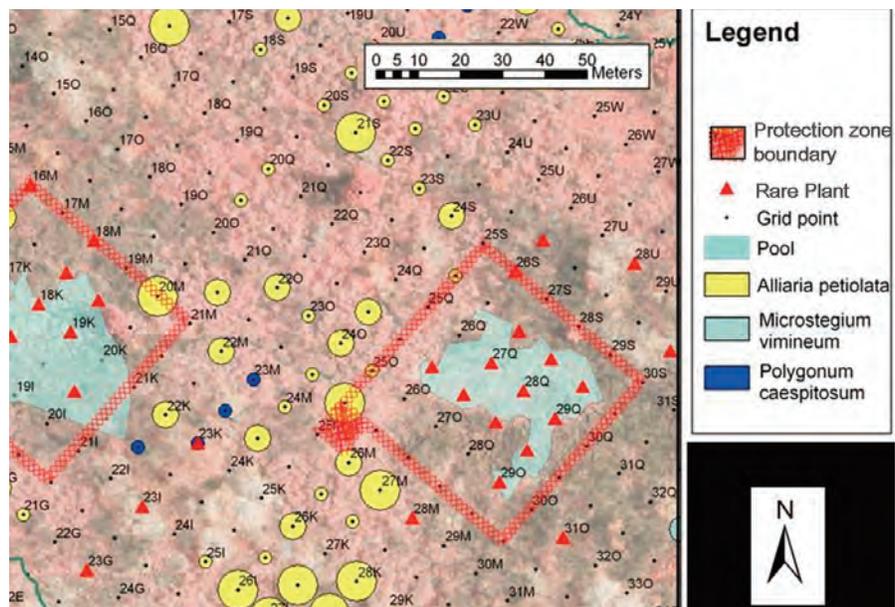


Figure 2. Proximity of rare plants and invasive plants.

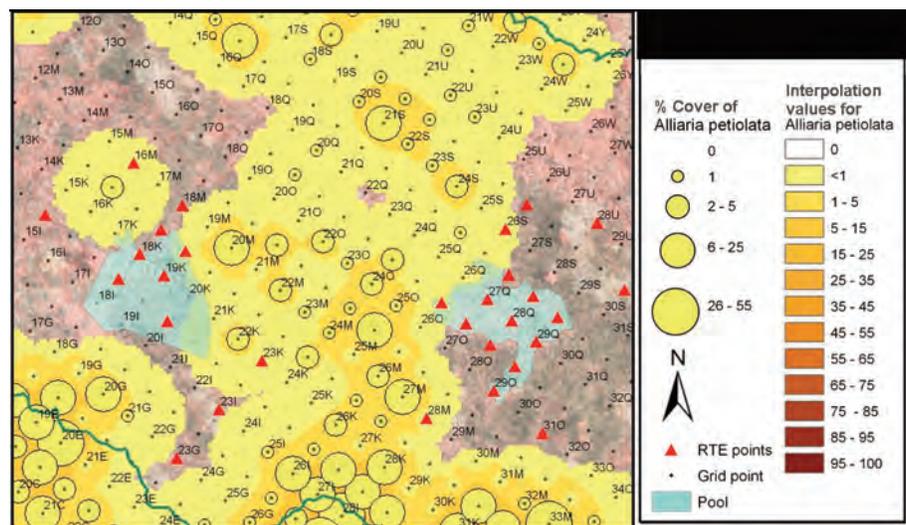


Figure 3. Inverse Distance Weighted interpolation of proximity of rare and invasive plants.

Hand-pulling of invasive plants was then begun in 2006 and continued through 2007 in an effort to protect the two most pristine concentrations of rare plants in the Swamp (Figure 4). Though highly labor intensive, hand-pulling is the preferred method of invasive plant control when working in proximity to the Swamp's rare plant communities because there is no herbicide available that will kill both the broadleaved and grass invasive species without harming the adjacent native species.

We initially hand-pulled one 10 x 10 m area of invasive plants, but when that took 60 person hours to complete, we changed our strategy. We delineated two square "protection zones" 50 m on a side, that were rich in rare plants and clear of exotics in their interior. We then meticulously cleared the three target invasive species from within a buffer around each protection zone. The buffers were two meters wide the first time around, then were increased to four meters wide the second time around, continuing on until they were 20 meters wide on all sides of the two protection zones.

2008 work will focus on re-sampling all 1176 points within the Swamp to examine the rate of spread of invasive species, and work to re-check and expand areas previously cleared of invasive species around the two targeted protection zones. Park staff



Figure 4. Hand-pulling invasive plants.

and Dr. Yoder and his student interns plan to continue working cooperatively to monitor invasive species and protect the rare plant populations within the Big Meadows Swamp over the long-term. This type of sustained effort is what will be required to maintain the progress that has been made, and continue the protection of this valuable plant community.

Wendy Cass is a Botanist.

Park Staff Study Ways to Restore Native Plant Communities Through the Albright-Wirth Professional Development Program/Grant

By Jake Hughes and Wendy Cass

Vegetation restoration projects typically aim to establish and/or maintain native plant communities. Unfortunately, this apparently simple goal is often very difficult to reach. The revegetation of a recently disturbed site is often plagued by problems with invasive nonnative weeds overrunning new plantings, and requires repeated control with herbicide or other management tools. Similar difficulties are encountered when attempting to restore a native plant community by removing an invasive nonnative plant from a specific location. In such cases, preventing re-establishment of the nonnative species frequently becomes a never-ending

task.

But can these situations be avoided, or at least improved upon? Are there approaches to plant community restoration that make a site more resistant to the establishment (or reestablishment) of invasive nonnative weeds and, ultimately, more likely to succeed? Answers to these and related questions aren't readily available to the practicing resource manager. Like a lot of the information in the young, developing field of restoration ecology, many facts are buried in basic and applied scientific journals, unpublished gray literature and the minds of practitioners. Finding the time and funds to comb through university libraries and make dozens of

phone calls is not so easy.

In an attempt to capture some free time to focus on these issues, we applied for and received an Albright-Wirth employee development grant. Our proposal was to pursue knowledge about vegetation restoration approaches and techniques, under the guidance of Greg Eckert from the Natural Resources Program Center in Fort Collins Colorado. In addition to ourselves, our project working group included Joyce Lapp, restoration ecologist at Glacier National Park, and Cheryl Decker, botanist at Zion National Park. The goal of our three-week detail to Fort Collins was to acquire information useful in restoration work in our home parks, and to syn-

thesize and present what we learned in a format accessible to other land managers.

Following receipt of our grant, we spent several weeks at Shenandoah National Park (SHEN) planning and compiling lists of literature to review and experts to contact. Current NPS restoration projects were reviewed, and a questionnaire was created to guide phone interviews with restoration practitioners.

Once in Fort Collins, we went to work. We read and took notes on 60 journal articles, revegetation manuals and other pieces of literature and interviewed 32 restoration professionals including practitioners and researchers. We also visited Rocky Mountain National Park to see a vegetation restoration operation first hand at a park not too much larger than Shenandoah.

As we progressed through our review of the literature it became clear that the volume of available information was formidable. A great deal of research in recent years has been devoted to the maintenance and restoration of natural vegetation impacted by invasive exotic species. The relationship between species richness and/or diversity of a community and its susceptibility to invasion is a popular topic. The role of elevated levels of soil nutrients, particularly nitrogen, in favoring weeds over native species is another. Applied research exists examining the effectiveness of planting native species of the same ecological/community function to compete with an undesirable nonnative or using high seeding rates of native species to overcome seed limitations.

However, much of the information was specific to particular areas of the country (mainly in the western US), and general guidelines were difficult to discern. Much of the research that has been done has little direct relevance to the practitioner. For example, seeding native species at a rate of a few thousand seed per square meter,



The project working group, from left: Wendy Cass, Jake Hughes, Greg Eckert, Joyce Lapp and Cheryl Decker.

rather than the standard few hundred, might help to suppress an invasive species but it will probably be prohibitively expensive for a land manager to implement. Addition of carbon sources such as sawdust or table sugar to stimulate bacterial activity that immobilizes nitrogen has shown some promise at reducing invasive species in western communities, but at a cost of several to tens of thousands of dollars per hectare.

Our interviews allowed us to explore information with more practical relevance to those of us working in the East. However, while there were recurring themes in our discussions, solutions were hard to come by. Frustrations with the same invasive nonnatives (e.g. stiltgrass (*Microstegium vimineum*)) were mentioned repeatedly. Difficulty in finding the time to monitor was another common theme. Managers have been more successful at establishing native grassland vegetation than in restoring forest understory communities dominated by invasive nonnative plants.

At first, the relative lack of material with direct relevance to SHEN

was a bit disappointing. It was initially frustrating to not find many concrete prescriptions for restoring native vegetation where invasive nonnatives are present or threatening. But when one began to think about the possibilities available at SHEN, it became much more exciting and inspirational. Certainly, if Rocky Mountain National Park can propagate locally collected native plants to protect the genetic integrity of their populations, we can too (see next article). And many approaches were learned that, while not necessarily fully proven, may be worth trying here at SHEN.

Despite the western emphasis of the materials we reviewed, and the lack of any concrete prescriptions offering a solution to the problem at hand, we did produce a number of products as a result of our work. A restoration framework was drafted. This document outlines the steps to be considered when undertaking a vegetation restoration project. Specific information gleaned from the literature review and interviews was then incorporated into the framework. Additional products included an

annotated bibliography of 135 restoration references, and a list of websites providing restoration

resources. Greg Eckert is currently incorporating our products into a Service-wide guide for vegetation

restoration of sites affected or threatened by invasive nonnative plants.

Jake Hughes is a Biological Science Technician; Wendy Cass is a Botanist.

Native Plant Restoration Program Expanded

By Wendy Cass

There exist various justifications for using not just native, but locally native species, in restoration projects. Species from distant populations may not be adapted to conditions at the project site, resulting in failure or poor performance of the planting. A potentially more serious issue is that of the introduction of genes from far removed populations into populations near the restoration site. Not only can maladapted genes be introduced into a population, but evidence suggests that in some cases the combination of genes from different populations can result in breakdown of gene combinations that have developed over time. Both situations can potentially result in a situation known as outbreeding depression, where the offspring of crosses between individuals from different populations perform poorly (are less 'fit', to use the terminology of ecological genetics), relative to those produced from mating between individuals of the same population (Falk et al 2006). The importance of this issue in ecological restoration is still being studied and debated. However, National Park Service policy directs that "restoration of native plants and animals will be accomplished using organisms taken from populations as closely related genetically and ecologically as possible to park populations, preferably from similar habitats in adjacent or local areas" (NPS 2006).

The use of locally collected plant material has a long, if not consistent, history in SHEN.

The Civilian Conservation Corps collected seed in the area for propagation and eventual planting in the Park (Engle date unknown). More recently, through an agreement with the USDA Natural Resources Conservation Service, materials were collected in the Park, propagated and planted at construction sites in the early 1990's. Resource management staff occasionally 'salvage' native plant materials from the Air Quality site at Big Meadows for use in revegetation projects in the area.

In 2007, an attempt was made to increase the use of locally native plants in restoration projects in SHEN. The previous fall, seed was collected for several native grass species in the vicinity of Hogwallow Flats Overlook. Using

local genetic stock of native grasses collected in the Park may be especially important, as populations typically exist as widely scattered patches along roadsides or at isolated rock outcrops. Over the winter and early spring months, hundreds of seedlings were produced (in clear plastic salad containers on a windowsill!) and grown into 'plugs', ready-to-plant seedlings with a deep, narrow root system. In summer, the botany crew planted 600 of these seedlings below the overlook. By fall 2007, survival of these plantings was near 100%, and many individuals were flowering, less than 1 year after being collected as seed (see photo). Over time, these and additional plants will make it easier to control the invasive mile-a-minute vine at the site, and to manage the vista with prescribed fire.

Hopefully, in years to come, we

Broomsedge (*Andropogon virginicus*) and little bluestem (*Schizachyrium scoparium*) plugs at Hogwallow Flats Overlook, four months after planting.



can expand on these efforts. To that end, a small, temporary greenhouse was purchased for propagation of park-collected species. Seed of twenty plant species were collected in 2007 for propagation. A pickup truck-mountable hydroseeder, a device that can be used to spray a slurry of water, mulch and seed, was also purchased. This should make it possible to establish vegetation from seed on steep slopes and in areas where soil disturbance should be avoided. And to guide this work, a

'revegetation manual' specific to the Park is under preparation.

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Wendy Cass is a Botanist.



Proud volunteers participated in National Public Lands Day, one of Shenandoah National Park's short-term volunteer events. The next National Public Lands Day event is set for September 27, 2008.

Volunteers Make a Wonderful Difference: Invasive Plant Management is Greatly Aided with the Help of Short-term Volunteers at Shenandoah National Park

By James Åkerson

In its three-year existence, the Park's Short-term Volunteer Program has helped the Park manage sites that otherwise wouldn't have been treated and protected. "Volunteers are an essential ingredient in getting things done in these days of federal budget cutbacks," says Chas Cartwright, Park Superintendent.

Shenandoah National Park's volunteer program had three phases of development. The first, August 2004 to March 2005, was a time for setting up the organization. The Park obtained a joint funding grant from the National Park Foundation and Tauck Foundation. Staff created the program structure with cooperation between otherwise distinct divisions. The second phase,

April 2005 to December 2005, was a time for operations planning and build-up. They hired a Special Event Planner and the first Short-term Volunteer Leader to develop the volunteer contacts database and make a wide variety of public contacts. They set up volunteer events, created an initial draft strategic plan for the program, and developed several public relations

tools. The third phase, January 2006 to present, includes full operations.

To date there have been 70 volunteer events. At any given time we've had 14.1 volunteers, ranging from 1-to-128 people. The usual commitment that volunteers gave to the Park was 2.1 hours per event. The average area benefited was 1.1 acre per event. Participation by children under the age of 18 was 41%. Volunteers controlled Oriental bittersweet, garlic mustard, Oriental lady's thumb, Japanese stiltgrass, autumn olive, privets, bush honeysuckle, and tree of heaven on 76 gross infested acres. Without their help, we could not have protected those areas.

In the course of program development, we've cultivated sponsorships from many quarters. From the corporate side they include ARA-MARK, Inc., BASF, Inc., Dow Agro Sciences, Inc., Invasive Plant Control, Inc., Costco, McKee Foods Corporation, and Wal-Mart. From the non-profit sector sponsorships include Shenandoah National Park Association, National Park Conservation Association, National Public Lands Day, Leave No Trace, and National Audubon Society. Sponsorship took the form of direct funding and in-kind items such as snacks (majority).

We created two special annual events to attract the general public. They introduce the public to the overall volunteer program. The first was Save the Meadow! It is held the weekend after Mother's Day in May. Encouragingly, the second year attendance was double that of the first. The second is National Public Lands Day which is held the last Saturday of September. The event is part of a larger national program. As our host site becomes better known we expect it to grow modestly each year.

The mainstay of the short-term volunteer program is the Group



The National Audubon Society was the first group of 2007 for the Shenandoah National Park Short-term Volunteer Program, March 10, 2007. Included are a portion of that group and James Åkerson, NPS-Ecologist.

Event. Groups come from schools, colleges, churches, camps, non-profit interest groups, civic organizations, and families. The volunteer database is used to make contacts to set up events by appointment. Saturdays are the typical group event days but other mid-week days also take place for elementary and high schools.

A very high priority of the program is in making friends for the Park. Friendships and public support are at the core of how Shenandoah National Park can be successful in the future. The program made friends among organizations, families, and individuals. In April 2007, one volunteer said, "Feels like even small things can make a difference." That is so true. In March another said, "I had a very nice time and look forward to volunteering again in the future." The volunteer program is making a difference in the way the Park is able to address their resource management challenges. We hope you'll join us in 2008.



Volunteers at the Save the Meadow! event control highly invasive garlic mustard and yellow rocket, May 19-20, 2007. When these plants have developing flowers and seeds, they must be bagged and hauled away because the seeds will become viable. Eighty (80) garbage bags of pulled invasive plants were gathered during the two-day event! The next Save the Meadow! event is set for May 17-18, 2008.

James Åkerson is Director of the Mid-Atlantic Exotic Plant Management Team.

Didymo and Viral Hemorrhagic Septicemia-- Aquatic Invasives Could be in a Stream Near You!

By David Demarest

We all know the effects exotic insects and plants have had on our forests in Shenandoah National Park. What would happen to our streams if an invasive algae utilized all of the stream bed to grow and displaced most of the aquatic insects that depend on that habitat to live?

What about an exotic fish virus that has been blamed for massive fish kills in the Great Lakes?

Didymosphenia geminata, commonly referred to as Didymo or "rock snot" is showing up in coldwater streams in Virginia. It is an invasive alga that covers the stream bottom in a jelly type mass. So far it has been reported in the Smith and Jackson Rivers in Virginia. Both are tailwater trout fisheries and the algae can be transported on fishing equipment, clothes, and waders. Both Trout Unlimited and The Federation of Fly Fishers are actively educating their members on identification and ways to limit the spread of this algae to their "home" streams. Recommended gear cleansing for Didymo is drying all gear and waiting 48 hours after it is dry to the touch before using in another freshwater system. Another method that is recommended is a one minute soak in either 2% by volume of house-



hold bleach solution or a 5% by volume of salt solution.

Viral Hemorrhagic Septicemia is a coldwater fish disease that has been blamed for huge fish kills in the Great Lakes and St. Lawrence Seaway areas in the past two years. Many fishermen travel from our region to that area for the

salmon and steelhead spawning runs. Like Didymo, it can be transmitted by wet fishing gear, though a soak in 1% household bleach solution is enough to kill it. This disease has not been seen outside of the Great Lakes region but it seems to be only a matter of time.

While those with boats tend to think about washing their boats because of the exotics hydrilla and zebra mussels, few fishermen think about the consequences of transporting exotics on their pants or waders after wading. The time to act is now. Once either one gets here, there is no way to remove it from

the aquatic system. The key is to be vigilant! If you use your gear in streams outside the park, clean or dry it well before entering a Park stream! Better yet, clean or dry your equipment between every outing!

David Demarest is Biological Technician.

Web Resources:

<http://www.epa.gov/region8/water/didymosphenia/>

http://www.aphis.usda.gov/vs/ceah/cei/taf/emergingdiseasenotice_files/vhsgreatlakes.htm

http://www.aphis.usda.gov/publications/animal_health/content/printable_version/ia_VHS_Great_Lakes.pdf

The Return of the Gypsy Moth

By Rolf Gubler

Background

The European gypsy moth (*Lymantria dispar*) was introduced into the United States in 1869. Since then, it has been a significant pest to hardwoods in the eastern U.S. and parts of the Midwest.

The gypsy moth arrived at Shenandoah National Park in 1981. It was determined that 85% of the park's forest cover contained trees which were preferred food of gypsy moth (GM) larvae. Serious gypsy moth defoliation began in the northern part of the Park in 1986. For a 10-year period (1986-1995), park GM suppression activities included biological and chemical controls (the majority of aerial spraying consisted of using *Bacillus thuringiensis* (B.t.) and Diflubenzuron). During this time, many oaks were lost due to gypsy moth-related mortality. The added stress of drought, in the late 1980s, caused even higher mortality, especially in the northern half of the park. In some parts of the park, oak mortality was so pronounced that over 50% of the forest overstory was killed (e.g. dry chestnut oak sites).

The park GM population collapsed between 1995-1996, due to the increased activity of the fungus, *Entomophaga maimaiga*. This fungus was first introduced in the early 1900's to control the gypsy moth. In 1990, it reappeared or was inadvertently reintroduced. By 1996, this fungus had established large populations in the environment and as a result, there were virtually no areas in the park (or Virginia) that experienced GM defoliation. Since 1996, the fungus has been effective at keeping GM populations at low or endemic levels with one spot outbreak year in 2002 (3164 park acres). However, in 2007, a dry spring created conditions unfavorable for *Entomophaga*. As a result, the park experienced the highest gypsy moth defoliation since 1995. Over 7300 acres of trees were defoliated in the park.

2007 Survey Results and Proposed Treatment for 2008

In mid June, Natural Resources staff completed a Gypsy Moth Defoliation Assessment along portions of Skyline Drive in North District and several park developed areas. Areas of heavy defoliation included milepost 16.5 to milepost 28.5 (especially mileposts 23-27, mileposts 18-20, parts of Mathews Arm Campground, and Upper Keyser Run Fire Road). Other areas of heavy spot defoliation included the Mary's Rock Tunnel area, the Pinnacles area, and the Byrd Visitor Center area. Aerial reconnaissance and mapping conducted by the Virginia Department of Forestry (VDOF) staff in July verified the park's ground survey results. The mapping also determined that there were over 7300 park acres defoliated in 2007 (and over 73,400 acres statewide).

In June, staff noted sporadic GM caterpillar mortality in the North District. It was determined to be the nucleopolyhedrosis virus (*Borralinivirus reprimens*) or NPV. NPV can kill enough gypsy moth caterpillars when populations are high to eventually end an outbreak. Caterpillars infected with NPV die in an inverted V position (see photo below). The activity of NPV is specific in that it only kills gypsy moth caterpillars. It is noteworthy to add that staff did not see any signs of *Entomophaga* fungus mortality during these surveys.

In September, U.S. Forest Service (USFS) staff gathered gypsy moth egg mass count data from mileposts 12-30 (the area of highest defoliation along Skyline Drive). Within the milepost 16.5-28.5 section, staff calculated that the average gypsy moth egg mass density was over 2800 egg masses per acre – this is well above the gypsy moth spray threshold of 500 per acre. Using this data, USFS staff produced GM spray block maps (with collaboration with VDOF

Gypsy Moth Lifecycle

Female gypsy moths lay eggs as fuzzy, tan egg masses in mid-summer. Late, the following April, larvae (photo at right) emerge from the eggs and climb to the upper reaches of trees. They drop on silk-like treads and are dispersed by the wind. Feeding begins. Gypsy moths prefer the white oak group but will feed on approximately 400 species of plants and trees. After feeding and passing through several larval stages, the caterpillars will pupate in June and July. After two weeks they will emerge as adult moths. Shortly thereafter, the moths mate. Once the flightless female has laid her eggs she will die. Male moths live about one week after emerging from the pupae.



A victim of NPV

and park staff). The spray blocks include a section from mileposts 16.5 - 28.5 (600 ft. on both sides of the Drive) and Mathews Arm Campground. In September, park staff submitted a USFS Forest Pest Management funding proposal for 2500 acres of GM treatments in 2008. Pending approval, gypsy moth spraying will take place in May 2008 and will include aerial *Bacillus thuringiensis* (Bt) treatments. This treatment proposal supports the Park's gypsy moth suppression goals of protecting sensitive historic areas (e.g. historic overlooks), and providing visitor safety along Skyline Drive and other developed areas. It is recognized that these suppression goals will not eliminate gypsy moths from the park at large, but will minimize their impacts in those target locations.

Outlook for Spring 2008

Since there was moderate to heavy gypsy moth egg mass production in many parts of North District and isolated areas of Central District in 2007, there is a strong likelihood that we will see GM defoliation again in areas surrounding 2007 infestation points. The main factor that will dictate how heavy and widespread that defoliation will be is how much significant rain/moisture we receive in spring 2008. If we receive

average or better spring moisture throughout the infested areas, the *Entomophaga* fungus will likely kill many of the GM caterpillars and pupae in May-June. That would lead to a collapse in the GM population – perhaps back down to endemic levels. However, if this does not occur, we will likely see heavy and more widespread defoliation in 2008. With repeated dry springs, we could even see spotty oak mortality in areas that have been repeatedly defoliated and stressed by drought.

Future Outlook

Although natural resource impacts from gypsy moths in the park were many, the gypsy moth does not appear to have caused irreparable harm to the park's forest. In some ways, defoliation and tree mortality contributed to the diversification of species and age classes within the forest and may have left it better able to withstand future stresses. The fairly reliable presence of the *Entomophaga* fungus will continue to act as an effective regulator of gypsy populations at both low and high densities. In the park, we will occasionally see gypsy moth populations continue to boom and bust – just not at the same scale as we saw in the late 80s to mid 90s.

Rolf Gubler is a Biologist.



Gypsy Moth caterpillars

Bacillus thuringiensis is a naturally occurring bacterial disease of insects that has been formulated into an effective insecticide of defoliating caterpillars. Bt acts by producing proteins that react with the cells of the gut lining of susceptible insects. These Bt proteins paralyze the digestive system, and the infected insect stops feeding within hours. The most commonly used strain of Bt (kurstaki strain) kills only leaf and needle-feeding caterpillars. The most common use of Bt involves the kurstaki strain used to control caterpillars on vegetable crops. Bt is essentially nontoxic to people, pets and wildlife.

NCR Field Crew Tick Logs and Preventative Measures

By Shawn Green

The Natural and Cultural Resources field crews were given money in spring 2007 by the Park Safety Committee to purchase tick proof clothing in an attempt to reduce the number of tick bites received by employees. The work group wanted to assess the effectiveness of the clothing and see if it would meet park needs. There were a total of 21 employees and volunteers who filled out a daily tick log to address what preventative measures were used, how many embedded ticks were found, and where those bites were located. A daily tick check was not considered to be a preventative measure, but an end of the day necessity.

An attempt was made to require employees to wear either Bug Skinz or Rhino Skins one of four days a week. This quickly fell apart once hot weather set in. On days employees were not wearing bug proof clothing they were expected to wear Permanone or Deet. Many people do not like to use chemicals, so a few employees did not do this either.

Rhino Skin, Bug Skinz, and Heat Gear (which trails used) are all hot in 85+ degree temps with 65%+ humidity. Their use could lead to heat stress/exhaustion on some days. Rhino Skin, Bug Skinz, and Heat Gear users all reported needing to drink more water using this clothing under the Park Service uniform. The wicking nature of the material could make you extremely cold if caught in a storm or on a cooler day. The key with the clothing is that it must fit very tightly.

If not, ticks can crawl anywhere to embed.

These three tight fitting garments did drastically reduce WHERE the ticks were embedded, making finding them much easier. These areas were wrists (arms for Heat Gear), neck, waist, and ankles with very few that actually crawled further than the tight cuffs. Sprays didn't seem to work too well, except possibly after the seed ticks hatched (around July 20th this year). Very few ticks were found embedded on heads or in hair.

It was found that what employees did with their clothing at home was just as important. You can't just throw them in the hamper and not expect ticks to crawl out and all over the room. The botanist bought clothes bags for the crew, and they had excellent containment success at home spraying the bag once with Permanone, as you would your clothes, and putting work cloths in it immediately after taking them off. Prior to that, ticks were routinely found crawling in all employee homes.

Spray deterrents were harder to track. Much depends on how often Permanone is used to treat your clothing, or Deet is applied during the day. We also observed two individuals applying Permanone directly to the skin, which was promptly stopped per label instructions. Persons using Permanone after seed ticks hatched seemed to not pick up as many seed ticks as those that did not treat their clothing. Deet (Deep Woods Off, Cutter, and Ultrathon) did not seem to make much of a difference. It was noted that 3M's

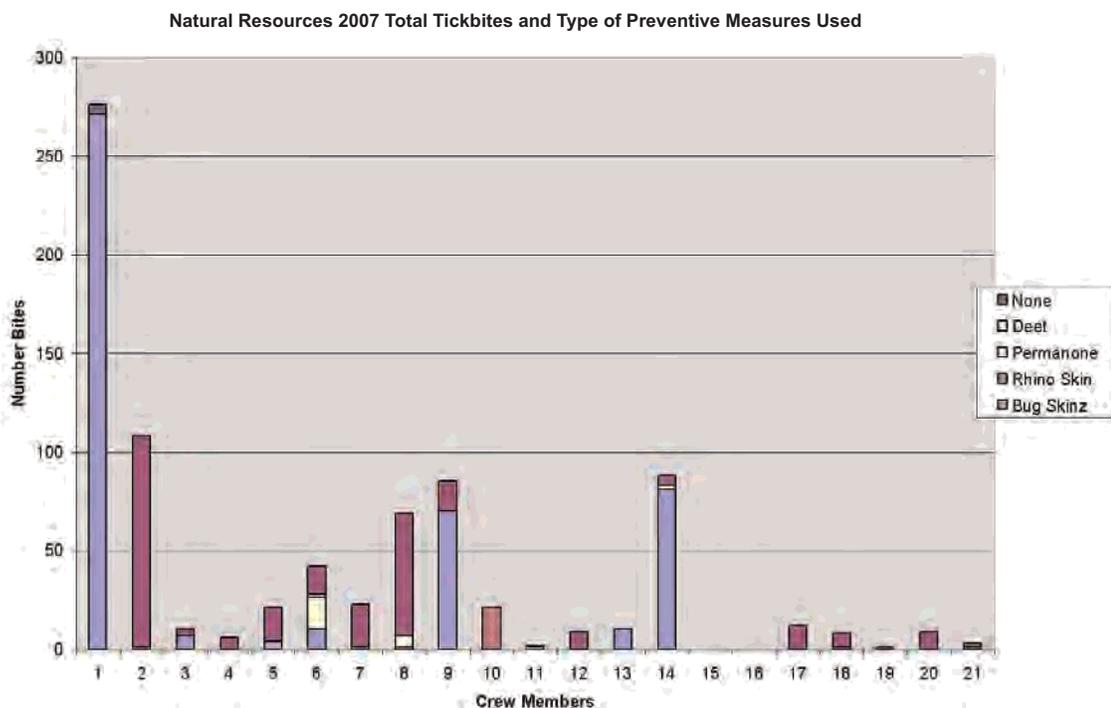


Figure 1. The number of all embedded ticks in relation to the deterrent

Ultrathon bug repellent was better at keeping the gnats away than Deep Woods Off, though not for more than about 2 hours.

Figure 1 depicts the number of all embedded ticks in relation to the deterrent used. The 21 employees documented 804 embedded ticks from the end of May 2007 to the end of September 2007. The second figure is the number of "seed" or 1st instar ticks found embedded and is split from the first to show that seed ticks account for a large percentage of the total number of ticks and may be less cause for concern. Seed ticks accounted for 569 of the 804 total bites. Two employees reported no tick bites, and two of the other 19 employees were treated for symptoms of Lyme Disease.

Another factor to consider is some people just seem to attract more ticks than others. For this reason one employee chose to wear Bug Skinz every day. There was one day he found it was too hot to hike out with the tops on and noticed it was considerably cooler without them. He also noted that his at work water consumption went from about 2 liters without Bug Skinz to 3.5-4 liters per 10 hour day wearing Bug Skinz. With 276 total embeds there were NONE that were further than 2" inside any cuff, and after starting to use the clothes bag he nor his dog picked up any ticks in his house. Using Bug Skinz he found that the time to check for ticks was greatly reduced upon arriving home, though it does not negate the need for a full body check. On at least two occasions,

he remembers brushing off over 40 adult crawling ticks in one day and is in the habit of looking for them each time he stops work. He noted that anytime you find a tick and tell your coworkers they start to look on themselves even if they had just looked over their clothing.

So, it appears that the short answer is this. There is no way to keep ticks off of you, but by wearing "tick proof" clothing you can reduce the amount of time it takes to check your body after changing out of uniform. Using this clothing seems to reduce the risk of missing ticks during your body check since they do not appear to be able to get to body parts you cannot see well. At certain times of the year (early season), you may be able to either not use, or reduce the amount of chemicals you use on your clothing. From the apparent reduction in the number of seed ticks found by crewmembers using Permanone on their clothing, it may be a good practice for employees to use this product after mid July. However, Permanone leaches out of clothing with water, and is poisonous to aquatic life, so this is not a good option for those working in and around water. Even office folks can get ticks as shown from the amount of ticks we picked up or saw in our homes from residual crawlers coming off of field personnel clothing. CHECK EVERY EVENING AT HOME, even in winter.

Shawn Green is a Park Trails Coordinator.

Total Number of Tick Bites vs. Early Instar or "Seed" Ticks

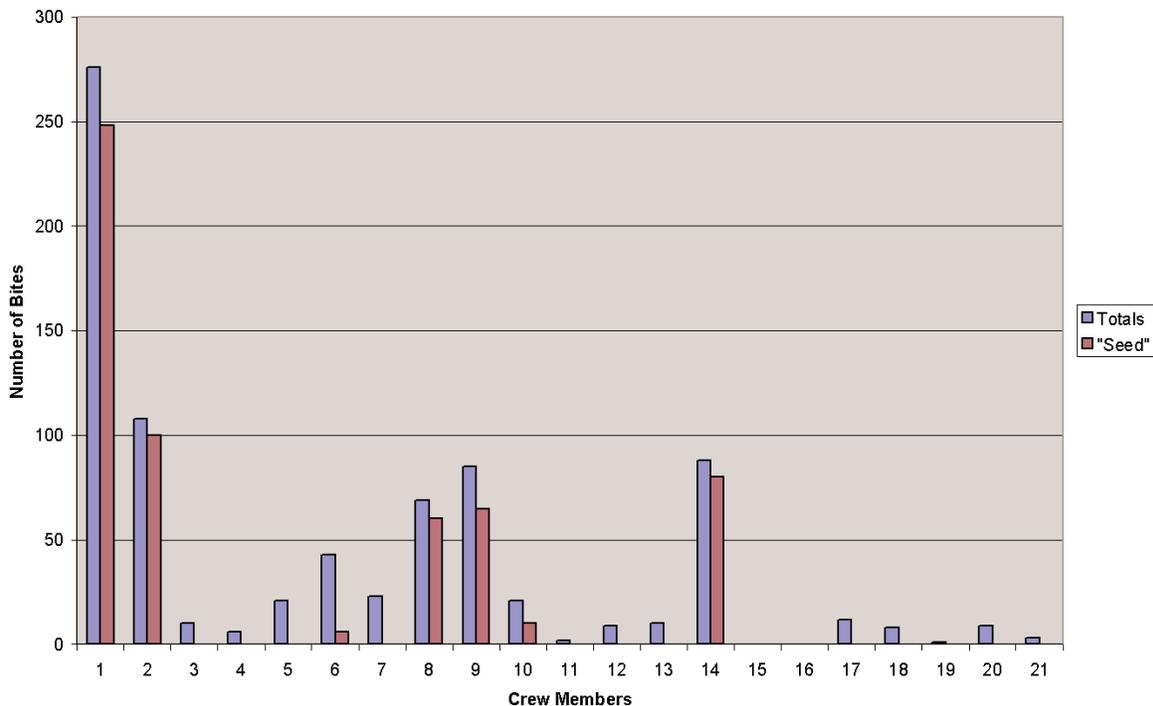


Figure 2. The number of embedded "seed" ticks in relation to the deterrent used.



Rock Outcrop Management Project Environmental Assessment Nears Completion

By Wendy Cass and Steve Bair

Park staff continue to forge ahead with the Rock Outcrop Management Project (ROMP) Environmental Assessment (EA) and Management Plan. The Park halted the ROMP EA public review process late last year due to technical problems with the September 2007 version of the document. Currently, we are working closely with a specialist in the regional office to revise and re-issue the EA, and anticipate having a draft available for public review by June 2008. The information contained in the final document will be very similar to that in the September 2007 version, but it will be packaged a bit differently, and will have more elaborate National Environmental Policy Act (NEPA) documentation.

Meanwhile, we are proceeding with some activities driven by ROMP inventory results and public involvement. The Park is working with local Master Naturalist chapters to develop a volunteer Adopt-an-Outcrop program to help monitor and protect rock outcrop resources. Also, in cooperation with Teamlink/Shenandoah Mountain Guides and the Potomac Appalachian Trail Club, we are developing the Old Rag Mountain Steward program utilizing well-trained volunteers to contact Old Rag visitors on weekends to educate visitors about recreational impacts to resources and Leave No Trace practices, provide information about Old Rag and the park, and provide assistance and initial response for injured or lost hikers.

Wendy Cass is a Botanist; Steve Bair is a Wilderness and Trails Manager.



2007 a Busy Year for Nuisance Wildlife

By Gordon Olson

2007 proved to be one of the most active years in recent history for park biologists in terms of dealing with human-wildlife interactions. A total of eight black bears were captured and relocated. Captures occurred in Matthews Arm Campground, at Franklin Cliffs, and at Lewis Mountain. In addition, repeated responses were made to Big Meadows Campground to deal with numerous striped skunks and eight feral goats were removed from the Stony Man summit. Fortunately, this year fisheries monitoring was not occurring. This freed park staff to respond to these incidents as needed.

Recognizing that response to these situations would have not been possible had the fisheries monitoring program been in operation, arrangements have been made to hire two seasonal employees in 2008 who will be assigned primary responsibility for responding to wildlife incidents. These employees will complete a variety of tasks such as managing visitors at wildlife jams along Skyline Drive, provide hazing and aversive conditioning to prevent or deal with animals that have lost their fear of people, providing employee and visitor education on wildlife interactions, relocation of nuisance animals, and monitoring food storage and trash removal efforts. While these tasks are anticipated to keep the Technicians busy, they will also assist with efforts such as the sampling that is ongoing for Chronic Wasting Disease monitoring.

Gordon Olson is a Supervisory Biologist.

Significant Progress Made on Cultural Landscape Inventories

By Jeff Killion

In the summer of 2006, park cultural resource managers initiated plans to complete Cultural Landscape Inventories (CLIs) for Skyland and the segment of the Appalachian Trail (AT) that passes through the park. A CLI is the baseline inventory of cultural landscapes that evaluates historical significance based on the criteria established by the National Register of Historic Places. The project was completed by the Olmsted Center for Landscape Preservation, a program of the Northeast Region of the National Park Service, and by students and staff from the State University of New York's College of Environmental Science and Forestry at Syracuse.

For six weeks during the summer of 2006, the time-consuming field-work for the CLIs was completed using GIS and manual inventory methods. On the AT, the students inventoried over 1,800 landscape features, including nearly three miles of stone retaining walls, hundreds of trail markers, and remnant orchards and forest plantations, while also encountering twenty-three bears. The team discovered that although the trail may have shifted a bit in a few places, it remains largely intact. Stone edging still defines the trail for miles, and the Civilian Conservation Corps' massive stone retaining walls are mostly in excellent shape. Students researched archival material and were able to match a number of historic photos with their current locations, such as a mid-1930s photo of the trail at Mary's Rock and its match from July 2006. At Skyland, historic and contemporary buildings, structures, circulation features, views and vistas, and small-scale features were documented and evaluated.

The data gathered over the course of the field school, as well as narrative histories and an evaluation of historic integrity, were packaged into reports and added to the NPS Cultural Landscapes Inventory database in 2007. Another field school is planned for the summer of 2008 to work on five more CLIs at Shenandoah: Big Meadows, Headquarters, Dickey Ridge, South River Picnic Grounds, and Rapidan Camp.

Jeff Killion is a Historical Landscape Architect.



St. Mary's Rock, Appalachian Trail, 1930s.



St. Mary's Rock today.

American Electric Power Settlement

By Gordon Olson

Following is a press release that the Environmental Protection Agency released last fall:

"(Washington, D.C. - Oct. 9, 2007) American Electric Power has agreed to cut 813,000 tons of air pollutants annually at an estimated cost of more than \$4.6 billion, pay a \$15 million penalty, and spend \$60 million on projects to mitigate the adverse effects of its past excess emissions. The record settlement

was announced today by the Department of Justice and the Environmental Protection Agency. This is the single largest environmental enforcement settlement in history by several measures. For example, it is the largest settlement in terms of the value of injunctive relief, and will result in the largest amount of emission reduction from stationary sources, such as power plants and factories.

"Today's settlement will save \$32 billion in health costs per year

for Americans," said Granta Nakayama, assistant administrator for EPA's enforcement and compliance assurance program. "Less air pollution from power plants means fewer cases of asthma and other respiratory illnesses."

The AEP settlement will have an unprecedented impact on air quality in the eastern United States," said Ronald J. Tenpas, acting assistant attorney general for the Justice Department's Environment and Natural Resources Divi-

sion. "This settlement is a major victory for the environment and public health, and it demonstrates our continued commitment to vigorous enforcement of the Clean Air Act."

An unprecedented coalition of eight states and 13 citizen groups joined the United States government in today's settlement. The agreement imposes caps on emissions of pollutants from 16 plants located in five states. The facilities are located in Moundsville (2 facilities), St. Albans, Glasgow, and New Haven (2 facilities), W.Va; Louisa, Ky; Glen Lyn and Carbo, Va.; Brilliant, Conesville, Cheshire, Lockburne, and Beverly, Ohio; and Rockport and Lawrenceburg, Ind.

The AEP will install pollution control equipment to reduce and cap sulfur dioxide and nitrogen oxide emissions by more than 813,000 tons per year when fully implemented. By installing these pollution control measures, the plants will emit 79 percent less sulfur dioxide and 69 percent less nitrogen oxides, as compared to 2006 emissions.

The settlement resolves a lawsuit filed against AEP in 1999, alleging the company violated the New Source Review requirements of the Clean Air Act.

The company will spend an additional \$60 million to finance and conduct projects to mitigate the impact of past emissions. Of the total, \$24 million for these projects will be allocated among the states that joined the settlement. The remaining \$36 million will be spent on mitigation projects identified in the settlement agreement.

The following eight states joined as plaintiffs in the case: New York, New Jersey, Massachusetts, Vermont, Connecticut, New Hampshire, Maryland, and Rhode Island. The following citizen groups also joined the settlement as plaintiffs: Natural Resources Defense Council, National Wildlife Federation, Sierra Club, United States Public Interest Research Group, Izaak Walton League of America, Ohio Citizen Action, Citizens Action Coalition of Indiana, Hoosier Environmental Council, Ohio Valley Environmental Coalition, West Virginia Environmental Council, Clean Air Council, Indiana Wildlife Federation, and the League of Ohio Sportsmen.

So what does this have to do with Shenandoah National Park? First, and foremost, the emissions reductions could have an impact on the air quality at the park. Cer-

tainly this is an important step in the direction of protecting park resources. Second, a portion of the settlement funds are targeted to come to the National Park Service (\$2M) and be shared amongst three parks – Shenandoah, Great Smoky Mountains, and Mammoth Cave. Language within the Consent Decree (the legal document that establishes the agreement) states that funds are to be used for projects aimed at "the restoration of land, watersheds, vegetation and forests ... designed to improve ecosystem health and mitigate harmful effects from air pollution. This may include reforestation and restoration of native species ..." Last fall, representatives from each of these parks and the Air Resources Division met in Denver to begin discussions about how to expend these funds. No final decisions have been made.

This represents another exciting opportunity much like the VEPCO Settlement of a number of years ago. Stay tuned for updates in future issues of the newsletter.

Gordon Olson is a Supervisory Biologist.

Ambient Air Quality Data from Big Meadows

| Shenandoah National Park - Big Meadows | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|--------|-------|--------|-------|--------|--------|--------|
| Ozone Exceedance (> 85ppb) | 1 | 8 | 6 | 6 | 1 | 0 | 0 |
| 1st Highest, 8-hour Ozone Concentration (ppb) | 93 | 95 | 101 | 104 | 87 | 81 | 81 |
| 4th Highest, 8-hour Ozone Concentration (ppb) | 80 | 90 | 86 | 86 | 75 | 81 | 77 |
| Sulfur Dioxide, Annual Arithmetic Mean (ppb) | 2.5 | 2.3 | 2 | 2 | 2 | 2 | 1 |
| Average Wind Speed (Sealar) | 2.9 | 2.6 | 2.7 | 2.7 | 2.5 | 2.5 | 2.6 |
| Average Ambient Temperature (°C) | 7.6 | 8.8 | 9.6 | 7.5 | 8.2 | 8.2 | 9 |
| Maximum Ambient Temperature (°C) | 25.2 | 25.7 | 27.8 | 25.6 | 25.6 | 27.3 | 27.2 |
| Minimum Ambient Temperature (°C) | -18.1 | -14.2 | -15.2 | -20.1 | -21.4 | -20.1 | -19.5 |
| Average Relative Humidity (%) | 66 | 71 | 73 | 76 | 73 | 74 | 71 |
| Maximum Relative Humidity (%) | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Minimum Relative Humidity (%) | 8 | 10 | 5 | 12 | 4 | 8 | 8 |
| Accumulated Precipitation (mm) | 1040.9 | 965.5 | 1128.3 | 1736 | 1455.1 | 1407.4 | 1326.6 |
| Accumulated Precipitation (inches) | 40.98 | 38.01 | 44.42 | 68.34 | 57.29 | 55.41 | 52.23 |

Visibility at Shenandoah National Park in 2005

By Liz Garcia

The Interagency Monitoring of Protected Visual Environments (IMPROVE) Program is a cooperative measurement effort by a steering committee composed of representatives from Federal and regional-state organizations. The IMPROVE monitoring program was established in 1985 to aid in the creation of Federal and State implementation plans for the protection of visibility in Class I areas. The objectives of IMPROVE are to establish current visibility and aerosol conditions in mandatory class I areas, to identify the chemical species and emission sources responsible for existing man-made visibility impairment, document the long term trends towards the national visibility goal, and provide regional haze monitoring representing all visibility-protected federal class I areas. Sampling occurs every three days throughout the year (http://vista.cira.colostate.edu/improve/Overview/IMPROVEProgram_files/frame.htm).

Visibility at Shenandoah has been improving a little. On the best visibility days visibility is showing some improvement overall, yet on

days were the visibility is poor, the visibility has remained about the same. Looking at Figure 1 below, on the best visibility days we could see between 100.7 kilometers and 167.16 kilometers from 1990 to 2005. All of the distances are based off the annual average. Overall, the larger trend is showing improvement even though there are some smaller degrading trends. The year 2003 had the best visibility up to and through 2005 with a visual range of 167.16km. Since then, the visible range on the best days has decreased to 161.74km in 2004 and 146.67km in 2005. Even with the degrading trend in the last three years, the visual range in 2005 is still greater than it has been between 1990 and 2002. Looking at the worst visibility days overall we can see that there isn't much trend. Having no real distinguishable trend is not bad, but we definitely don't want the trend decreasing or degrading. Looking closely at the data there had been some minor improvement in the larger picture. Between 1990 and 1995 the standard visual range was between 13.92km and 18.69km. Since then the standard visual

range has increased to between 21.44km and 25.22km with the exception of the years 2002 and 2005 when the standard visual range dropped to 19.22km and 19.98km respectively. Between the years 1993 and 1999 there had been an improving trend, yet between the years 1999 and 2002 there had been a degrading trend. Overall in the past three years, 2003 through 2005, there has been a degrading trend in the standard visual range for both the best 20% and worst 20% days of recorded visibility.

One of the goals of the IMPROVE program is to identify the chemical species that contribute to our impaired visibility. Identified chemical species include; ammonium nitrate extinction, ammonium sulfate extinction, elemental carbon extinction, fine soil, organic carbon mass extinction fraction, and coarse mass extinction (particulate matter between 2.5 microns and 10 microns in size). Extinction is the loss of light due to scattering and absorption. Figure 2, shows the chemical species per month during



| Year | Best 20% | Units | Worst 20% | Units |
|------|----------|-------|-----------|-------|
| 1990 | 103.79 | km | 16.55 | km |
| 1991 | 110.97 | km | 13.92 | km |
| 1992 | 128.83 | km | 17.17 | km |
| 1993 | 114.85 | km | 14.93 | km |
| 1994 | 127.26 | km | 16.42 | km |
| 1995 | 115.27 | km | 18.69 | km |
| 1996 | 100.7 | km | 21.44 | km |
| 1997 | 120.21 | km | 22.07 | km |
| 1999 | 136.21 | km | 25.22 | km |
| 2000 | 134.34 | km | 23 | km |
| 2001 | 105.59 | km | 22.08 | km |
| 2002 | 127.02 | km | 19.22 | km |
| 2003 | 167.16 | km | 22.86 | km |
| 2004 | 161.74 | km | 21.68 | km |
| 2005 | 146.67 | km | 19.98 | km |

Figure 1, Best 20% and Worst 20% of the Standard Visual Range <http://vista.cira.colostate.edu/dev/web/AnnualSummaryDev/Trends.aspx>

Table 1. Data Values for the Best 20% and Worst 20% of the Standard Visual Range at Shenandoah National Park Data from VISTA, <http://vista.cira.colostate.edu/dev/web/AnnualSummaryDev/Trends.aspx>

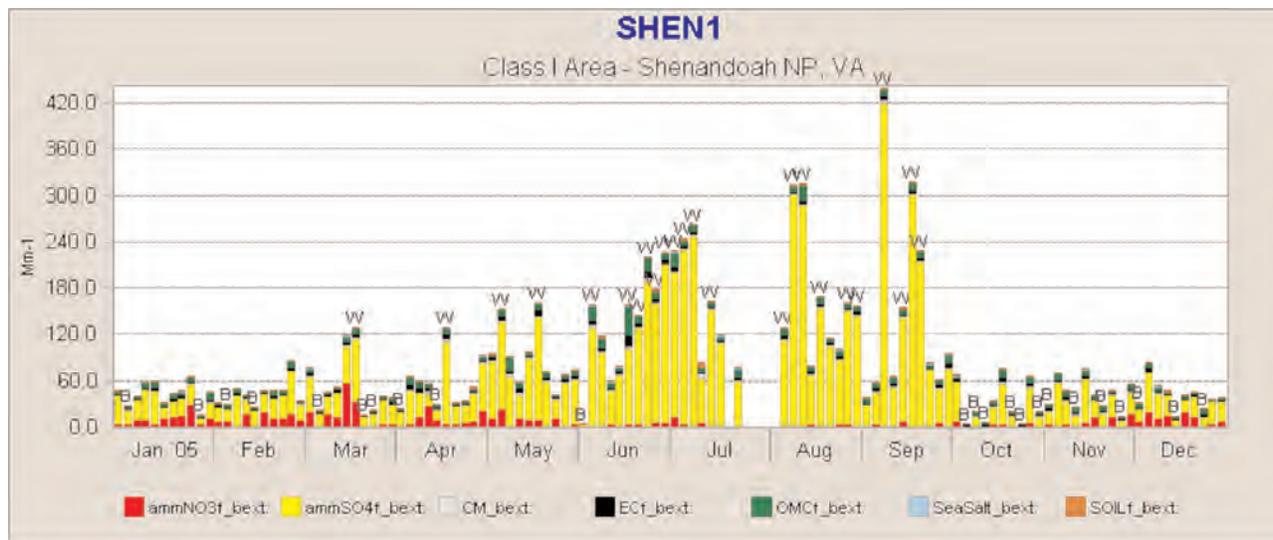


Figure 2, Seasonal Variations of Chemical Species
<http://vista.cira.colostate.edu/dev/web/AnnualSummarydev/Composition.aspx>

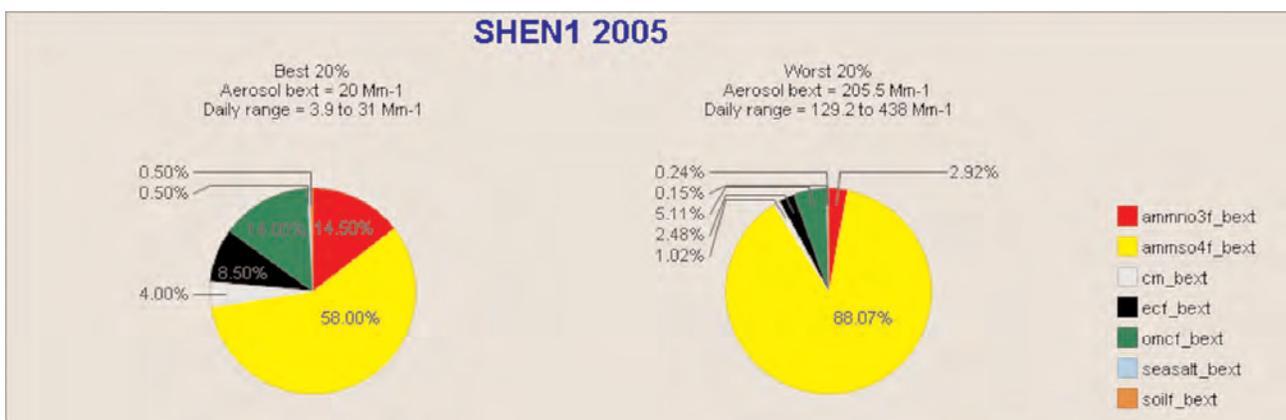
the year of 2005. The chemical species that compose the years of 2003 and 2004 are similar to that of 2005 as well as the seasonal variation. We can see that the most particulates in the air are in the summer months and the air is primarily composed of ammonium sulfates. In the winter months ammonium sulfates still account for about 1/2 the chemical composition but ammonium nitrates are not far behind. Most of our poor visibility days are in the summer months and our best visibility days are in the winter months with the spring and fall being the shoulder months. All of the worst visibility days occurred between March and September. Taking that into consideration, Figure 3 shows the chemical species

breakdown for both the best and-worst visibility days in 2005. Ammonium sulfates make up most of the particulates in the air in both the summer and winter months but it is more predominate in the summer months (worst 20%) with 88.07% of the total chemical species. In the winter months (best 20%) the ammonium sulfates make up 58% of the total chemical species with ammonium nitrates following with 14.50%. The winter months also show greater amounts of organic carbon 14%, elemental carbon 8.50%, coarse mass 4%, sea salt 0.50%, and soil 0.50%. The summer months differ from the winter months in that they have a higher amount of organic carbon 5.11%, than ammonium nitrates 2.92%.

It can be concluded that the amount of sulfates in the air has a direct impact on visibility and the standard visual range. Sulfates tend to have a brownish colored haze and can often be seen in layers in the atmosphere. Sulfates and nitrates are the major precursors of acid rain, which can acidify soils, lakes and streams, as well as accelerate the corrosion of buildings and monuments. Stringent regulations have reduced sulfate emissions over the last 30 years, yet sulfates are still a pollutant of concern in many areas of the Southeast and throughout the United States.

Liz Garcia is a Physical Science Technician.

Figure 3, Breakdown of Chemical Species in 2005
<http://vista.cira.colostate.edu/dev/web/AnnualSummarydev/Composition.aspx>



Ozone Monitoring in 2006

By Liz Garcia

Notable successes in ozone reduction at eastern parks have occurred at Great Smoky Mountains, Mammoth Cave, and at Shenandoah, where ozone at these parks has dropped below the NAAQS. The NAAQS standard for ozone is 0.08 ppm over an 8-hour period. An exceedance of the standard occurs when the 8-hour ozone concentration is greater than or equal to 85 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 85 ppb.

This year, 2006, is the second year in a row that there was no exceedance of the standard for Ozone. The 1st highest ozone level was 81 ppb, under the NAAQS by 4 ppb. The 1st highest ozone level had fallen from 87 ppb in 2004 to 81 ppb in both 2005 and 2006. The 4th highest ozone level was 77 ppb, which helped keep the 3-year average of 77 ppb out of violation of the NAAQS standards for the 3rd year in a row.

At Big Meadows, ozone increased during the 1990s to above the 8-hour average standard, but since the peak in 1999, the ozone concentrations have decreased and the park is currently below and in attainment of the standard. Although we are currently in attainment, since the start of monitoring in 1988, the net change in the highest ozone concentrations has shown no improvement at Big Meadows. Ozone should be watched carefully to see if the current improving trend persists.

Ray, J.D. 2007. Annual Data Summary 2006: Gaseous Pollutant Monitoring Program, National Park Service Air Resources Division. Natural Resource Technical Report NPS ARD/NRPC/NRTR-2007/058. National Park Service, Denver, Colorado.

Data can be found at: <http://ard-aq-request.air-resource.com/>

Liz Garcia is a Physical Science Technician.

| Year | Number of Ozone Exceedances | 1 st Highest Ozone Concentration |
|------|-----------------------------|---|
| 1994 | | 90 ppb |
| 1995 | 7 | 93 ppb |
| 1996 | 1 | 87 ppb |
| 1997 | 6 | 95 ppb |
| 1998 | 22 | 110 ppb |
| 1999 | 15 | 101 ppb |
| 2000 | 1 | 93 ppb |
| 2001 | 8 | 95 ppb |
| 2002 | 6 | 101 ppb |
| 2003 | 6 | 104 ppb |
| 2004 | 1 | 87 ppb |
| 2005 | 0 | 81 ppb |
| 2006 | 0 | 81 ppb |

| 3-year Average | 4 th Highest Ozone Concentration |
|----------------|---|
| 2004-2006 | 77ppb |
| 2003-2005 | 80ppb |
| 2002-2004 | 82 ppb |
| 2001-2003 | 87 ppb * |
| 2000-2002 | 85 ppb * |
| 1999-2001 | 87 ppb * |
| 1998-2000 | 93 ppb * |
| 1997-1999 | 96 ppb * |
| 1996-1998 | 92 ppb * |
| 1995-1997 | 85 ppb * |
| 1994-1996 | 83 ppb |
| * indicates a | violation |

Rapidan Camp Streambank Stabilization and Bridge Construction



By Shawn Green

In September 2003, Tropical Storm Isabel brought flooding rains and powerful winds across the crest of the Blue Ridge. East of Big Meadows, the headwaters of Rapidan River rose rapidly picking up pieces of fallen dead hemlock trees which lined the streambanks. A pile of hemlock logs jammed against the footings of the "Hoover Bridge" at Rapidan Camp, President Hoover's mountain hideaway in the 1920s. The resulting flood damaged the bridge beyond repair, and severely eroded the streambank within 25 feet of the historic President's Cabin (Brown House). (See photo at left.)



The bridge as photographed in the 1920s (left) and the bridge after reconstruction in 2007(right).

Cultural Resource Specialist Reed Engle obtained funding with the goal of stabilizing the streambank to protect the Brown House and reconstruct the historic bridge. After a lengthy permitting process with the Army Corps of Engineers, in consultation with the Virginia Department of Game and Inland Fisheries, a plan was devised to armor 45 feet of streambank to a height of 4 feet with a series of gabion-size rocks, then backfill the undercut streambank with smaller rocks. Key to the plan was moving tons of large rocks into place using a cable and rigging system, rather than using heavy equipment in the stream bed. To accomplish this task, Central District Trail Supervisor CT Campbell was called in to plan and lead this complex operation.

The park Trails staff set up a skyline cable system across the 50 foot wide stream bed. Then using a variety of rigging hardware, including grip hoists, wire ropes, blocks and shackles, one hundred large rocks were carefully set in place. Hundreds of small rocks and tons of crushed stone were used to fill in the undercut stream bank as the wall went up. It took about 10 days with an average crew size of seven workers to accomplish this project.

Once the streambank was protected, South District Trail Worker Riese Painter led a small crew of workers in the construction of the new Hoover Bridge. Riese worked from plans drafted by Reed Engle to match the historic architecture found on the deck of the Brown House. As the bridge reached completion, Trails stone mason Joey Hilliard reconstructed the stone walkway linking the bridge to the walkway from the Brown House. Now park visitors to Rapidan Camp can safely enjoy the camp experience as President Hoover and his guests once did with a relaxing stroll onto the bridge spanning Mill Prong creek, within sight of where the Mill Prong and Laurel Prong join to form the Rapidan River.

The park Trails staff enjoyed the challenge of working on these two exciting projects. We patiently look ahead in anticipation of the next tropical storm to buffet the Blue Ridge and see how the handiwork holds up.

Shawn Green is Park Trails Coordinator.



Streambank before reconstruction



Working on streambank



Streambank after reconstruction

Planning and Compliance for Initial Response to Chronic Wasting Disease Underway

By Gordon Olson

Chronic Wasting Disease (CWD), a disease of white-tailed deer, is considered to be exotic in the eastern United States. CWD is a progressive and irreversible neurological disease that attacks the brains of infected deer and elk and eventually causes death. It is characterized by loss of body condition, emaciation, excessive salivation, stumbling, trembling, and loss of fear of humans. No treatments or cures are available. According to public health and animal health officials, data available to date indicate that CWD cannot be naturally transmitted to humans, or to animals other than deer or elk.

Deer within Shenandoah National Park are currently at relatively high risk of contracting the disease. Several cases on the disease have been found in deer in West Virginia during the past couple of years. Those cases have been within no more, and in some cases significantly less, than 60 miles of the northern portions of the park. Additional risk is posed to Shenandoah because of relatively high deer densities in portions of the park and because of presence of captive deer facilities in neighboring counties. The remote nature of many areas in the park and some history of dumping of carcasses in those remote areas further intensifies the level of risk to park deer because those carcasses can spread the disease. In response to this situation, park and regional staff have started monitoring efforts under a categorical exclusion from NEPA. All samples that have been collected have tested negative for CWD. Planning and compliance has also been

initiated to prepare for initial response to the disease. During 2007, public and internal scoping meetings were held and some writing was done. In addition, a Science Advisory group was convened to respond to specific technical issues related to this issue. That planning will result in the ability of the park to take monitoring actions beyond those covered under the categorical exclusion and to take steps to determine disease prevalence rates should the disease be detected within the park. This effort is ending with the preparation of an Environmental Assessment and an anticipated Finding of No Significant Impact. Compliance should be completed sometime in 2008. This planning effort is being undertaken in consultation with park, region, and Washington Office staff and has actively involved state officials. A similar, parallel planning effort is underway for Antietam and Monocacy National Battlefields in the National Capital Region.

During internal scoping discussions associated with the above mentioned planning, it became evident that CWD is highly likely to show up in deer in Shenandoah and that the current planning will not be adequate to allow actions for the management of the disease within the park.

In light of the high risk that is posed and the apparent likelihood that CWD will show up in the park in the very near future, it is imperative that an additional planning and compliance effort be started. White-tailed deer, while not unique to the park, certainly constitute an important element of the visitor experience. Aside from scenic viewing,

the opportunity to view wildlife, particularly large mammals, clearly represents one of the most important elements of the visitor experience. Loss of large numbers of deer due to the disease would directly impact those experiences. White-tailed deer are also an important component of the eastern deciduous forest ecosystem. Their significant influence on forest interior and edge communities.

Currently available management tools are limited but include things like animal immobilization and lethal actions. Hence, public response is anticipated to clearly warrant development of a full Environmental Impact Statement rather than preparing an additional Environmental Assessment. A draft proposal for the development of an Environmental Impact Statement has been prepared.

In addition to this proposal, Shenandoah has proposed implementation of a deer population study to provide significantly more up-to-date information upon which to base deer management decision-making. Planning and compliance would proceed based on currently available information, even if this study is not funded. The deer population study would be highly advantageous though, at the stage of management plan implementation and to provide baseline information for determining management efficacy.

Watch for future updates on this topic.

Gordon Olson is a Supervisory Biologist.

Stone Planter Blooms at Byrd

By Wendy Cass

Two years after the construction of the Byrd Visitor Center restrooms was complete, the large stone planter on the patio outside the restrooms remained empty and bare. Funding was not available for the soil and plants needed to complete the planter, and it stood like a shallow swimming pool, collecting cigarette butts and gum wrappers, and serving as a sort of play-pen for groups of enthusiastic school children. Fortunately, Interpretive Ranger, Mara Meisel, saw an opportunity to beautify the area, and educate visitors, and contacted the park's Natural Resources staff for assistance in bringing the planter to life.

Together we created a list of fifty deer-resistant plant species, and completed the environmental compliance paperwork to allow for the local salvage of native plant material. The botany crew moved several large rocks from the north

slope of Hawksbill Mountain to serve as focal points in the planter. Mara secured donations of top-soil from Burner organic recycling, mulch from Sue Schaefer and Paul Dennison, and assistance with plant salvage from Betty Rosson. But it still wasn't enough to complete the planter. More assistance was needed. Greta Miller from the Shenandoah National Park Association (SNPA) was contacted, and over fifty SNPA members responded to our need by donating a total of more than \$2,000 to support the purchase of plants and supplies. Additional funds were provided by Phyllis and Krin Ihrman to purchase plant labels and a fence. This additional support allowed for the purchase of native plants which were then installed, labeled, and fenced within the planter.

We are extremely grateful to all who donated money and time to make this project a success. Several volunteers contributed substan-

tial amounts of time to assemble the planter, install the plants, and provide on-going care for the vegetation, especially our lead volunteers Betty Rosson, Sue Schaefer, and Paul Dennison. By the end of the summer, the planter had been transformed from an eyesore, to a beautiful and educational native plant garden. Byrd Visitor Center staff comment that visitors love the display, and that an entire meadow interpretation program could practically be conducted right there at the planter. The project stands as a great example of how things can get done when there is enough desire and need, as long as you also have plenty of collaboration, resourcefulness, and help from your friends.

Wendy Cass is a Botanist.



Preservation Maintenance for Historic Rock Spring Cabin

from *The Potomac Appalachian*, October 2007

By Cliff Willey, Jack Berry, Steve Bair and Mel Merritt

The last native stone was set in the new porch floor to finish the renovation of Rock Spring Cabin in Shenandoah National Park (SNP) this year.

Renters of times past will not believe the changes. For one, Wilma, the pesky wood rat, who made for amusing entries in the cabin log has been evicted... the cabin log will not be as interesting, but renters should be happier.

Remember the cold winter nights? Well, those are no more. The cabin now sports a new two-burner cooking and heating stove that takes 22-inch logs. Remember trees and brush partially blocking the enticing view of Stanley off in the valley below? They're gone, and the view is restored to its past historic vista.

And how about the cabinets, table and benches? It was sad to see the historic old table and benches, built by the Civilian Conservation Corps (CCC) go, but they are now in storage waiting to be placed in the CCC museum in SNP. The replaced furnishings, which are not as rustic, are easier to use and clean than the previous furniture.

All this makes for happy renters, but the real story is the restoration of the cabin structure itself and the people who made it happen. The cabin, built for hikers by the CCC in the late 1930s, had problems: rotting back wall and porch beams, deteriorating roof, badly broken stone porch floor, and more.

In late 2003, Steve Bair, SNP Backcountry Wilderness and Trails Manager, who is responsible for



Rock Spring Cabin with new roof beams and a view of the valley.

the cabins, announced that SNP had found resources to bring in the National Park Service Historic Preservation Training Center (HPTC) for most of the major renovations. The Potomac Appalachian Trail Club (PATC), which maintains the cabins in agreement with SNP, took a supporting role, which included improving drainage around the cabin, interior restoration, new windows, and masonry work. In the Spring of 2004, with our Supervisor of Facilities Mel Merritt in the lead, PATC cleared out the cabin. SNP and HPTC immediately went to work replacing the worn-out asphalt-shingle roof with cedar shingles reminiscent of the handmade spilt chestnut shingle used by the CCC when the cabin was built. They installed new porch support beams cut from oak to resemble the old Chestnut beams, including axe marks. And they rebuilt the back cabin wall, using what they could of the old chestnut logs.

In the Spring of 2004, with our Supervisor of Facilities Mel Merritt in the lead, PATC cleared out the cabin. SNP and HPTC immediately went to work replacing the worn-out asphalt-shingle roof with cedar shingles reminiscent of the handmade spilt chestnut shingle used by the CCC.

Meanwhile PATC worked on drainage, windows, and masonry. By early summer 2004 PATC was able to restore the interior of the cabin with the new furnishings and returned it to the rental system. But, alas, work was not complete... there was the porch floor.

But before we get to that, let's mention those who helped. Adventure Scouts, brought in by then cabin Overseer Glen Tsaparis, did everything from hauling gravel and pulling nails to hauling cabin materials. Tom Jorgenson and his loyal band of volunteers were willing to be covered with mud and tar working on a drain and waterproofing a wall. PATC's Blue and White Crew pitched in to help with the drain, back wall cribbing and trails around the cabin. Volunteers led by



The cabin work crew gets a lesson in buttering the blade with mortar.

PATC District Supervisor Cliff Willey spent a weekend learning masonry skills from HPTC so that they could restore cabin stone work. Later on, a renter, Jim Seasey, volunteered to supply screens for the cabin and installed custom-crafted hardwood-framed screens. And last, but not least, throughout, CT Campbell and his SNP Central District crew gave valuable support hauling materials to and from the cabin and restoring the viewshed. Of course Steve was

always there helping out.

The porch floor, the last chapter, took time: time to find suitable native stone in the park for the floor, time to bring in more than a ton of sand, cement, and stone; time to remove the old floor; and time to painstakingly lay in new stone - lots of pain as Jack Berry, the new cabin overseer, will attest. But at last in June, Jack, his son John, and Cliff set the last rock. It was done, finished, amen.

Come by and take a look, enjoy the view, or try one of those cold weather trips. Rock Spring is back again as a cabin you will want to visit time and again.

Cliff Willey, Jack Berry, and Mel Merritt are with PACT, and Steve Bair is Backcountry Wilderness and Trails Manager at Shenandoah National Park.

Shenandoah National Park's Fireplaces Back in Shape

from The Potomac Appalachian, October 2007

By John Hedrick

An effort has been ongoing to rehab the SNP backcountry fireplaces at the seven Appalachian Trail huts and the three maintenance huts. Thanks to some funding from Appalachian Trail Park Office and the Appalachian Trail Conservancy and from the park, the rehab has been completed.

The work was led by Joey Hilliard, the park trails mason, with grunt assistance from Potomac Appalachian's (PATC) Dick Hostelley, Jim Tomlin, and Supervisor of Trails John Hedrick. Joey did a superb job and is a real credit to the park.

Two fireplaces, Rock Spring and Blackrock, were totally rebuilt, and the others required varying levels of work. The space between the back stone and the firebrick in front was mostly dirt and loose rocks (and some snakes). It's surprising the fireplaces held up for as long as they did.

The existing stone was retained in most instances. All the old, loose mortar was removed; some of it looked like sawdust. A lot of new mortar was required, 4,920 pounds to be exact, and it all had to be mixed. John discovered some new muscles in the process. PATC

contributed almost 300 work hours to the task. Chas Cartwright, SNP superintendent, noted, "Two and a half tons of mortar - it makes me tired just thinking about it." This was a very worthwhile effort, and PATC is pleased to have been a part of it.

John Hedrick is PATC's Supervisor of Trails.



Blackrock Hut fireplace in 2005.



Blackrock Hut fireplace in 2007.

Mount Vernon Furnace Protection Efforts Begin

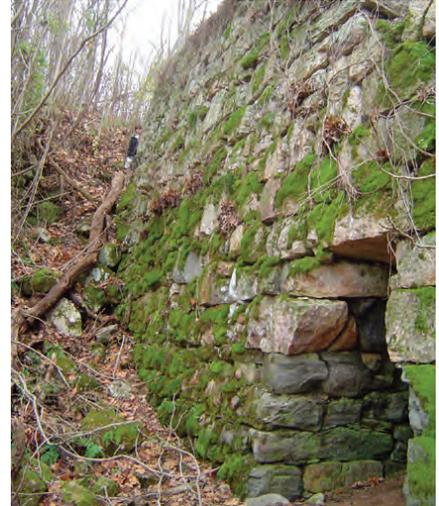
By Carole Nash

The Department of Integrated Science and Technology at James Madison University (JMU) hosts a cooperative agreement between Shenandoah National Park and the University for archaeological services. Reed Engle was instrumental in developing this relationship. Directed by Carole Nash, archaeological work in the Park includes assessments of archeological site conditions, National Register nominations, field survey and testing, and GPS/GIS efforts. Since 2005, Geographic Science and Anthropology faculty and students have undertaken a variety of National Historic Preservation Act (Section 106) projects.

Since the fall of 2006, documentation of the Mount Vernon Iron Furnace complex in the Park's South District has been underway. Constructed around 1830, the hot blast iron furnace consumed over 29,000 acres of timber by its closing in the late 1880s. At the height of its operation before the Civil War, it was active 36 weeks out of the year and produced 750 tons of pig iron. During this time, it was owned by John Miller, one of the largest slaveholders in Rockingham County. Miller also owned large tracts of timber and ore lands in the vicinity.

To date, much of the archaeological investigation has focused on survey and GPS mapping; limited test excavations at several sites have revealed prehistoric occupations along the banks of Madison Run, along with Furnace-period sites. The Furnace, constructed of dressed quartzite block, stands approximately 30' high and 25' square at the base. Adjacent to the furnace are the wheel pit, furnace-related structure foundations, workers houses, roads, tramways, a possible slave settlement, and massive open pit mines. Intensive survey of the Browns Gap Road, an early trace through the Blue Ridge and the most direct route from the Valley to Charlottesville, has found that much of the historic road remains in use today, while now-defunct side roads connected the furnace to settlements to the north and south (near modern-day Port Republic and Grottoes, respectively).

Historical research demonstrates strong links between furnace owners and investors in the New Shenandoah Canal Company. During the Battle of Port Republic in 1862, the Mount Vernon Furnace vicinity was used as a headquarters location by Stonewall Jackson in 1864.

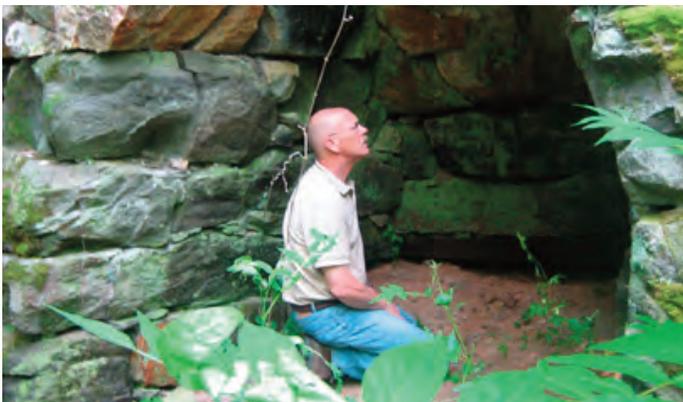


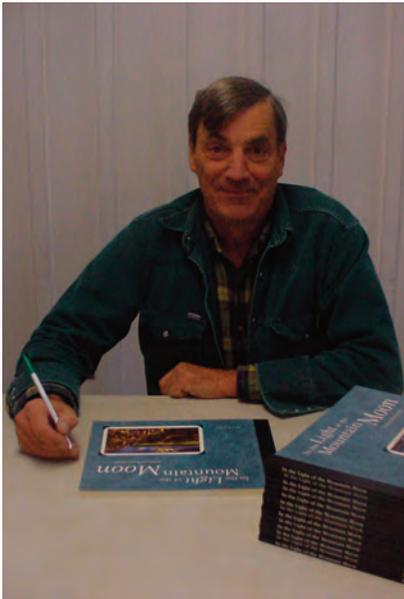
The Grottoes CCC (Civilian Conservation Corps) camp enrollees, whose facility was close by, maintained the site during their tenure. Current efforts are focused on assisting the park with stabilizing the Furnace and preparing a National Register nomination. Chris Robinson of NPS' Historic Preservation Training Center has visited the site and made initial treatment recommendations. One of these is currently underway: the eradication of Tree of Heaven, an exotic species, around the Furnace.

Mount Vernon Furnace brings to light significant but little-studied elements of Shenandoah's story: the impact of extractive industries on the environment, the work of enslaved populations, contested lands during the Civil War, and a modern cultural landscape that is reflective of the transition from subsistence to market economies.

Carole Nash is an Anthropologist/Archeologist at James mason University.

Above: JMU Geography student behind Mt. Vernon Furnace. Below left: Chris Robinson investigating Mt Vernon Furnace busk. Below right: Students crossing Madison Run near Shenandoah National Park to do GPS mapping.





Reed Engle

By Kandace Muller

Who was Reed Engle and what did he mean to Shenandoah National Park? Reed Engle the park landscape architect retired from Shenandoah National Park and the National Park Service in August of 2007. I had known him on and off since 1995 and started working at Shenandoah National Park in July of 2007 at which time he was preparing for retirement. As I settled in at the park, various staff members told me over and over, "there was no cultural resource program before Reed". Steve Bair, Backcountry and Wilderness Coordinator talks of how Reed made him look at the resource differently. Whether Reed Engle was the driving force behind the recognition of Shenandoah National Park's cultural resources or as he says, "Sensitivity to [Cultural Resources] was something everybody contributed to. [Interpretation and Education], Robbie Brockwehl, the preservation folks in maintenance. John and Joanne Amberson. [Shenandoah National Park Association]. Everybody worked, and will continue to work, for preservation of the resources.," is beside the point. He obviously contributed to an appreciation of and changing attitude regarding the history of the park and

A Special Legacy

its cultural resources.

Prior to coming to Shenandoah National Park in the mid 1990s, Reed Engle was Chief of Maintenance at Gettysburg National Military Park and in the Regional Office as historic architect and cultural landscape architect. Until then the wonderful natural resources of the park were the major focus of park management and staff. Perhaps it would take a landscape architect like Reed Engle to make many people see and become consciously aware of the cultural influences and features in the park and their value. When created, the park was meant to be an eastern equivalent of the type of national park in the West. Most of the Western parks in the early 1900s were chosen for unique and beautiful natural scenery. Early Shenandoah National Park stewards strove to create a natural appearing park, and even today many people think of Shenandoah National Park only as a place of natural beauties. So the assumption up to the 1990s that the park was a repository of natural beauties is not surprising.

What is fascinating is that Reed Engle along with other staff members could look at the park and see the remnants and influences of people upon this landscape and recognize the importance of them. Archeological studies, historic landscape inventories and other studies highlighted the lives of those who lived within the park boundaries prior to it becoming a park; it was not a vast empty wilderness. These studies managed by Reed Engle brought to light peoples' lives, structures and crops. In the midst of forest one can come across apple trees from old orchards, building foundations and machinery. Research into the park establishment called attention to the role of President Herbert and Lou Hoover in the creation of the park. Reed Engle worked to preserve structures within Camp Rapidan, where the

Hoover's had their camp, and make it available to the general public. The camp now hosts the refurbished Hoover cabin and a structure containing exhibit space telling the Hoover story. He was also involved in the refurbishing and exhibit at Massanutten Lodge. In 2005 Reed demonstrated his knowledge and dedication to cultural resource preservation and management conducting historical research and contributing to the final design for the new exhibit at the Byrd Visitor Center on the decade of the park establishment including the Civilian Conservation Corps (CCC) infrastructure, Lewis Mountain as a segregated campground and the Appalachian Trail in the park, Skyline Drive, and President Hoover's role.

During his years in the park Reed Engle accomplished many goals that help preserve and tell the story of human interaction with the natural environment at Shenandoah National Park and how the natural and cultural resources mesh. Perhaps one of the most subtle but pervasive influences which Reed Engle's landscape architect background would make him particularly sensitive to is the Skyline Drive. The Drive, a major reason for the creation of Shenandoah National Park is a cultural feature. With the help of the CCC, engineers created their vision, building and modifying the Drive changing landscapes in areas to meet their vision, slopes were changed, drainage put in place, plants and buildings added and removed. The landscape was not natural but "re-created" to meet a set vision and visitor needs. The drive, overlooks, and vistas form a large human landscape incorporating natural features. Reed helped the park re-create this vision encouraging the park to cut trees back at overlooks returning the historic views planned by the designers of the Drive. Now visitors experience these same views.

Gary Somers ended his 2005 Appleman-Judd-Lewis award nomination for Reed and what he did for the cultural resources program with, "His research on the CCC, on historic road building, and how to restore historic buildings and landscapes when original materials may not be available or meet current fire codes are all applicable to many parks in the system. His example of developing working relationships with critical partners, even before they became critical, is a model that others would do well to follow. His personal and professional commitment to all aspects of historic preservation and cultural resource management in the parks should be an example for cultural resource professionals elsewhere in the service to imitate."

From 1999 to the 2007 in cooperation with Shenandoah National Park Association he developed a series of cultural history publications aimed at the park audience. These publications were "Everything Was Wonderful: A Pictorial History of the Civilian Conservation Corps in Shenandoah National Park," "In the Light of the Mountain Moon: An Illustrated History of Skyland," "The Greatest Single Feature... A Sky-Line Drive: 75 Years of a Mountaintop Motorway." He was a driving force behind another book in this group, "In the Shadow of Ragged Mountain: Historical Archeology of Nicholson, Corbin, and Weakley Hollows" by Audrey Horning. All of these books won placement in the National Association for Interpretation's (NAI) Interpretive Media Competition. He assisted in research for and in reviewing the text for the fifth and final book in this series on Lewis Mountain and the history of segregation in the park from 1930 to 1950. He provides this service as a volunteer since he has retired. Through these books he helped make the cultural history of the park accessible to the public.

In 2006 he received the Appleman-Judd-Lewis Award. The nomi-

nation for this award lists many of his accomplishments from articles and books through partnerships with other agencies. With his writings, support he gave to other programs, and the projects he initiated, Reed was instrumental in adding significantly to the cultural resource knowledge and preservation within the park and making these resources available to future generations. He recognized the museum collection and shaped it getting the Archives building built to house the collection, collecting artifacts, making images and oral histories available to the public on the park website. Under his management, projects and writings, Reed Engle has made the park cultural resources available to individuals who can not visit the park. He saw to the preservation of buildings and structural features in the park sharing his knowledge base of historic construction materials and techniques. Reed Engle and his research are part of efforts to have Skyline Drive declared a National Historic Landmark. Skyline Drive is currently listed on the National Register of Historic Places and the Historic Landmarks Advisory Committee voted on December 5, 2007 to approve the Skyline Drive in Shenandoah National Park as a National Historic Landmark.

When I asked Laurel Racine one of the regional staff members who worked closely with Reed Engle what she thought of as his legacy, I received the following, "I think the overarching idea about Reed's work is how much he accomplished in such a short period of time. He took a nonexistent cultural resources program and single-handedly built it up by advocating with management, successfully competing for funding, and managing a wide range of complex projects. The projects that come to mind include constructing the collection storage and work rooms; expanding the facility to include an office, research room, and photography space; managing Historic

Furnishings Reports for Massanutten and Rapidan; implementing the Historic Furnishings Reports for both structures; restoring the structures and landscapes at Massanutten and Rapidan; providing input for Byrd VC exhibit; getting the park's archives, archeology, and other collections catalogued; writing three books (award-winning) and numerous articles; and building a CCC collection for the park."

Like Ms. Racine his previous supervisor, Bob Krumenacker noted how much Reed accomplished in the time he worked here and how he helped shift attitudes. When I spoke with him he said he thought Reed was a "catalyst" for change. Reed Engle was the right person at the right time to help expand the focus of Shenandoah National Park to add the cultural story to the natural resource story and provide a richer more complex story. As one of the individuals responsible for taking the cultural resources legacy forward from here, I look at what occurred during the time Reed Engle worked at the park and say "Wow, what accomplishments." Just having so many people talk about the cultural resources and the respect with which they speak of them is a great legacy for those coming after Reed Engle. He brought an awareness and respect to the park for cultural resources making it much easier for those who follow him. We do not have to raise awareness but can work with others in the park to preserve the cultural resources and make the information they contain available for future generations to enjoy and study. Can there be a greater legacy than being part of building something that will carry forward for untold generations?

Kandace Muller is a Museum Specialist.

Long-Term Park Cooperator Honored

The Executive Committee for the Tyler Prize for Environmental Achievement announced the awarding of the 2008 Tyler Prize for Environmental Achievement on its thirty-fifth anniversary to Dr. James N. Galloway, and one other scientist.

The Tyler Prize for Environmental Achievement is the premier award for environmental science, energy and medicine conferring great benefit upon mankind.

Through their work, Tyler Laureates have focused worldwide attention on environmental problems by their discoveries and the solutions that resulted.

Tyler Laureates receive a \$200,000 annual prize and are presented a gold medallion at ceremonies at ceremonies in Los Angeles. The Tyler Prize, administered by the University of Southern California, was established by the late John and Alice Tyler in 1973.

The 2008 Tyler Prize for Environmental Achievement is being awarded to Professor James N. Galloway in recognition of his contributions to earth system science through research on local and global biogeochemical processes as modified by human impact, and alerting the international community to the environmental consequences of these modifications. He is honored for his quantitative characterization and detailing of biogeochemical cycles, the multiple impacts of human inputs to them, and the consequences for the global environment, particularly as illustrated through his development of the concept of the "nitrogen cascade."

The "nitrogen cascade" represents the myriad, complex and linked impacts that molecules of reactive nitrogen can have in the environment of the land-atmosphere-ocean system. The "nitrogen cascade" concept defines the major human induced perturbations of the nitrogen cycle of the earth and their present and continuously growing impacts on terrestrial and aquatic ecosystems. These include eutrophication and acidification of soils, lakes, streams and estuaries, the development of hypoxia in ocean waters, as well as the effects of increasing fluxes of nitrogen oxides on global climate change.

Galloway is both a pioneer and an exceptional leader on global biogeochemical issues focusing on documenting and understanding the massive changes that are occurring in the global nitrogen cycle both through his own research as well as fostering a major international effort. He has chaired the International Nitrogen Initiative for the last 4 years which has

pooled worldwide knowledge on the complexities of the nitrogen cycle, how humans are altering it, and what the consequences of these human induced alterations are. He has led major efforts to synthesize the vast body of literature on the natural and human

dimensions of the nitrogen cycle at regional and global scales. He has engaged and brought together colleagues across the spectrum of the basic sciences of terrestrial and aquatic systems, the agricultural and industrial food sectors, energy production, economics and environmental policy related to nitrogen. With his collaborators, he has been among the first to demonstrate the consequences of the intensification of agricultural practices in Asia,

particularly the increase in meat consumption, on global nitrogen dynamics.

Dr. Galloway was born in Annapolis, Maryland at the Naval Academy Hospital on October 26, 1944. He obtained his B.A. in Biology and Chemistry in 1966 from Whittier College, Whittier, CA and his Doctor of Philosophy in 1972 in Chemistry from the University of California, San Diego/La Jolla, CA for his studies on "Man's Alteration of the Natural Geochemical Cycles of Selected Trace Metals". He was a postdoctoral associate in Ecology and Systematics at Cornell University in Ithaca, NY from 1974-1976. He began his academic career as an Assistant Professor in the Department of Environmental Science at the University of Virginia, Charlottesville, VA in 1976. He rose through the academic ranks at UVA to become a full professor in 1988 and served as the Chair of the Department from 1996 to 2001. He has been a visiting scientist (summer) at the Marine Biological Laboratory in Woods Hole, MA, since 2001.

Dr. Galloway has published over 200 articles, book chapters, reviews and reports with over a half dozen of them in *Science* and *Nature* magazines. He has over 53 first authored peer-reviewed publications and 28 book chapters. His papers have been cited (according to ISI) in over 7,700 articles. He has served on numerous National and International Committees including committees of the World Meteorological Organization (WMO), National Academy of Sciences (NAS), American Meteorological Society (AMS), National Park Service (NPS), Environmental Protection Agency (EPA). Professor Galloway has been a key voice in raising the scientific and public awareness of the major human perturbations on the global nitrogen cycle directly through his research and his superb leadership in organizing the research community to address this critical area.

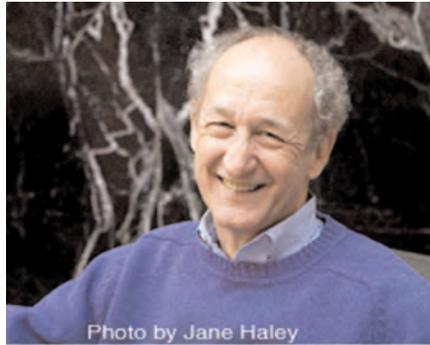


Photo by Jane Haley

Dr. James N Galloway

Dr. Galloway has sustained a long-term relationship with Shenandoah National Park through his work with the Shenandoah Watershed Study and

other investigations focused on acid deposition and atmospheric chemistry. We join his peers in congratulating him on this achievement.

Filling a Critical Need

By Gordon Olson

Right before the arrival of the deadline for this issue of the Resource Management Newsletter, Ann Kain, the park's new Cultural Resource Manager arrived and started work. She is filling a critical vacancy that was created by the retirement of Reed Engle (see related article).

Ann comes to Shenandoah after having worked as the Cultural Resource Manager at Denali National Park and Preserve for ten years. Prior to that position she had worked for nearly seven years in the Alaska Regional Office as an Historian. Ann has a Bachelor's Degree in History and Anthropology from Ohio University and a Master's Degree in Cultural Resource Management from Antioch University, also in Ohio.

Ann is well known throughout the Service and brings a great reputation with her. We welcome Ann and look forward to working with her in the protection of Shenandoah's cultural resources.



Ann Kain

Park Vegetation Program Welcomes Two New Employees

By Gordon Olson

Join us in welcoming Wendy Hochstedler (shown with son Isaac) and Jake Hughes as new permanent employees of the Park's Vegetation Monitoring and Management Program. Wendy is a graduate of Eastern Mennonite University and Miami University. She comes to us with extensive experience using GIS, studying invasive plant impacts to native forest, and with conducting forest vegetation monitoring. Many park employees may recognize her from her four seasons of technician work with the vegetation monitoring crew from 2001 through 2004. She will be serving as the crew leader for the park's native plant monitoring crew and will be involved in long-term forest monitoring, rare plant monitoring, and plant protection activities.



Wendy Hochstedler



Jake Hughes

Jake Hughes has been serving as the crew leader for the Park's invasive plant management program since 2005. He is a graduate of the University of Maryland, College Park, and worked at the National Arboretum and Rock Creek Park prior to his employment at Shenandoah. Jake has extensive knowledge and experience in invasive plant control techniques, exceptional field plant identification skills, and an interest in developing a native plant restoration program for the park. He will be serving as the crew leader for the park's invasive plant removal and monitoring crew and will also be involved in vegetation monitoring, rare plant protection, and plant restoration activities.

New Museum Specialist - Kandace Muller

I came to Shenandoah National Park in July of 2007 as a museum specialist. I am responsible for the care, documentation and preservation of the park museum collection and archives. It has been quite an adventure getting settled in and becoming familiar with the museum collection and the park resources as the previous park cultural resources staff members both were retired by the end of August. I am taking great pleasure in exploring the great cultural resource in the field and within the Archives building.

I have spent twenty-two years working with museum collection issues in the National Park Service (NPS). Most recently I was responsible for the museum collection at Andersonville National Historic Site, Georgia. A collection composed of archeological, historic and archival materials associated with the prisoner of war story from the Revolutionary War up to the present. I also developed temporary exhibits

and worked with an oral history collection of almost 1000 American prisoner of war interviews.

Prior to that, I spent twelve years working with the National Catalog and NPS Clearinghouse programs for the Washington Office Museum Management Program. There I assisted with the development of the museum collection software currently used throughout the NPS. I provided technical assistance to parks throughout the Service with museum documentation issues and helped place NPS Clearinghouse museum objects in appropriate museum collections.

My earliest work with the National Park Service encompassed two historic house museums. The Adams National Historic Site, Massachusetts, which tells the story of four generations of the John Adams family. This family was intimately associated with the early political and social history of the United States.



Kandace Muller

Before that, my first job with the National Park Service was at the Eleanor Roosevelt Site, New York where I was the first permanent museum staff member. While there I also assisted at the Franklin Delano Roosevelt National Historic Site and the Vanderbilt Mansion which operate under the same management as the Eleanor Roosevelt National Historic Site.

Making Connections: Public Understanding of Park Science

By Gordon Olson

Park resource managers and scientists often conduct their business behind the scenes in park settings. On one level this is entirely appropriate. The visiting public comes to the park to enjoy scenery, to learn about human and natural history, to relax, and to re-charge themselves. Understanding the intimate details of how parks are managed and protected is of secondary, if any, concern to the visitor. On another level, however, public knowledge regarding resource management and science is vital. That knowledge fosters recognition that park management is complex and needs to have a solid foundation – a foundation often rooted in

good science. It also fosters an appreciation for the fact that park managers need help from the public in the protection of park resources.

This past year staff in the Resource Management and Interpretation and Education Divisions joined together to create a series of Science Posters that were subsequently posted in various locations throughout the park. Initially, five of these posters have been created on the most critical resource issues that are found at Shenandoah including exotic plant management, forest health, acid deposition, and so forth. The posters are intended to be place-based. That is, they are displayed in areas of the park where the particular issue or condi-

tion may be observed by the visitor.

Furthermore, each poster is structured around a handful of key concepts including graphics that catch the attention of the public, brief messages that explain the issue or problem, an explanation of how park science is helping to resolve or deal with the issue, and finally a challenge to the public to get involved. The posters represent a welcome break from the traditional scientific poster which often includes vast quantities of text, tables and charts that are not easily deciphered, and technical terms that are beyond the understanding of all but those most closely tied to the science.

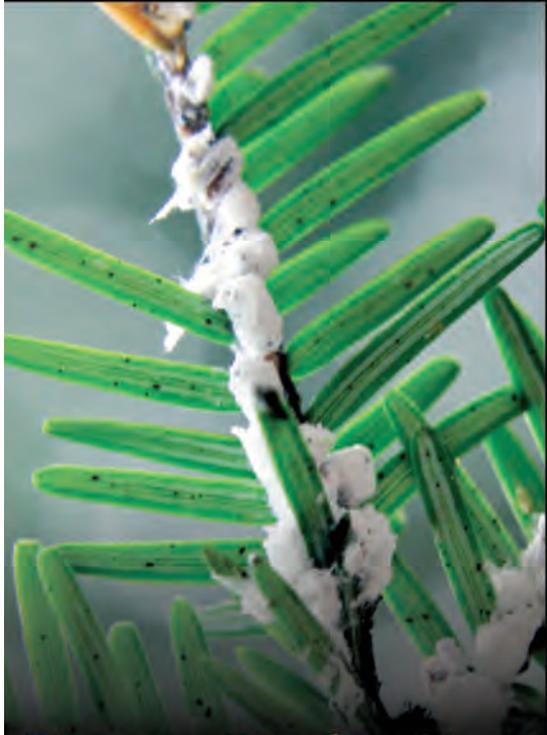
In addition to displaying the posters in various locations in the park, they are posted on the park's website and have been taken to a variety of citizen-science meetings in local communities. The public response seems to be very favorable.

It is hoped that during 2008, some additional posters will be added to the series.

Gordon Olson is a Supervisory Biologist.

Shenandoah**Science**

National Park Service
U.S. Department of the Interior
Shenandoah National Park



Forests Under Siege by Exotic Insects & Disease

Humans have introduced a wide array of exotic insects and diseases into eastern forests over the past century. Here in Shenandoah National Park, we have seen the chestnut blight, gypsy moth, dogwood anthracnose, and hemlock woolly adelgid cause significant changes in the forest's composition and health. Because these forest pest species are exotic (they exist outside of their natural range), the park staff strive to control them. Currently, Shenandoah is battling the tiny hemlock woolly adelgid and treating roughly 1300 eastern hemlock trees per year with a pesticide injected into the soil near the roots. Left unchecked, this Asian adelgid threatens to kill virtually all of the park's hemlocks. However, park scientists are committed to saving a lasting remnant of this important species for future recovery or restoration.

Scientific studies are underway to identify new approaches to control exotic insects and diseases.

YOU CAN HELP limit the spread of non-native species by cleaning camping gear, hiking boots, and horse trailers before coming to the park. You are also encouraged to use firewood from local sources rather than transporting it from home.



The woolly adelgid has decimated Shenandoah's hemlocks.
NPS Photo



NPS staff member is treating an eastern hemlock tree with a pesticide injected into the soil near the roots.
NPS Photo



The park is taking steps towards preventing the spread of the emerald ash borer into Shenandoah National Park by encouraging visitors to not transport firewood into the park.
Illustration/Michigan State University, USDA Forest Service

A sample of the posters that can be downloaded from <http://www.nps.gov/shen/naturescience/science-posters.htm>

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