Shenandoah National Park

National Park Service
U.S. Department of the Interior

Resource Management

Shenandoah National Park Boundary Nonnative Plant Survey: 2003 Preliminary Results

By Matthew Arsenault, Nicholas Fisichelli, Cynthia Longmire, James Åkerson, Ronald Nemes

Abstract

The Shenandoah National Park boundary was surveyed for nonnative plant species over the course of the 2003 field season. A total of 255 transects radiating into the Park were established at pre-determined points along the Park boundary. Nonnative plants were identified and coverage estimated at plots along the transects.

Tree of heaven (*Ailanthus altissima*) was the most common nonnative tree species and was encountered in 22% of the plots.

Japanese honeysuckle (*Lonicera japonica*), the most abundant shrub species, was found in 39% of the plots. Wineberry (*Rubus phoenicolasius*) and multiflora rose (*Rosa multiflora*), the second and third most common shrubs, occurred in approximately 20% of the plots.

Garlic mustard (*Alliaria petiolata*), Japanese stiltgrass (*Microstegium vimineum*), and oriental ladysthumb (*Polygonum caespitosum*) were the most abundant forb species along transects and in the forest with 57%, 19%, and 20% occurrence in the plots, respectively. These nonnative species were all able to penetrate deep into the forest from the boundary and were established in designated wilderness areas within the Park. The abundance of oriental ladysthumb and its ability to completely carpet areas of the forest merited its promotion from a non-target to a target species. This species warrants closer study in the future because it is a great threat to the diversity of low growing plants on the forest floor.

The existence of nonnatives followed many trends in the Park. More nonnatives existed in the northern portion of the Park than in the southern, more nonnatives existed on the east side than the west side, and more existed in mesic conditions than in xeric conditions. Precipitation, disturbance, and development along the boundary played key roles in the existence of nonnative plants within the boundaries of Shenandoah National Park.

Eight species of plants, previously unknown within Shenandoah National Park, were identified, collected, and mounted for the Park herbarium.

Garlic mustard (*Alliaria petiolata*)

Tree of heaven (*Ailanthus Altissima*)

The tree of heaven is the only nonnative tree species that penetrated deep into the Park.

Eight species of plants, previously unknown within Shenandoah National Park, were identified, collected, and mounted for the Park herbarium. These species were European columbine (*Aquilegia vulgaris*), greater bladder sedge (*Carex intumescens*), squarrose sedge (*Carex squarrosa*),

rigid sedge (*Carex tetanica*), common scouring rush (*Equisetum hyemale*), climbing milkvine (*Matelea obliqua*), hardy orange (*Poncirus trifoliata*), and beak-rush (*Rhynchospora* spp.).

Introduction

The purpose of the survey was to document the occurrence, coverage, and penetration of nonnative plant species along the Park boundary. Transects were established along the entire boundary at various locations from Front Royal to Waynesboro.

Methods

Circular plots were established at 50 m intervals along 300 m transects. In many cases, transect starting points included trailheads, fire road gates, boundary corners, and convergence with streams, highways, and summits. Nonnative species were identified and divided into tree, shrub, and forb categories. Percent cover for each nonnative tree, shrub, and forb species were estimated as well as the total cover for each of the three categories. Within each 100 m^2 plot, a 1 m^2 subplot was established and centered 2.82 m due north of plot center. Nonnative plants were counted and the percent cover was estimated within each subplot. Tree species were identified as belonging to one of three size classes based on diameter at breast height (DBH) with class 1 trees less than 7.5 cm DBH, class 2 trees between 7.5 and 15.0 cm DBH, and class 3 trees greater than 15.0 cm DBH. Nonnative canopy cover was visually estimated and the total canopy cover was calculated using a spherical densiometer. Slope position, cover type, aspect, and slope percentage were also determined at each plot.

Results

A total of 531 plots were established along 255 transects, with 43 different nonnative plant species documented in plots. Average cover of nonnative trees, shrubs, and forbs varied between districts and boundary sides (Table 1). The average total forb, shrub, and tree layers were all highest on the west side of the north district. The west side of the south district had the lowest average cover of forbs and nonnative trees. The average total tree cover was fairly consistent among the three districts and between the east and west sides.

Table 1. Nonnative Plant Cover.

District	Boundary	Avg Of Forb Total Cover (%)	Avg Of Shrub Total Cover (%)	Avg Of Nonnative Tree Total Cover (%)	Avg Of Tree Total Cover (%)
North	East	11.25	5.40	1.73	81.07
North	West	18.36	7.43	2.88	85.46
Central	East	2.93	3.35	1.59	85.33
Central	West	8.65	3.89	2.27	83.82
South	East	2.84	1.84	1.08	85.24
South	West	1.82	2.05	0.83	83.85

Trees

Tree of heaven was the most abundant nonnative tree species with 1310 individual plants found in 22% of plots surveyed. The majority were categorized as class 1 trees (DBH up to 7.5 cm). These were small saplings and sprouts that did not extend into the canopy layer. In several areas, these small trees covered numerous acres of the Park. A total of 1240 class 1 trees were found in the plots. Only 36 class 2 and 34 class 3 were documented in the plots.

Tree species rarely documented in the plots included princess tree (*Paulownia tomentosa*), Norway maple (*Acer platanoides*), sweet cherry (*Prunus avium*), and paper mulberry (*Broussonetia papyrifera*). Mimosa (*Albizzia julibrissin*) was not observed in the plots and was seen only occasionally along the Park boundary and on adjacent private property.

Tree Penetration

Tree of heaven was the only nonnative tree species that penetrated deep into the Park. Populations were found up to 300 m from the Park boundary along the transects. The other aforementioned tree species were found only up to 100 m from the Park boundary.

Shrubs

More than half of the plots surveyed contained nonnative shrub species. Japanese honeysuckle was the most abundant nonnative shrub, occurring in almost 39% of plots. Multiflora rose and wineberry, the second and third most common shrubs, were found in over 21% of the plots surveyed. Several other nonnative shrubs including Japanese barberry (*Berberis thunbergii*), autumn olive (*Elaeagnus umbellata*), oriental bittersweet (*Celastrus orbiculatus*), kudzu (*Pueraria montana* var. *lobata*), and common privet (*Ligustrum vulgare*) were found in far fewer numbers (Table 2). English ivy (*Hedera helix*) and other target nonnative shrubs including common barberry (*Berberis vulgaris*) were not seen along the Park boundary.

Shrub Penetration

Several nonnative shrubs penetrated deep into the Park from the boundary. The shrubs with the highest cover inside the boundary included Japanese honeysuckle, multiflora rose, and wineberry. These species were all

Table 2. Nonnative Shrub Species In Plot.

Species	# Of Plots	Occurrence (%)	AvgOfCover (%)
No nonnatives	240	45.2	n/a
Japanese honeysuckle	206	38.79	4.7
Wineberry	114	21.47	3.57
Multiflora rose	113	21.28	4.68
Japanese barberry	40	7.53	1.25
Oriental bittersweet	28	5.27	7.61
Common privet	11	2.07	2.09
Autumn olive	2	0.38	1
Kudzu	1	0.19	35

found at 300 m from the Park boundary along transects. Japanese barberry reached 300 m into the Park but only averaged less than 2% cover. Other species including oriental bittersweet, common privet, autumn olive, and kudzu had not penetrated deep into the forest and were found within 200 m of the Park boundary.

Forbs

Nonnative forb species were present in two thirds of the plots surveyed. Garlic mustard was the most abundant forb species. It was established in 57% of the plots monitored. Oriental ladysthumb and Japanese stiltgrass were also extremely abundant along the boundary. Both of these species were common and have a high average cover. Other nonnative forb species occasionally documented in plots but with small average cover included Asiatic dayflower (*Commelina communis* var. *ludens*), common burdock (*Arctium minus*), common mullein (*Verbascum thapsus*), periwinkle (*Vinca minor*), and ground ivy (*Glechoma hederacea*) (Table 3).

Table 3. Nonnative Forb Species In Plot.

Species	# Of Plots	Occurrence (%)	AvgOfCover (%)
Garlic mustard	303	57.06	3.88
No Nonnatives	177	33.33	n/a
Oriental ladysthumb	107	20.15	5.71
Japanese stiltgrass	101	19.02	21.78
Common burdock	21	3.95	2
Asiatic dayflower	19	3.58	1
Common chickweed	12	2.26	1.08
Ground ivy	11	2.07	1.64
Wild madder	11	2.07	1
Common mullein	7	1.32	1
Common dandelion	6	1.13	1
Common St. John's wort	6	1.13	1
Curly dock	4	0.75	1
Periwinkle	3	0.56	31
Mile-a-minute weed	1	0.19	1

Forb Penetration

Several nonnative forb species penetrated deep into the Park from the boundary. The three most prevalent species included garlic mustard, oriental ladysthumb, and Japanese stiltgrass. Other forb species documented did not penetrate deep into the Park or had very low coverage within the plots.

Nonnative Plant Presence in the Wilderness Area

The Shenandoah National Park boundary often coincides with the Park's wilderness boundary. A total of 39 transects were established in designated wilderness. Fifteen nonnative plant species were found in the plots in wilderness. Tree of heaven was the only tree species found in wilderness plots. Five shrub and nine forb species were also identified in these plots (Tables 4 and 5).

Discussion

Physiography and Weather

The boundary survey was divided geographically into north, central, and south districts and also by survey location on the east or west Park boundary. Shenandoah National Park is roughly 70 miles long and contains a wide array of forest ecosystems. Soils, precipitation, and natural and human caused disturbance are a few of the factors that determined the species composition at each transect site.

The south district of the Park had a very apparent difference in moisture levels between the east and west boundaries. Due to prevailing weather patterns, the west side received less rainfall and thus typically had more xeric sites. This information was based on xeric and mesic indicator species found in the forest and through oral communication with the Park Forest Ecologist James Åkerson.

One of the most common forest types found on the boundary was a dry oak or oak/hickory forest. Over-story species included chestnut oak (*Quercus prinus*), hickories (*Carya* spp.), red maple (*Acer rubrum*), and black gum (*Nyssa sylvatica*). Sassafras (*Sassafras albidum*) was the predominant tree in the understory, while the shrub layer consisted of mountain laurel (*Kalmia latifolia*), blueberries (*Vaccinium* spp.), eastern chinquapin (*Castanea pumila*) and azaleas (*Rhododendron* spp.). Generally, no forbs were found in this forest, and the majority of sites contained very few nonnative plants.

Areas with higher available soil moisture provided better conditions for the growth of nonnative plants. These forests often contained more mesic species like tulip tree (*Liriodendron tulipifera*), basswood (*Tilia americana*), bitternut hickory (*Carya cordiformis*), black walnut (*Juglans nigra*), and spice bush (*Lindera benzoin*). In general, higher numbers and coverage of nonnatives were found in these areas, for example the east side of the south district.

The above average rainfall during the 2003 growing season in comparison to three previous consecutive years of drought affected the growth and vigor of all plants. Oriental ladysthumb and Japanese stiltgrass, both nonnative annuals, covered large areas of the forest floor in several areas of the Park this summer. Their dense coverage inhibited the growth of other species, native or nonnative. It is unclear whether the heavy precipitation, in particular, fueled the abundance of these or any other nonnative plants encountered this year. Data from subsequent field seasons with varying precipitation levels could provide information on the effects of precipitation on the profusion of

Table 4. Nonnative Shrubs In Wilderness.

Species	Plots Not in Wilderness	Plots In Wilderness	AvgOfCover in Wilderness (%)
No Nonnatives	205	35	n/a
Japanese honeysuckle	174	32	3.28
Wineberry	97	17	6.47
Multiflora rose	97	16	2.25
Oriental bittersweet	24	4	1
Common privet	10	1	1

Table 5.Nonnative Forbs In Wilderness.

Species	Plots Not in Wilderness	Plots In Wilderness	AvgOfCover in Wilderness (%)
Garlic mustard	262	41	2.24
No Nonnatives	144	33	n/a
Oriental ladysthumb	95	12	1.08
Japanese stiltgrass	89	12	23.92
Common burdock	16	5	4.6
Asiatic dayflower	18	1	1
Common mullein	6	1	1
Common dandelion	5	1	1
Common St. John's wort	3	3	1
Common speedwell		1	1

plants both native and nonnative and how the moisture balance influences the competition among these species.

Position on the landscape also played a role in the existence of nonnative plants. Lowland, stream side plots contained more nonnative plants than neighboring upland areas. Moist soils and openings in the canopy above streams favored the growth of nonnative plants. As transects headed up out of stream bottoms and onto drier sites, coverage of nonnatives dropped significantly.

Disturbance

The presence of nonnatives also increased from south to north with the northern end of the north district having heavily invaded sites. Human-caused disturbance along the wildland/urban interface may have been one of the biggest factors at work in this trend. The most heavily invaded sites along the boundary are located near developed areas. These developed areas included pastures, logging operations, homes, businesses, power line right-of-ways, railroad tracks, and state and county roads. Land outside of the Park is most developed in the north and least developed in the south. Private land along the boundary in the south often contains intact forests that act as extensions of the Park's forest. These unbroken forests operate as a buffer to most nonnative plants, which often require disturbance to colonize an area. Especially in the north district, commercial and residential developments were found in high numbers and close to the Park's boundary. The town of Front Royal pushed right up against the Park. The major highways that run near or through the Park, US 340, US 522, US 211, and US 33, acted as corridors for nonnative plant establishment. The fragmented forest, abundant edges, and open ground have provided ideal habitat for the colonization of many nonnative species adjacent to the Park boundary. These nonnatives are then able to spread their seeds the short distance into the Park. The relentless development and residential sprawl beginning along the Park's boundary is a great threat and concern today and in the future. Aerial photos and other remote sensing techniques may be able to better quantify the development and disturbance occurring along the Park boundary.

Trees

The average total tree canopy cover did not correlate strongly with any of the nonnative plant category average total covers. The forest canopy in the Park was fairly uniform and dense with an average cover around 83%. On a plot by plot basis, though, very low total tree canopy cover often correlated with high coverage of nonnative plants.

The nonnative tree of most concern in Shenandoah National Park was tree of heaven. It was found in large numbers in all three districts of the Park, but was twice as abundant on the east side as on the west side. The south district in particular has four times as many plots with tree of heaven on the east boundary than on the west. The apparently higher soil moisture content on the east boundary of the Park provided more suitable growing conditions. Areas with openings in the canopy, including burned sites, stream corridors, areas of windfall, and areas of "bug kill", can have dense infestations.

Tree of heaven was a light demanding, shade intolerant species. The majority of individuals found fell into the class 1 range; less than 7.5 cm DBH. Many of the infestations contained a high dominance of class 1 trees. A prolific seeder, it produced these areas with high numbers of class 1 trees. Without gaps in the canopy, these seedlings/saplings were unable to mature into the overstory.

Areas with a continuous overstory canopy of tree of heaven also contained an understory of that species. These dense infestations will continually replace themselves and expand into neighboring forests subsequent to any canopy opening disturbance. Native trees were unable

to grow and compete in these dense tree of heaven forests. Large infestations were found in stream side areas, mesic habitats, recent burns and other areas with crown opening events.

Princess tree, though rarely documented within the plots, was occasionally encountered within the boundary of the Park. This tree species often grows along streams and road sides. Protocol rejected plots located partially on roads or in streams and thus princess tree was not found within the plots as often as it was encountered in the field. New, moderate or large infestations of this species were not discovered. Generally it was found singularly or in small groups. The typically dense forest canopy of Shenandoah does not provide sufficient sunlight for light demanding seedlings of this species. However, the seed producing capability of this plant combined with future disturbance could produce large infestations.

Sweet cherry was often found in the forests of Shenandoah. It did not appear to be invasive or form dense thickets. Norway maple also did not appear to be a threat in the Park at this time. Paper mulberry, though somewhat invasive in nature, was only found along one transect and rarely seen in the Park.

Shrubs

Japanese honeysuckle was very widespread and common in a variety of forest types. It was the second most common nonnative recorded in the plots. Generally found in low concentrations, it penetrated deep into the forest. Areas with moderate to high sunlight caused dense growth of this vine on shrubs and up into trees. Streamside areas also appeared to have denser growth than drier, upland areas.

Multiflora rose was a fairly common nonnative plant. An ornamental shrub, it was especially found where the Park boundary was also the wildland/urban interface. The data also suggested that multiflora rose penetrates far into the forest. Moist areas along streams and openings in the canopy encouraged the growth of this plant.

Wineberry was equally as common in the Park as multiflora rose. Wineberry produces delicious fruit during mid-to-late summer. Bears and other woodland animals play a key role in the distribution of the seeds of wineberry. This fact may account for its wide range and penetration into the forest.

Though a problem along Skyline Drive and in isolated pockets, oriental bittersweet was not abundant along the Park boundary.

Other shrubs of concern encountered included Japanese barberry, common privet, autumn olive, and kudzu. Japanese barberry appeared to be able to penetrate well into the forest (300 m), but when encountered averaged less than 2% cover. Common privet and autumn olive were fairly rare and had not infested any significant areas within the Park. Kudzu, always a nonnative species of concern, turned up at only one transect in the Park.

Forbs

Garlic mustard was the most common nonnative plant encountered within Shenandoah National Park. The species showed up in more than half of the plots surveyed and was usually found in very low concentrations of 1-5%. In addition to being very common, it penetrated deep into the forest and was found throughout the Park. The plant grows in most forest types except for very dry sites.

Oriental ladysthumb was fairly common in moderate to moist soil conditions throughout the Park. The similarity among species in the *Polygonum* genus and mid-to-late summer flowering and fruiting character led to some initial difficulties in the identification of the species. Oriental ladysthumb was often found in dense patches along the forest floor, outcompeting all other plants. As mentioned earlier, the wet growing season may have contributed to the robustness of this annual forb. The abundance of this species and its ability to completely carpet areas of the forest merited its promotion from non-target to target species. This species warranted closer study in the future because it was a great threat to the diversity of low growing plants on the forest floor.

Japanese stiltgrass grew in great quantity, especially in the north district of the Park. The often dense cover of this grass, over 20%, can crowd out all other plants. It penetrated deep into the forest and under a continuous canopy. This species maintained an average cover of around 20% from 10 m to 300 m into the Park. The huge acreage this plant covered also makes it detrimental to the health of the forest.

Other nonnative herbaceous plants were far less common within the forest. Orchard grass (*Dactylis glomerata*), crown vetch (*Coronilla varia*), spotted knapweed (*Centaurea maculosa*), black medick (*Medicago lupulina*), coltsfoot (*Tussilago farfara*), common mullein, common dandelion, and others common along roads, trails, and meadows were not able to penetrate into the forest and thus did not show up in our data. Asiatic dayflower and common burdock, both common along edges, were able to penetrate a short way into the forest and thus were picked up on several transects.

Nonnative Plant Presence in the Wilderness Area

The number and percent cover of nonnative species was not drastically different under wilderness and non-wilderness designations. The most common nonnatives in the Park as a whole were also the most common within wilderness. In general, the average percent coverage of nonnatives was slightly lower in wilderness. For example, multiflora rose had an overall average cover of 4.68% and only 2.25% in wilderness. Japanese honeysuckle dropped from 4.7% in non-wilderness to 3.28% average cover in wilderness. On the other hand, Japanese stiltgrass increased from 21.78% in the Park to 23.92% in the wilderness area.

Summary

The data gathered illuminate the composition and coverage of nonnative plant infestations within the Park. Several trends were strongly suggested from the accumulated data. There were, however, limits to the information gleaned from the numbers. The study focused on areas of likely infestation and therefore was biased toward areas with nonnative plants. (Continuation of plots along transects took place only when nonnatives were present. Also, transects could be terminated when the coverage of nonnatives reached a consistent, unchanging, minimal percentage over several plots.) Overall, the study accurately illustrated the high number and concentration of nonnative species along the Park boundary.

Appendix

Additional Tables

Table 6. Nonnative Plant Cover By District.

District	Avg Of Forb Total Cover (%)	Avg Of Shrub Total Cover (%)	Avg Of Tree Total Cover (%)
North	14.24	6.26	2.21
Central	5.54	3.60	1.90
South	2.46	1.92	0.99

Table 7. Nonnative Plant Cover By East and West Location.

Survey location	Avg Of Forb Total Cover (%)	Avg Of Shrub Total Cover (%)	Avg Of Tree Total Cover (%)
East	5.97	3.61	1.47
West	10.43	4.72	2.11

Boundary Survey Crew Members: Cynthia Longmire, Matthew Arsenault (Biological Science Technicians), Natalie Yacobucci (Student Conservation Association), and Nicholas Fisichelli (Biological Science Technician).

James Akerson is a Supervisory Ecologist & Ronald Nemes is a Lead Biological Science Technician.

Fisheries Monitoring Update: Recent Trends and New Developments

By Jim Atkinson

Park streams finally got a reprieve from the prolonged drought that has been in effect since the late 1990s but not in time to forestall negative affects on fish populations, particularly brook trout. A total of 2640 brook trout were captured from 46 monitoring transects along 22 park streams during 2003. This represents a 58 percent decline from the Parkwide brook trout sample during 2002. Fish populations were most severely impacted in the North Fork, Moorman's River, sections of which ran nearly to completely dry during the late summer and fall of 2002. Reduced fish populations were also most pronounced in the smaller, primarily first order streams that drain the western slope of the Park. Annual production and recruitment were fair to good this year; however, as young-of-the-year (YOY) trout comprised approximately 40 percent of the albeit reduced Parkwide total sample.

Monitoring efforts and associated fish capture totals during 2003 were hampered to a degree by high flow conditions along most Park streams due to near constant runoff from a series of persistent rain events that extended from late May through early August. Runoff swollen streams pose a range of difficulties to an electrofishing crew including reduced mobility, increased resistance against the gear (nets and probes) and reduced visibility within the water column, all of which function to reduce fish capture efficiency.

Monitoring program results for the past eight years clearly illustrate the explosive dynamic in both directions that is typical of fish communities in mountain stream habitats. The highly prolific nature of brook trout and other fish species encountered within Park streams provides the degree of resilience necessary to ensure sustainable and viable populations over the long term in habitats that routinely experience flow extremes. Within all years, trout density and biomass estimates tend to track directionally similar between most park streams. One of the most dramatic parallels that best illustrates this trend exists between North Fork, Dry Run (Figure 1) and the Hughes River (Figure 2). Both streams share a granitic bedrock type and associated water chemistry characteristics. Dry Run however is a fairly small, first order stream located along the western slope (Potomac Drainage) while Hughes River is a large third order stream located just across the ridge on the eastern slope within the Rappahannock Drainage.

Shenandoah fish shocking crew.

The only new Park stream added to the schedule this year was Stull Run, a small drought prone stream located along the western slope (just north of Paine Run) in South District. Stull Run shares the bedrock and associated water chemistry characteristics of the most sensitive (acidic) streams in the Park. An initial reconnaissance visit to the stream during early September revealed an absence of any fish from the Park boundary to approximately 1800' elevation which includes well over half of the total length of the stream.

Considering the surge in water flows this year and the tendency of stream fish to move upstream during periods of increased flow, no new fish species were encountered within Park streams during 2003. The current list of fish species encountered within the Park as the result of the fisheries monitoring program includes 33 species in addition to the tiger trout hybrid. Of these, 26 species maintain a permanent or near permanent presence within Park streams from year to year. There are a number of additional fish species located within several miles of the Park boundary along some of the larger streams that have the potential to move up into the Park at times.

Preliminary results from the U.S. Geological Survey (USGS) project

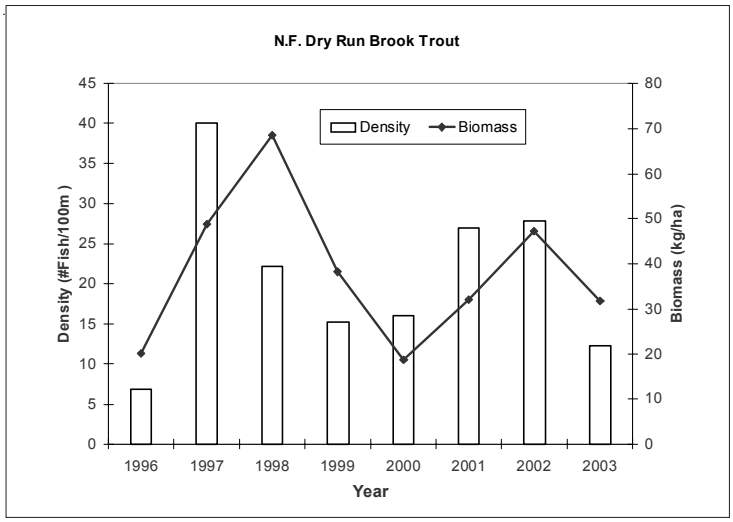


Figure 1. Summary of density and biomass estimates for North Fork, Dry Run brook trout for the period of 1996 to 2003.

to identify genetic diversity among brook trout populations within Park streams demonstrates clear distinction (and thus difference) between trout populations within the three major drainages (Potomac, Rappahannock and James) of the Park. One particularly interesting revelation from this project to date is the discovery that trout sampled from the Rapidan and lower Staunton Rivers are of southern strain origin, not the northern strain that is native in the northern Blue Ridge of Virginia. From U.S. Fish and Wildlife Service (USFWS) stocking records within the Park back in the mid 1950s, there was a documented release of 22,000 southern strain brook trout within 13 Park streams including the Rapidan River. These fish originated from a hatchery in Erwin, Tennessee. Following a severe flood event during August, 1955 (immediately following the trout stocking effort), the USFWS surmised that few if any of the young trout had survived. It is now obvious, nearly 50 years later, that was not the case. The Park will receive Natural Resource Preservation Program (NRPP) funding beginning in 2004 to extend the current project to include all trout streams within the Park.

Another USGS, NRPP project that has been approved and is likely to be funded in 2004 will investigate the effects of streamwater chemistry on mercury (Hg) concentrations in brook trout within a suite of Park streams. The goal of the study is to ensure that Hg contamination poses no threat to humans or fish populations in the Park. The specific objectives are to determine the distribution, abundance, and variability of Hg in fish in Shenandoah National Park, and to assess the relationship between streamwater chemistry and Hg concentrations in brook trout. Mercury is a toxic element that naturally occurs in aquatic systems in very low concentrations. Past human use of the metal for industrial and agricultural purposes has resulted in serious contamination of many surface waters. Even in remote, relatively pristine areas where direct anthropogenic inputs are lacking, long-range atmospheric transport of Hg from fossil fuel combustion and other sources has led to increased concentrations in freshwater systems and biota. Fish for this study will be randomly collected from selected streams as a component of the 2004 field season.

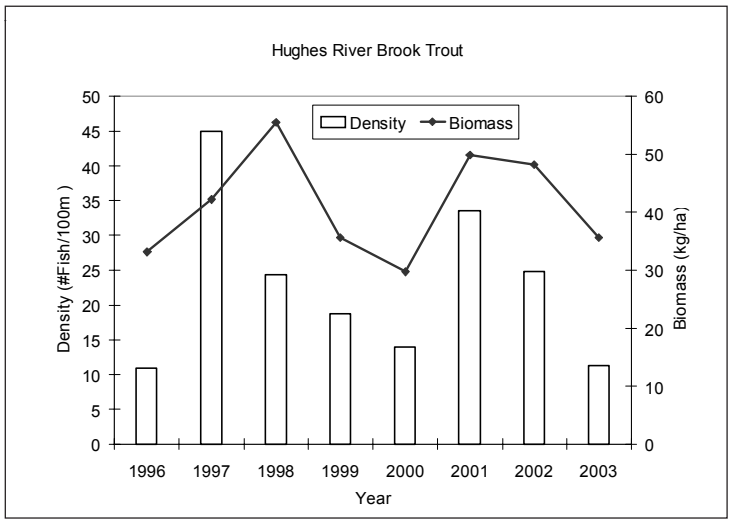


Figure 2. Summary of density and biomass estimates for Hughes River brook trout for the period of 1996 to 2003.

Jim Atkinson is a Wildlife & Fisheries Biologist.

National Park Service
U.S. Department of the Interior

Shenandoah National Park lies astride a beautiful section of the Blue Ridge, which forms the eastern rampart of the Appalachian Mountains between Pennsylvania and Georgia. In the valley to the west is the Shenandoah River, from which the Park get its name, and between the north and south forks of the river is Massanutten, a 40-mile-long mountain. To the east is the rolling Piedmont country. Providing vistas of the spectacular landscape is Skyline Drive, a winding road that runs along the Blue Ridge through the length of the Park.

Address
Shenandoah National Park
3655 Highway 211 East
Luray, Virginia 22835

The National Park Service cares for the special places saved by the American people so that all may experience our heritage.

2003 Peregrine Falcon Monitoring, Restoration, and Tracking Update

By Rolf Gubler

Status and Monitoring

Over the past several years, peregrine falcon recovery has been slow to non-existent in the Central Appalachians. In 2003, there were no documented successful nesting pairs in the mountains of Virginia, West Virginia, or Maryland. Additionally, no peregrine falcons were sighted during spring cliff surveys from March to May at Shenandoah. The peregrine falcon is currently listed as threatened under Virginia law.

Restoration

Working cooperatively with Center for Conservation Biology at the College of William and Mary (CCB) and the Virginia Department of Game and Inland Fisheries (VDGIF), staff members at Shenandoah hacked*, released, and successfully fledged ten young peregrine falcons in 2003. This was done through the Foster Falcon Program – a Virginia peregrine restoration partnership with the CCB, VDGIF, and Shenandoah. Its purpose is to remove young, (at-risk) falcons from coastal Virginia bridge nests (where fledgling survival rates have been poor due to premature fledging over open water) and relocating them to Shenandoah. The ultimate goal is to improve survival rates of young falcons in Virginia and to boost peregrine numbers in the Central Appalachians.

Tracking

Shenandoah staff members assisted the CCB in fitting 18-gram solar-powered satellite transmitters onto three of the ten falcons released at Hawksbill Mountain. Of these "tracked" falcons, one falcon is currently active, and two falcons have died. One female falcon went down near Stanley, Virginia (recovered satellite transmitter on February 19, 2004) and the other went silent in December 2003 after a major snowstorm. The female falcon that is still active in the study migrated to Long Island, New York during September 2003 and is still there as of February 2003 (see map on next page, SHEN03-01). Seven falcons without transmitters successfully fledged in June of 2003. However, one female falcon died of unknown causes in late July and her leg bands were recovered northwest of Hawksbill Mountain near the Appalachian Trail. The other six falcons (4 males and 2 females) are presumed to be alive.

Adult peregrine in flight. Photograph courtesy of Craig Koppie.

Additionally, a female falcon (*9/*B) that Shenandoah sponsored in 2002 wintered in the outskirts of New York City (near JFK Airport) in 2002/2003. She began her spring dispersal in March 2003. Shortly thereafter, she traveled through New York, New Jersey, Pennsylvania, West Virginia, Ohio, Virginia, Maryland, and Kentucky. She spent most of her summer near the border of Pennsylvania and Ohio. She is currently wintering in Pittsburgh, Pennsylvania as of February 2003.

Education/Web Information

Natural Resources staff worked with the Interpretative Division's Visual Media staff to begin developing a Peregrine Falcon Restoration and Natural History webpage within the Park's website (http://www.nps.gov/shen/).

Plans for 2004

Staff will continue annual spring cliff surveys targeting historic peregrine nesting areas throughout the Park. In order to increase the likelihood of a breeding pair, we are planning to implement temporary cliff closures at Hawksbill Mountain and Crescent Rocks during the peregrine

*Hacking refers to the practice of taking falcon chicks and placing them on a suitable cliff habitat in a protected hackbox. It also involves feeding them, monitoring them, and protecting them during the periods before and after release (while minimizing exposure to humans). During this process, the hacked falcons begin imprinting on the cliff site/hack site. They quickly become self-sufficient and disperse in late summer. The hope is that they return to these cliffs (or nearby cliffs) and nest in future years.

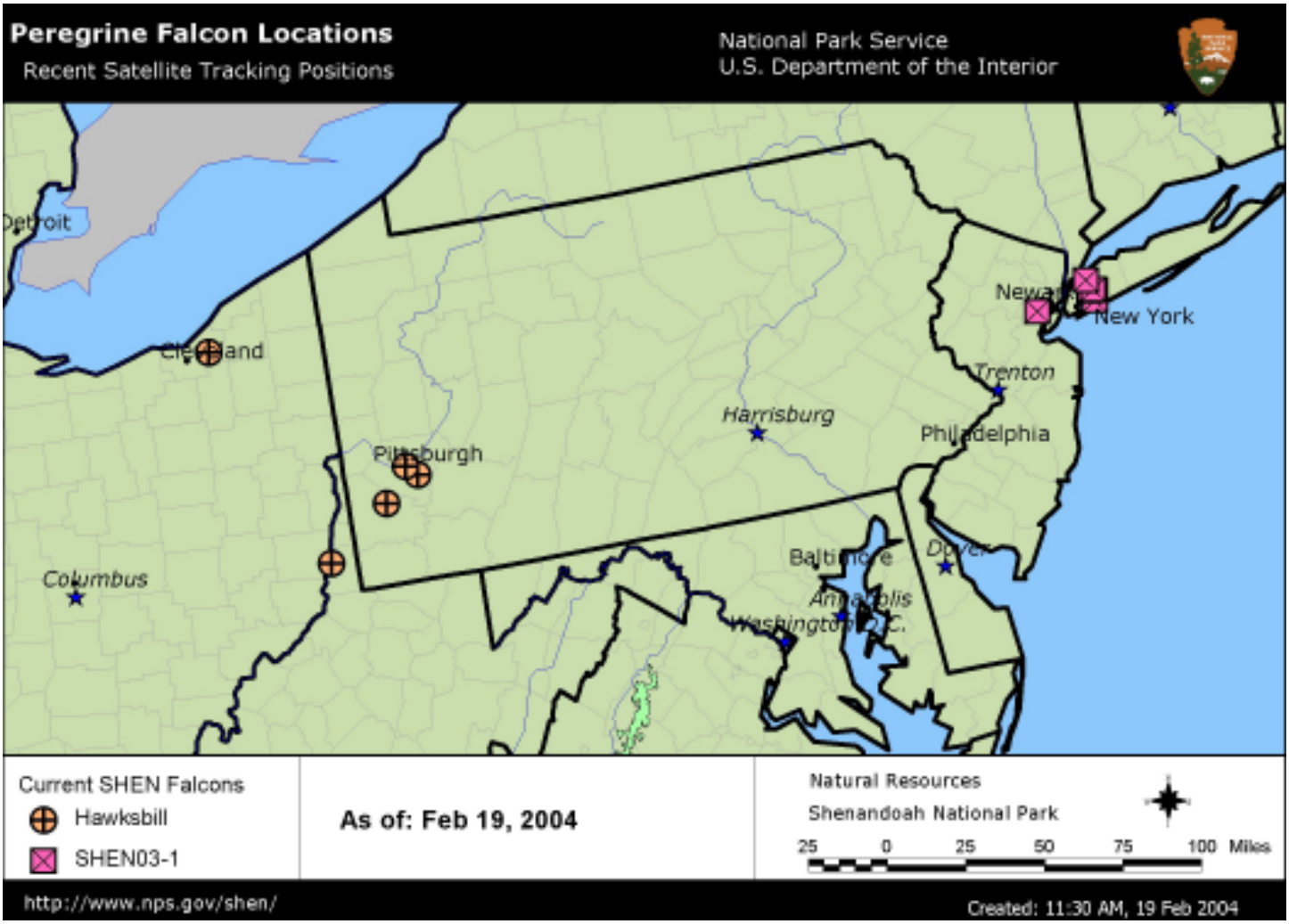
courtship period. Closure periods should extend from mid- March to late April 2004.

Working cooperatively with the CCB and the VDGIF, we plan to hack and release 4-10 at-risk falcons in Shenandoah. In order to minimize disturbance to the young falcons, we will implement a temporary closure of the cliff area located south of Hawksbill Summit including the nearby 80-yard connector trail (late May - July).

Working with the CCB and VDGIF, we will continue to support the multi-agency FalconTrak Project and track peregrine falcons in Virginia to learn more about peregrine migration patterns, behavior, and to identify new nesting pairs. Ultimately, the FalconTrak Project which utilizes satellite tracking technology, will aid in the monitoring of the peregrine's long-term recovery. This directly supports the USFWS's five-year monitoring goal of any recently de-listed federally endangered species.

Finally, we will continue developing the Park's peregrine falcon webpages and support the CCB's VAFalcons website (http://fsweb.wm.edu/ccb/) in order to disseminate peregrine falcon restoration information, FalconTrak information, and satellite tracking status to the interested public and scientific community.

Rolf Gubler is a Biologist.



This falcon tracking map shows the locations of the SHEN-released falcons as of February 2004. This map is now a permanent feature of the Park's peregrine falcon web pages (http://www.nps.gov/shen/).

Big Meadows Vegetation Responds Successfully to Management

By Wendy Cass

Four years have passed since the Park began its most recent effort to preserve the Big Meadows landscape. One goal of the project was to explore the success of different management techniques at modifying and maintaining the Meadow vegetation. Combinations of mowing and burning have been our primary vegetation management tools since the project began in 2000. Today, differences are clearly visible when you look out across the Meadow (Figures 1 and 2), but what exactly has changed?

Figure 1. July 1999 view of Big Meadows facing south from Skyline Drive.

The Park vegetation monitoring personnel have been working to quantify these changes by sampling throughout the Meadow from 1998 – 2003, and can now provide a more detailed picture of what has occurred. Monitoring efforts have focused on measuring percent cover of three vegetation groups: herbs, low shrubs (woody plants < 0.5 m tall), and high shrubs (woody plants ≥ 0.5 m tall). Vegetation trends were examined individually for three separate sections of the Meadow (Upland, Wetland, and Western), because of differences in plant composition, historic treatment, and current management regimen (Figure 3). Yearly samples taken along 79 transects, each 50 meters long, show clear changes in the abundance and composition of these vegetation groups within each Meadow section.

Over the course of our recent management activities, Upland and Western sections of the Meadow have shown a steady decrease in the cover of tall shrubs such as deerberry (*Vaccinium stamineum*) and maleberry (*Lyonia ligustrina*), with a simultaneous increase in the cover of grasses and other herbs. Changes were most pronounced in upland areas after the Fall mowing of 2000, but have been successfully maintained by subsequent burns (Figures 4 and 5). Changes in low shrub cover have been more variable. An initial flush of sprouting followed the 2000 burn, however cover was then decreased by mowing and maintained for one year at a lower level by burning. In 2003, a rebound in low shrub cover composed mainly of late low bush blueberry (*Vaccinium pallidum*) is clearly visible. This was likely the result of the increased sprouting encouraged by fire coupled with above-average rainfall amounts.

The Wetland section of the Meadow has also undergone similar, but even more pronounced changes. In the case of the Wetland, however, all changes are the result of yearly burns (2000 – 2003). The 2000 fire burned particularly aggressively through the Wetland as it consumed the densely growing fine stems of meadowsweet (*Spirea alba*). Subsequent burns were less intense, but have clearly decreased and maintained lower levels of high shrub cover, and increased and maintained higher levels of herb and grass cover (Figure 6). Low shrub cover shows a rebound similar to the trend visible in the Upland and Western meadow sections. This trend was also likely the result of greater available moisture.

Numerous Park employees have been involved in recent efforts to manage and monitor the vegetation of Big Meadows. The interdivisional working group formed in 1999 to recommend management actions for the Meadow continues to meet and

Figure 2. July 2003 view of Big Meadow facing south from Skyline Drive.

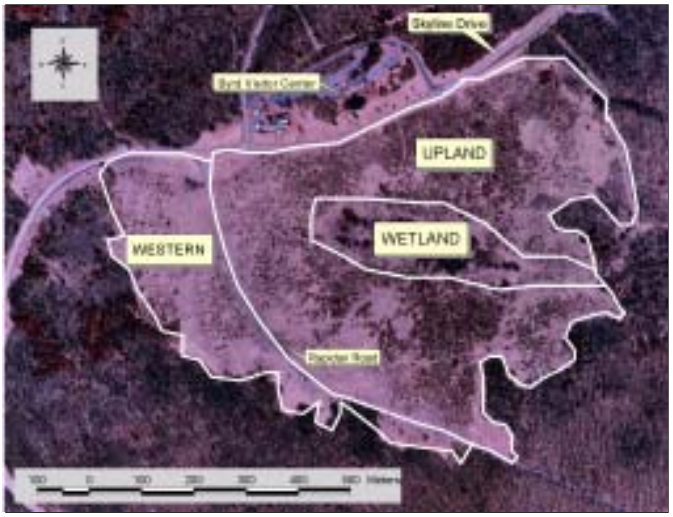


Figure 3. Aerial photo of Big Meadows (1993) showing the location of the three vegetation sampling sections – Upland, Wetland, and Western.

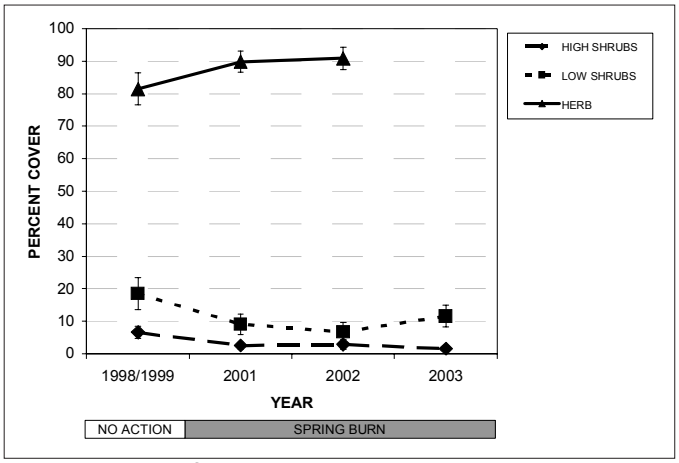


Figure 5. Graph of High Shrub, Low Shrub, and herbaceous (Herb) vegetation percent cover in the Western section of Big Meadows over four sample periods. All sample periods cover one year except for the initial sample period which spans 1998 and 1999. Values represent the mean cover + the standard error of the mean. No data were collected in 2000 because this section of the Meadow was omitted from management actions. Herbaceous cover was not sampled in 2003. Management actions for the Western Meadow are shown below the bottom of the graph.

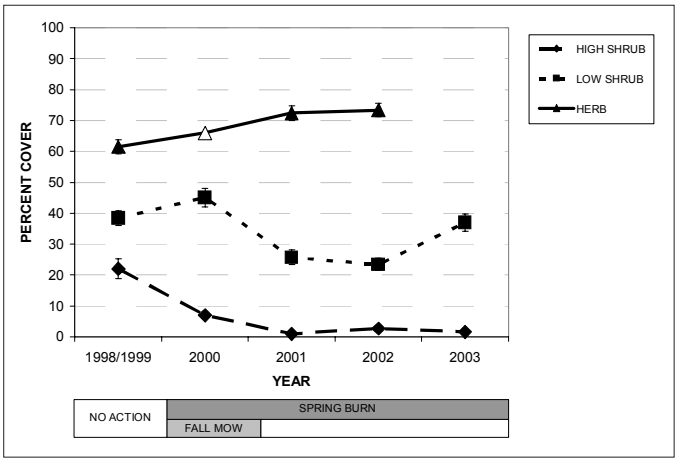


Figure 4. Graph of High Shrub, Low Shrub, and herbaceous (Herb) vegetation percent cover in the Upland section of Big Meadows over five sample periods. All sample periods cover one year except for the initial sample period which spans 1998 and 1999. Values represent the mean cover + the standard error of the mean. Herbaceous cover was not sampled in 2000 or 2003. Management actions for the Upland Meadow are shown below the bottom of the graph.

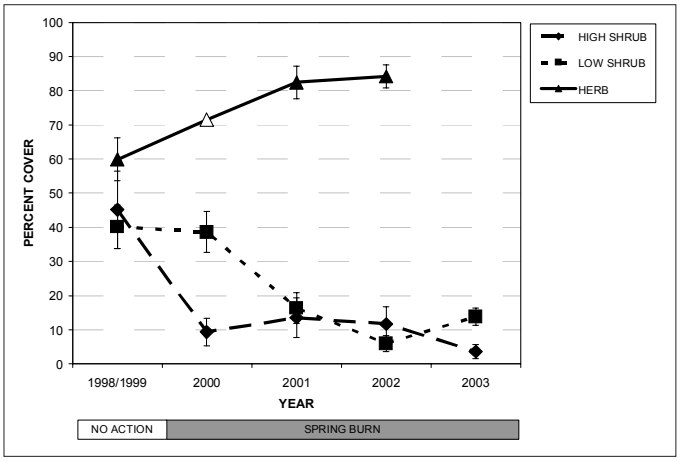


Figure 6. Graph of High Shrub, Low Shrub, and herbaceous (Herb) vegetation percent cover in the Wetland section of Big Meadows over five sample periods. All sample periods cover one year except for the initial sample period which spans 1998 and 1999. Values represent the mean cover ± the standard error of the mean. Herbaceous cover was not sampled in 2000 or 2003. Management actions for the Upland Meadow are shown below the bottom of the graph.

make progress toward a revision of the 1985 Meadow Management Plan. Our knowledge of the recent vegetation changes combined with prior studies will play an important roll in designing the new plan so that it is a success.

Wendy Cass is a Botanist.

A Nationally Funded Tactical Exotics Team Gets Started

By James Åkerson

The Problem

What's worse than kudzu vine smothering a once pristine forest? Try several dozen invasive exotics doing the same thing, all at the same time. That's what is going on at Shenandoah and other parks around us. Through crowding, smothering, and chemical warfare, they are damaging our native species and ecosystems. Though many plants don't have recognizable names, they are exerting intense pressure upon our forests and meadows. Perhaps one day we'll know them with names like, "Godzilla."

Westbrooks (1998) believes that the homogenization of the world's flora and fauna leads to decreased biological diversity and long-term harm. He states, "Unlike chemical pollutants that degrade over time, invasive organisms can become established and reproduce. Once established, they can spread from site to site, and region to region, often without further human assistance." Elton (1958) believes that many native species will decline or disappear altogether.

Throughout the history of European settlement of the Americas, exotic species have both been introduced accidentally, with new immigrants or on trade goods, or with the purpose of the supposed betterment of human health, agriculture, and land reclamation efforts. Negative impacts were realized early on. Farmers and ranchers became early proponents of "noxious" weed control to fight the economic losses due to invasions of various weeds upon their grazing and agricultural lands.

In the last decade, the National Park Service (NPS) has taken steps to create a concerted effort to control invasives. Resisting biological invasion is an essential part of our mission to "conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations" (US Congress 1916). Indeed, not actively controlling exotics is abetting their expansion and consequent resource derogation.

Parks within the Mid-Atlantic area have specifically increased their knowledge of local infestations and exotic plant control technologies since the mid-1990s. Colonial National Historic Park, Gettysburg National Military Park, and Shenandoah National Park created small programs to inventory and control invasives. With a successful NPS grant proposal in FY 2000 for the creation of a traveling exotics team for parks in Virginia, there began an effort to cooperate with sister parks and collaborate with surrounding landowners to control the worst of the known infestations. The momentum and expertise garnered during the 2000-2002 period became invaluable for the emerging Mid-Atlantic Cooperative.

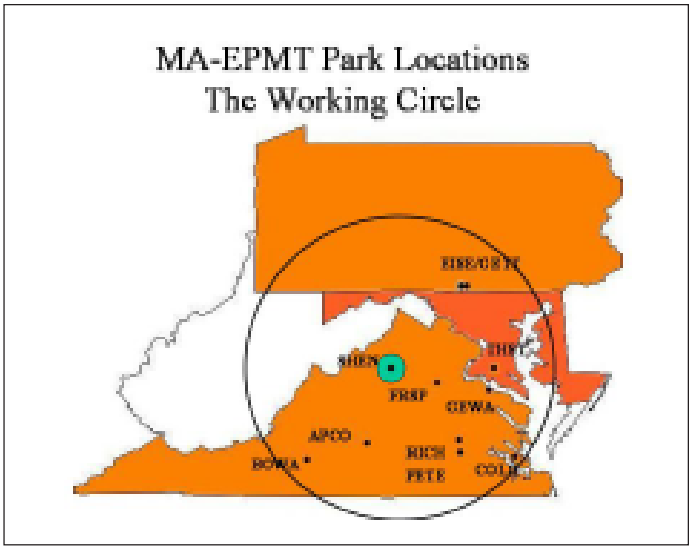


Figure 2. Map illustrating the general locations of partner parks within the Mid-Atlantic Cooperative.

The Mid-Atlantic Exotic Plant Management Team

This was the first year of the newly formed team. It began with some frustration since federal policy does not allow new programs to begin operations until Congress authorizes appropriate funding. Congress delayed its final approval of the FY 2003 Interior Budget until after February 2003, fully five months into the fiscal year. Activity and results are therefore reflective of one-half year.

The Mid-Atlantic Exotic Plant Management Team operates under the umbrella of its overarching Mid-Atlantic Cooperative of eleven parks. Housed at Shenandoah National Park, the organization serves national parks in Virginia, Maryland and Pennsylvania. Representatives from each park comprise the Steering Committee that provides management direction and priority setting.

James Åkerson, Team Liaison, provides daily operations leadership and coordinates all activities with individual parks. Norm Forder, Crew Leader, provides direction for on-the-ground activity and oversees matters of safety, equipment maintenance, and staff training. The crew members include Rodney Martinez, Biological Science

National Parks	State
Appomattox Court House National Historic Park	VA
Booker T. Washington National Monument	VA
Colonial National Historic Park	VA
Eisenhower National Historic Site	PA
Fredericksburg and Spotsylvania County Battlefields Memorial National Military Park	VA
Gettysburg National Military Park	PA
George Washington Birthplace National Monument	VA
Petersburg National Battlefield	VA
Richmond National Battlefield Park	VA
Shenandoah National Park **(Host Park)**	VA
Thomas Stone National Historic Site	MD

Partner Parks of the Mid-Atlantic Cooperative

Technician, Dale Meyerhoeffer, Biological Science Technician, and other temporary employees and volunteers. Part of the team during July-August 2003 was Rasmus Jorgensen, Danish forestry student. Russian education/geography student, Svetlana Goudkevitch, was with us October 2003 – January 2004. A private contract was let during the year so that beginning in FY 2004, work is also being performed by Invasive Plant Control, Inc., a company with Southeastern experience.

Partnerships with park staffs and neighboring landowners are increasing the effectiveness of treatments and broadening the organizational capacity to successfully address invasive exotic plants within the Cooperative. In-kind contributions of staff time, vehicle fuel, storage facilities, and housing totalled an estimated $73,600, amounting to 20% of total program value. This contribution is expected to nearly double next year.

Helping parks to focus on and target exotic plants that are both environmentally serious as well as programmatically achievable (controllable) has been an important function of the team's time and expertise. The span of targeted exotic species for parks within the Cooperative is quite wide. It can be said, however, that a common threat are the fast growing vines, such as kudzu, mile-a-minute, Oriental bittersweet, and Japanese honeysuckle. Other common targeted highly invasive exotics include tree of heaven, common reed, Japanese barberry, Japanese stiltgrass, Johnson grass, multiflora rose, and privets.

Notable Achievements

The following team achievements are notable for FY 2003.

- Created the team by advertising and filling four permanent positions, two temporary positions, and one student intern position. Hiring took place during the period April 6 through August 10.
- All staff members became certified to apply herbicides within the Commonwealth of Virginia[1]. Additionally, the Team Liaison became certified to apply herbicides in Virginia, Maryland, Pennsylvania, and West Virginia to oversee activities in those states.
- Conducted field inventories on 1,112 acres at nine parks. Controlled exotic vegetation on 63.5 acres at nine parks.
- Initiated and completed a contract to conduct exotic plant control on 121.5 acres using a private sector contractor in FY 2004.
- Initiated a cooperative bamboo control project with two Park neighbors of Shenandoah National Park where each party will contribute to the overall 0.4-acre eradication effort.
- The Mid-Atlantic Cooperative's approach to exotic species prioritization became a benchmark for other teams when it was selected for presentation to the US Department of the Interior Science Advisor and Deputy Assistant Secretary (Budget & Policy) in August.
- Initiated or responded to public outreach initiatives such as: (1) a day-long presentation to the University of Richmond ecology class on invasive exotics, and several one-hour talks to such groups as the Federal Executives and Shenandoah adult education seminar; (2) media interviews with three newspapers, four professional newsletters, and a Washington, DC, radio station; and (3) presented poster papers at a professional conference.
- Initiated discussion within the Cooperative for our FY 2004 budget and work plan. The resulting document was approved in November and became a benchmark for the other teams around the country.

Rodney Martinez, Biological Science Technician and Svetlana Goudkevitch, Russian Education/Geography student, apply herbicides at Appomattox Courthouse National Historic Park.

Building and Growing

As one writer put it so aptly, "Unlikely as it may seem, a new National Park Service job recruiting ad might read, 'Wanted: A few good men and women with the killer instinct'" (Toops 2003). That may well be what it takes to begin controlling unwanted exotics. Formation of the Mid-Atlantic Cooperative is an essential step to build and grow a program to save our natural and cultural resources from irreparable harm.

[1] Certification is generally required only of the Team Liaison or Crew Leader. Having all crew members become certified indicates the organization's high degree of interest in risk management and personnel safety.

Come join us. If you find exotics in remote areas of Shenandoah and its partner parks, let local resource managers know about them. Encourage local plant nurseries to trade in native stock or at the very least non-invasives. If you would like to use your muscles to good purpose, come help us uproot, cut, spray, or otherwise put the hurt on invasive exotics. It's good for the land, good for the soul.

James Åkerson is a Supervisory Ecologist.

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The 2003 Mid-Atlantic Exotic Plant Management Team; from left to right, James Akerson, Team Liaison; Rasmus Jorgensen, Danish forestry student; Kate Jensen, Biological Science Technician; Norman Forder, Crew Leader; Rodney Martinez, Biological Science Technician; and Dale Meyerhoeffer, Biological Science Technician.

A Synopsis of "Studies of Benthic Macroinvertebrates for the Shenandoah National Park LTEM: Statistical Analysis of LTEMS Aquatic Dataset from 1986 to 2000 on Water Chemistry, Habitat, and Macroinvertebrates"

By David Demarest

In May 2002, Michael D. Moyekens and J. Reese Voshell from Virginia Tech (VT) completed a report titled "Studies of Benthic Macroinvertebrates for the Shenandoah National Park Long-Term Ecological Monitoring System: Statistical Analysis of LTEMS Aquatic Dataset from 1986 to 2000 on Water Chemistry, Habitat, and Macroinvertebrates". The VT work that lead to the report was a statistical analysis of Shenandoah's existing dataset aimed at "1) selecting a suite of metrics that will be effective for long-term biomonitoring of benthic macroinvertebrates in Shenandoah National Park (SNP) streams; 2) ascertaining the ecological condition of streams in SNP as compared to other similar streams in the Blue Ridge Ecoregion; 3) determining if the ecological condition of any streams differs within SNP, and, if so, which ones are different and whether the differences are related to any of the likely causative factors in SNP; and 4) if the ecological condition of SNP streams compares favorably with that of streams outside SNP and if the ecological condition of streams is consistent within SNP, deciding if the current benthic macroinvertebrate biomonitoring protocol in SNP is effective at discerning impaired ecological condition if significant pollution or environmental stress did occur in SNP".

Moyekens and Voshell selected twelve metrics for Shenandoah's staff to use to determine the ecological conditions of Park streams. These will help define if there is a problem with a specific site or stream as well as allow staff to compare Park streams with those outside the Park.

Moyekens and Voshell used these twelve metrics to analyze the Park's existing data. From this analysis, they found the only distinct changes that occurred within the insect community were between "low" acid neutralizing capacity and "normal" acid neutralizing capacity streams (ANC). There was no major difference between "medium" and "high" ANC; therefore, they lumped them together and called them "normal ANC".

In their comparison of Park streams to those found elsewhere in the Blue Ridge, Moyekens and Voshell found Shenandoah's streams are "comparable to the best that can be found in the Blue Ridge Ecoregion". They found this to be true even when comparing the low ANC streams and felt that a difference in sampling techniques may cause the burrowing macroinvertebrates to be sampled more easily in Shenandoah than the techniques typically used outside the Park. This sampling technique, along with the more tedious method of identifying the whole macroinvertebrate sample instead of a subset, may lead to a slightly higher statistical value for Park samples.

Past studies have shown that farming and logging can have an effect on watersheds for many years (Harding et al. 1998). Moyekens and Voshell looked at the Park's past land use by the number of buildings in each watershed at the time the land was purchased. There was no significant difference in macroinvertebrate communities within similar watersheds except for the low ANC types. A possible explanation for this is the high gradient of most Park streams allowed the siltation from past uses to be quickly exported out of the system allowing for a rapid recovery. By watershed, Moyekens and Voshell's analysis did not show that our current road and trail system was having an effect on the aquatic macroinvertebrate community. Finally, the metrics were tested against known impaired datasets from the Blue Ridge Ecoregion and were proven to be effective.

Park staff is currently utilizing the new statistical metrics to draft the first comprehensive report by site and stream.

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David Demarest is a Biological Science Technician.

A Synopsis of "Recovery of Aquatic Macroinvertebrate Communities Following a 500+ Year Flood Event in Shenandoah National Park"

By David Demarest

On June 27, 1995 two different storm cells pushed into Shenandoah National Park after four days of heavy rains had already saturated soils. These two cells dumped rain at a rate of about 19+ inches per hour. The result in the Staunton River and two other drainages within the Park was a flood event of 500+ year's magnitude.

In April 2002, Zane B. Johnson and Craig D. Snyder of the United States Geological Survey (USGS), completed their work on "Recovery of Aquatic Macroinvertebrate Communities Following a 500+ Year Flood event in Shenandoah National Park". The USGS study compared the severely flood impacted Staunton River to the relatively unaffected Whiteoak Canyon Run. The main goal of this project was to see how the community and productivity had changed in response to the altered habitat rather than how badly the flood had affected the aquatic macroinvertebrate assemblage. Collection work on this project was started in the fall of 1998 and was completed in the spring of 2001. Whiteoak Canyon Run was chosen as a reference to the Staunton due to the same approximate number of tributaries and drainage size. Ten sites were sampled on the Staunton and eight on Whiteoak.

On the Staunton River, USGS scientists found that mean daily water temperatures at the downstream site were significantly higher than the mean daily temperatures at the upper sites in the spring, summer and fall seasons. On Whiteoak Canyon Run, they found there was no significant difference between the mean daily water temperatures at the sites and inferred that the loss of canopy due to the flood resulted in higher downstream temperatures on the Staunton. Looking at substratum, they found that the stream bottom composition was too variable, even within the same site, to be helpful differentiating between sites.

In the flood affected sites of the lower Staunton River, they found the expected community change of a lack of shredders, the insects that break down leafy and woody material in the stream. This is because of the lack of those inputs due to nonexistent riparian cover. However, the scraper groups (species that scrape algae off the substrate) have increased dramatically in that section due to the increase in algae (an effect of increased light). They also found an increase in caddisflies and mayflies that are classified as grazers and filter feeders. These species are typically found more abundantly in Piedmont than in mountain regions but have found a new niche due to the increased light.

USGS scientists also measured secondary production of macroinvertebrates by sampling certain sites once a week at certain times of the year, taking a subsample of insects collected, identifying, and measuring each one in the subsample. By doing this, they were able to estimate the biomass per square meter for almost every insect species collected and compare the impacted and non-impacted reaches of stream. This information was then condensed to trophic group percentages. Using this technique, they determined that scrapers composed about 30% of the yearly community production in the impacted sites and only 15% in the unimpacted sites; shredders 1% in the impacted sites and 12% in the unimpacted sites; gatherers were almost the same at about 34% each; collector-filterers 20% in the impacted sites and 11% in the unimpacted sites; and predators 21% in the impacted sites and 25% in the unimpacted sites.

Some studies in clearcut watersheds have shown benthic community's to recover in as little as 16 years (Stone and Wallace, 1986) but Harding et al.(1998) found that after 47 years many southern Appalachian watersheds had not recovered to predisturbance levels. The large wood debris in the stream that catches leaf litter and other vegetative debris for insects to feed on were also washed away with the flood event. As this material is replenished and the riparian cover redevelops in the lower Staunton, the insect community will gradually revert to what it was with more shredder type macroinvertebrates. Until then, the scrapers and collector-filterers will dominate the substrate and how long "recovery" will take is anyone's guess.

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David Demarest is a Biological Science Technician.

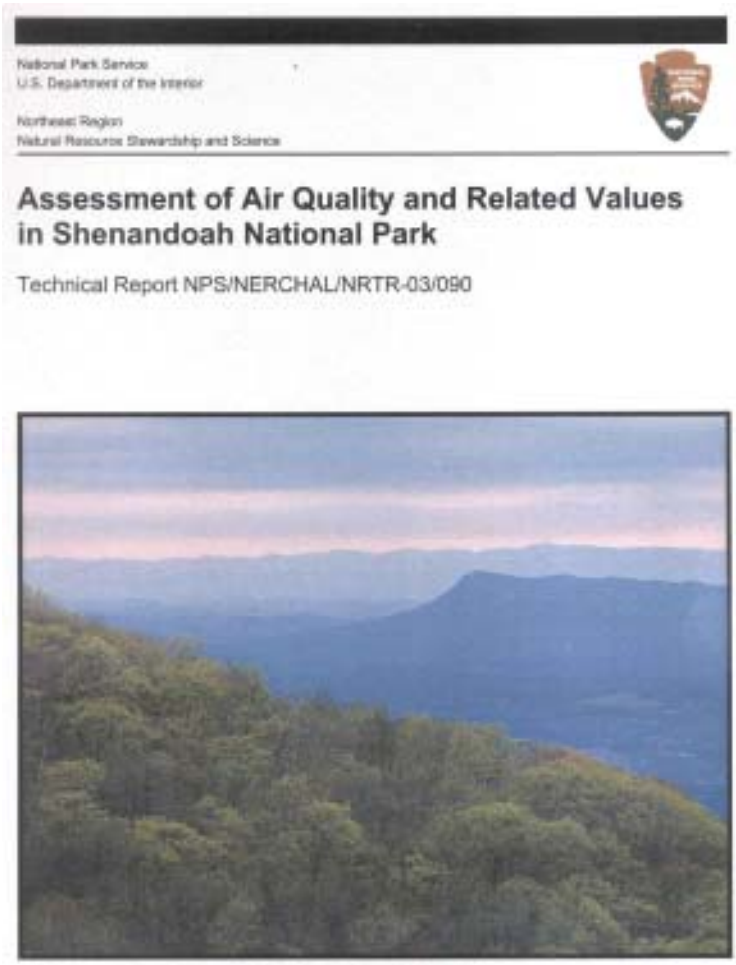
Air Quality Assessment

By Gordon Olson

A multi-year effort spearheaded by Christi Gordon, the Park's former Air Resources Specialist, came to closure with the publication of the *Assessment of Air Quality and Related Values in Shenandoah National Park*. This voluminous document is anticipated to be a watershed document for years to come. It provides an exhaustive summary of what is known about air quality at the Park as well as the environmental impacts of polluted air. Prepared by a team of fourteen scientists and technical experts, the document pulls large quantities of information from disparate sources together. It also contains numerous graphs, charts, tables, and diagrams which help explain report findings.

Many significant findings related to emissions and pollutant transport are documented in the report. For instance, emission of sulfur dioxide from point sources, or single industrial facilities, have the greatest effect on Park resources. In-Park emissions, or those generated by Park operations, only constitute one percent of the total human-made emissions within the eight counties that include Shenandoah. Emissions from sources in thirteen eastern states account for 80 percent of the acid deposition and haze impacts at the Park and sources within 200 km cause greater impacts, on a per ton basis, than do more distant sources.

The heart of the report makes numerous points regarding the status and trend of the effect of air pollutants on Park environmental conditions. The current average annual visual range is about 20 percent of the estimated natural visual range of 115 miles. Even the Park's clearest days, which occur during the winter, are substantially degraded by human-made particulates. White ash was determined to be more sensitive to ozone-induced effects than seven other species that were examined.



Based on ozone levels documented in the Park between 1997 and 1999 and modeled over a 100 year period, a 50 percent decrease in white ash could be expected in chestnut oak forests. Furthermore, modeling suggested that the most acid sensitive streams in the Park have lost one or two species of fish since 1990.

Finally, the authors of the report analyzed a series of emission control scenarios, including the 1990 Clean Air Act, to determine if natural resource conditions in the Park, would recover under the provisions of each scenario. Even under the most stringent of the scenarios, full recovery was not achieved.

This technical document, while understandable by the lay-person, is intended for use by the technocrat and the academician. Park staff hopes to develop a much shorter, less technical summary of the document in the near future.

Gordon Olson is a Supervisory Biologist.

Long -Term Ecological Monitoring Program Reviewed

By Gordon Olson

Background

Monitoring of natural resources at Shenandoah National Park has been ongoing in some form for approximately 20 years. In 1992, Shenandoah was selected to participate as a Prototype Monitoring Park by the National Park Service. In 2002, a significant reorganization of the natural resources operation at the Park occurred. Furthermore, it is anticipated that between 2004 and 2005, planning will begin for implementation of a natural resource monitoring program under the auspices of a network system. Shenandoah will join ten other parks in the Mid-Atlantic Region in this effort. Each of these situations points to the fact that a review and assessment of the Park's monitoring program was timely.

In 1996, Washington Office staff reviewed Shenandoah's monitoring program. The 2003 review was fundamentally different from that review and others conducted by central office staff. Differences included: the fact that 2003 review was self-imposed, that funding decisions by central office staff are not hinged on the outcome of the 2003 review, that emphasis was placed on clarifying understanding of the program's framework [1], and that discussions addressed the relationship between Shenandoah's program and monitoring in the Mid-Atlantic Network. The 2003 review was similar to central office reviews relative to the desire to assure scientific integrity, compliance with agency standards, identification of program weaknesses, and establishment of future directions.

Review Objectives

The following objectives were established for the 2003 review:

A. The review will provide a mechanism for familiarizing new employees/cooperators with the history and scope of monitoring at Shenandoah.

B. The review will clarify what is meant by Long-Term Ecological Monitoring as well as what components[2] comprise the program.

C. The review will establish a uniform framework that will be used by all monitoring program components.

D. The review will provide an opportunity to apply that framework to current components and determine what shortfalls exist.

E. The review will lead to determinations regarding continuation, suspension, or addition of new components to the program.

F. The review will generate ideas for assuring the sustainability of the program.

G. The review will identify ways Shenandoah staff can assist in the implementation of the Mid-Atlantic Network monitoring effort and ways that effort can assist Shenandoah.

Review Results

Despite a significant winter storm, 19 employees and cooperators gathered to discuss the status of the program. About 10 other invitees were unable to participate because of the weather or other conflicts.

Substantive discussions were conducted dealing with distinguishing monitoring from inventory efforts, the history of monitoring at Shenandoah, and description of the Vital Signs Monitoring Program. Discussions also focused on improving understanding program conceptual design work, assessment of the status of ongoing programs, establishing programmatic standards and applying those standards to ongoing activities. Finally, a brainstorming session, aimed at assuring the monitoring program would remain relevant and sustainable, was conducted.

The meeting concluded with the understanding that a great deal of work needs to be done in the areas of conceptual design preparation, articulation of specific programmatic standards and implementation of those standards.

- History of Ecological Monitoring at Shenandoah

Gordon Olson gave a short presentation outlining the history of monitoring in the Park. This was essential because of staff turnover over the years, the presence of several individuals who had not had previous

[1] The monitoring program Framework is anticipated to include a set of standards outlining the need for things like written protocols, written reporting, data management procedures, power analyses, QA/QC documentation, and so forth. These standards would be applied to ALL program components.

[2] Program Components are discrete elements of the overall program generally focused on a single natural resource category (e.g. Vascular Plants). Subcomponents and sub-subcomponents may also exist (e.g. Vascular Plants: Unique Vegetation Areas: The Big Meadow)

contact with the program, and the sense that there was some lack of understanding regarding the full scope of the monitoring program.

- What is Meant by Long-Term Ecological Monitoring?

The group held a discussion to distinguish between Inventory (a one time enumeration or description of a resource) and Monitoring (repeated measurement of an indicator or attribute). The point was made that Monitoring needs to focus on developing an understanding of status and trends over time. Discussions also clarified that the Park's monitoring program is much larger than what is paid for by accounts established under the Prototype Monitoring Program.

- Vital Signs Monitoring and Networks

Gordon led a discussion that explained the origin of Vital Signs Monitoring and the establishment of park networks. Vital Signs Monitoring was compared to the Prototype Monitoring Program. Limited details regarding administrative organization, planning, and finances in the network context were discussed.

- Monitoring Program Conceptual Designs and Program Component Selection

Gordon introduced the idea that it appears little documentation exists regarding the thoughts that went into the early phases of monitoring program design at Shenandoah. It was also pointed out that during the past 10 to 12 years, the Service has gained an improved understanding of what it takes to adequately design monitoring efforts. With that as an introduction, the highlights of what should be included in a good Conceptual Design for monitoring were reviewed. Those include: objective setting, development of conceptual ecological models, articulation of ecosystem stressors, preparation of criteria (based on objectives, models, and stressors) that would be used for selection of program components/indicators/attributes, and finally documentation of the selection of those components. Other elements of a Conceptual Design such as discussions about component integration were also acknowledged. Key to this planning effort, is development of a paper trail. In most cases, it appears that these elements were never developed for Shenandoah or if they were, the documentation is missing.

Follow up item: The group reached consensus on the fact that we need to start a fresh Conceptual Design planning effort that would build on work done in the past. It is anticipated this planning effort will probably take at least two years to complete. It was also agreed we would continue data gathering without interruption unless other circumstances such as severe budget cuts dictated otherwise. Once the Conceptual Design effort is complete, programmatic changes could occur (discontinue some programs, start new program components, etc.).

It is anticipated the Conceptual Design effort will probably be accomplished through a series of workshops that will engage multiple stakeholders and experts. Wendy Cass, Shane Spitzer, and Jim Atkinson agreed to organize the first workshop during which conceptual ecological models of the Park would be developed.

It is hoped this planning effort at Shenandoah will contribute to planning efforts for Vital Signs monitoring in the Mid-Atlantic Network.

- Program Framework or Standards

This discussion focused on the need to develop a universal set of standards that would be applied to all components of the monitoring program. Gordon presented an initial list of those standards to the group and requested feedback. That list included: protocols for each monitoring component, program component inclusion in the Research Permit and Reporting System (a standardized, automated NPS system), environmental and historic preservation compliance, data management, and reporting.

Follow up item: The group reached consensus that they would apply a universal set of standards to each monitoring program component. Gordon agreed that he would compile written material that documents those standards and those would be distributed to the group for review and comment.

- Current Status of Monitoring Program Components

The group was provided with a table listing all of the original (1991) program components as well as components that appear to have been added subsequently. Those additions were documented in various revised monitoring planning documents, in Park file material, or through actual field implementation. A lack of clarity regarding what is part of the monitoring program had developed gradually over the years. This was an appropriate time to revisit this topic. The group went through the table line by line and commented on the status of each component.

- Status of Program Components in Relation to the Program Framework or Standards

The group was broken up into three smaller groups and asked to assess the condition of each active monitoring program component in relation to the standards agreed to previously in the meeting. The components and participant groups were vegetation, wildlife, and abiotic resources. This was done to assist the group to better understand the full scope of work that lies before us relative to bringing the monitoring program up to an acceptable professional level. The exercise also aided in improving knowledge about closely related programs and started the process of overcoming misunderstandings and misconceptions. It

appears the monitoring program has had a long history of isolationism between program components and has suffered as a result. This was a first step toward improved integration.

Each group prepared a draft matrix that compared the program components to the standards and presented their findings to the group at large.

Follow up items: As time allows, a master matrix, reflecting the status of all monitoring program components, will be prepared. Park staff also agreed to sit down again with this matrix in hand and begin to set some priorities on what is to be worked on first and to discuss how to mesh this workload into the overall workload of the Natural Resources Branch.

- 1996 Program Review

A summary table of the recommendations that came out of the 1996 interagency review of Shenandoah's monitoring program was provided to the group. This was done because it appeared several of the recommendations had never been implemented and staff response to the review was unclear. During the discussion, it became very clear that most of the Park staff had not seen the recommendations from the review.

Follow up items: The summary table of the 1996 review will be updated and redistributed to monitoring program staff. It will also be provided to Washington Office staff to bring the 1996 review to an official close.

- Program Sustainability

The last discussion session consisted of a brainstorming session to develop ideas to assure the monitoring program would remain sustainable and relevant. Given severe financial constraints that exist in the park, serious concerns exist for the monitoring program. Although direct funding reductions are not occurring, there are other situations that impact the program such as pay increases that are expected to be absorbed and loss of positions in other program areas that result in staff time being pulled away from monitoring duties.

- Meeting Close Out

The meeting was closed with a brief review of the Anticipated Outcomes list and a general discussion of the items the group had reached consensus. It was agreed this meeting was just the beginning and that it will take a number of years to implement all of the recommendations and ideas.

Gordon Olson is a Supervisory Biologist.

How Compliant Are You?

By Gordon Olson

Mention the terms "environmental compliance" or "cultural resource compliance" and the eyes roll back in heads and the groans begin. How unfortunate that is. The steps required of Park staff members to be "compliant" with both environmental and cultural resource laws are some of the most effective ways we have of preserving Park resources. By adhering to the compliance process, projects are often improved because multiple perspectives are brought to bear on an issue, the Service can avoid much litigation, members of the public gain a sense of ownership and involvement, and practical measures can be planned for which will protect park resources.

Objections to compliance often include things such as dissatisfaction with paperwork, too many bureaucratic hoops, and suspicion of or discomfort with those who are perceived to be scrutinizing one's efforts. Staff members of the Natural and Cultural Resources Division challenge other park staff members to embrace compliance and work toward the benefits that can be derived from it including improved communications, better projects, and more environmentally sensitive ways of doing business. Even within the Natural and Cultural Resources Division compliance can be seen as a bother. Specialists in the Division would much rather do other things than review paperwork or be placed in circumstances that may be confrontational. Attitudes need to be redirected toward using compliance as an opportunity to implement effective environmental protection measures and to instill environmental ethics.

Most parks, particularly those that have large numbers of projects underway, have developed written procedures that explain to park employees how Federal laws that require compliance are to be implemented. Shenandoah National Park has those procedures outlined in Park Directive NCR-401. If you are responsible for conceiving ideas for projects and providing oversight to their implementation, you should be familiar with this Directive. Consult with your immediate supervisor or your Division Chief. They can help you understand the procedures.

This Directive was updated in 2003/2004 with the express purpose of improving understanding of the steps in the compliance process and better explaining what the project originator needs to know and do. Compliance involves many laws, regulations, and policies, each with its own unique requirements. The revision of the Directive was partially aimed at clarifying who is responsible for these various stipulations.

For most employees, the most significant change is the revision of the Project Clearance Form or PCF. Your cooperation is sought in using the most current version (2004) of this form. Remember, that it is to your advantage to provide plenty of detail when describing your project. New PCF instructions have also been prepared so you should consult those.

Do not hesitate to contact your supervisor or Division Chief if you have compliance questions. You can also contact Reed Engle for questions regarding cultural resource compliance and Gordon Olson regarding environmental compliance. Early discussion with staff specialists can be very helpful in your project's success.

Remember that your attitude will either help or hinder as you become more "compliant".

Gordon Olson is a Supervisory Biologist.

Setting the Record Straight

By Gordon Olson

Traditionally, scientists and Park staff involved in the preservation of Park resources have prepared a wide variety of reports, technical documents, maps, and photographs to document their work and the condition of Park resources. The quantity of those documents can become voluminous and difficult to keep track of, particularly at a Park like Shenandoah where the resource management program has been active for many years. Between ten and fifteen years ago, the Service recognized the need to better manage this information and staff began building bibliographic databases as a minimum means of keeping track of past scientific work. Those databases have grown and adapted to the current computer technologies. Shenandoah National Park has nearly 4000 citations in its natural resource bibliographic database and the number is increasing on a daily basis.

Management of both the database and the documents themselves has varied from year to year but more often than not, it was a task that was given a low priority. In addition, the fact that no uniform system was in place for receiving and organizing information, as it was produced, fostered decentralization and scattering of information. These circumstances were unfortunate. Employees that are new to the Park need access to the documents to quickly familiarize themselves with Park resources and the work that has gone on in the past. Cooperating scientists need access to the information to improve the work they are doing. Interpretive staff could make use of the information as they prepare public programs, exhibits, and publications, if it was more easily obtained.

During the past year, a concerted effort has been underway to improve the organization and availability of these documents and to update the bibliographic database. The first step in this process has been to develop a general conceptual model for how information resources would be handled by the natural resource management operation. In this context information resources include documents, photographs, maps, data, and natural history specimens. That model is now in place. The second step has been to try to locate all of the items that are currently cited in the bibliographic database and house them in one location. Most of the effort in this vein has focused on reports, journal articles, conference proceedings, other miscellaneous documents, and maps. Although the bibliographic database contains citations for videos and slides, minimal effort has been exerted to deal with organizing these. The third major step has been the addition of titles to the database. These are documents that have been prepared in more recent years or older documents that have only recently been found.

Steps that will be taken in the next year include shelving the documents, establishing check out procedures and retiring documents related to projects that are over twenty years old. Retired material will be sent to the Park Archives for long-term storage. Decisions will also need to be made about organizing aerial photographs, videos, and slides and prints as well as newer forms of information such as digital photographs and posters.

When this project is "completed", a searchable database will be available to Park staff and the public and the documents (or other media) will be stored in a retrievable system. As Park staff and cooperators become familiar with the system, they will begin to contribute to it regularly and the quantity of information will expand.

Gordon Olson is a Supervisory Biologist.

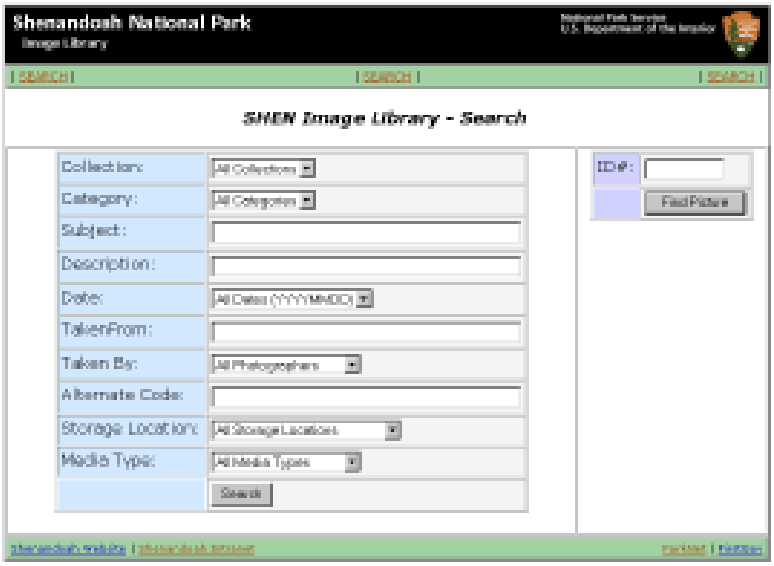
Digital Image Library Management at Shenandoah -- Part 2

By Alan Williams

In the Spring 2002 edition of the this newsletter (http://165.83.127.139/ncr/newsletters/2003-03.pdf) an effort at Shenandoah to clean-up and manage an increasing number of digital images that were being generated by the Park was introduced. In 2002, we purchased a limited number of licenses of Extensis Portfolio 6 to minimize the start-up / development time of our new Digital Image Library. It was easy to learn and turned out to be a very good cataloging tool. Many new images were scanned and included in the library. Even with the modest price per copy, however, it was going to be expensive to outfit all the staff who would want access. It also had some technological issues that would make it difficult, or a least much more expensive to implement Parkwide.

At that time, the main driver for the project was the desire to digitize the interpretive slide collection at Byrd Visitor Center to facilitate access to the images by staff putting together digital presentations. The best slides from that collection are still being digitized. Now, however, more image collections and their metadata are emerging that need to be managed so that staff can search for and find them. The major options seem to be: 1) no access; 2) multiple storage places and software packages; or 3) a centralized solution that will fill most staff needs. Currently we seem to be using option 2. Some staff members are happy with access to their images but don't or can't access images in other collections. Others are frustrated because they can't access any of the images. Still others don't even know there are digital image collections in the Park they could have access to. This range of views and problems suggests at least a study of option 3 to see what ways we could improve access to digital image collections in the Park.

As we began again to look for other solutions, we looked at other parks as well as servicewide efforts. Not surprisingly, all of the really promising options were using web-based solutions. These take advantage of minimal additional software added to each user's computer, wide distribution potential, and inherent flexibility built into many internet applications. The major drawback seems to be internet connection speed. Digital pictures tend to be large files and therefore can take more time to download. This waiting can be frustrating for users with slow internet connections.



Prototype intranet search page for Shenandoah National Park (SNP) Image Library.

Here are some sites we sampled (some sites may only be available via the NPS Intranet):

http://focus.inside.nps.gov/
http://data2.itc.nps.gov/hafe/
http://data2.itc.nps.gov/hafe/hfc/npsphoto.cfm
http://www.glac.nps.gov/glac/image.cfm
http://firepix.blm.gov/

There are a variety of approaches but, the basic layout consists of a search page with multiple fields. Search results are displayed as a set of small pictures with brief descriptions. If selected, an individual image page, with more details about the image is available. This approach allows for easy access to images and metadata by the general user. We did some research and began to construct a web site that would serve our staff needs. In the test site we have constructed, the web-based approach will work well for searching multiple collections of digital images that have been cataloged. The current site uses a Microsoft Language that comes with MS Windows Server software, called Active Server Pages (ASP), to pull metadata information from a MS Access database to create the web pages as users call them. This limits the number of 'pages' that need to be created/edited/maintained for the digital library to work. Other similar technologies such as Macromedia's Cold Fusion do much the same thing but require purchasing a license for the server hosting the application. We recently upgraded one of our

servers with extra hard drive space in order to better house our internal digital information. Our image library currently resides on this server, but it could be moved if needed.

So it seems we are back to a custom solution to our image library dilemma that uses software already available to all of the staff. It also means we are not going to rely on Extensis Portfolio 6 for managing the whole library but we could still use it to catalog smaller collections before moving them to the main library. We will be back to doing the design and creation of the application (data entry and searching tools); but we now are closer to a solution that may meet more of our needs and be a little easier to upgrade in the future. The long-term commitment to scanning slides, entering digital pictures and managing the metadata will continue to be the major challenge in maintaining a useful digital library.

Search results thumbnail summary page for SNP Image Library.

Image details page for SNP Image Library.

Alan Williams is an Ecologist.

The PATC Receives the 2003 Northeast Region Conservation Partnership Award

By Steve Bair

The Potomac Appalachian Trail Club (PATC) was recently presented with the 2003 NPS Northeast Region Conservation Partnership Award as nominated by Shenandoah National Park.

The PATC is a non-profit volunteer organization and member club of the Appalachian Trail Conference. The PATC assumes responsibility for cooperative maintenance and management of the Appalachian National Scenic Trail (AT) and many other foot trails and associated facilities in the Shenandoah National Park (SHEN) and in Virginia, Maryland and Pennsylvania. The PATC was established in November 1927 to help build the Appalachian Trail (AT) in the mid-Atlantic region. According to the PATC Mission Statement, "*The Potomac Appalachian Trail Club, through volunteer efforts, education and advocacy, acquires, maintains and protects the Trail and lands of the Appalachian Trail, other trails and related facilities in the mid-Atlantic region for the enjoyment of present and future hikers.*"

The PATC and Shenandoah National Park have been jointly involved in the stewardship of trails since the Park's establishment in 1936. PATC's trail activities actually began in the 1920's prior to the establishment of the Park. SHEN nominated the PATC for the 2003 NER Conservation Partnership Award on the basis of PATC's cumulative extensive and exceptional continued activities and programs conducted in partnership with SHEN. PATC's diverse programs and projects have contributed quite substantially to the preservation and protection of natural and cultural resources and recreation use facilities, and the visitor experience in the Park and the region. Recent contributions by the PATC are described as follows:

Trails program

As described in the long-standing Memorandum of Understanding (MOU) between the Park and the PATC, first formalized in 1972 and revised in 2001, the PATC performs routine and recurring trail maintenance including blazing, trimming and removal of encroaching vegetation, clearing treefalls, and construction and maintenance of erosion control structures on trails for which the Club has accepted responsibility. Currently, PATC shares responsibility with the Park for maintenance of nearly 300 miles, or nearly 60%, of Park trails, including 100 miles of the Appalachian National Scenic Trail. The PATC recruits and obtains volunteers who adopt and oversee maintenance of individual trail sections. PATC Trails Managers also direct organized crew efforts on specialized and advanced trailwork projects. Nearly all PATC trails activities are funded by the PATC, including purchase and maintenance of all tools and accessories used to maintain and rehabilitate Park trails.

The PATC demonstrates excellent stewardship of Congressionally-designated SHEN wilderness areas by training volunteer overseers of wilderness trails in the use of traditional handtools and utilizing handtools, rather than motorized equipment, to maintain trails to condition standards.

AT Huts and Maintenance Buildings program

Formerly part of a concession contract with the Park, this program was incorporated into the PATC Trails MOU in 2002. Huts are three-sided shelters intended for overnight use by long-term AT hikers. The maintenance buildings are enclosed shelters utilized by the PATC as trail tool storage depots and volunteer overseer bunk space for overnight work trips. The PATC recruits, obtains, and trains volunteer overseers to perform recurring maintenance to seven huts and three maintenance buildings associated with the AT. Work is funded entirely by the PATC. Nearly all of these structures are historic and are maintained by the PATC to SHEN historic maintenance standards.

Cabins program

The PATC maintains and operates six historic backcountry cabins in the Park under a concessions contract. These structures are made available to the public by reservation through the PATC, for which the cabin user pays a fee. The cabins are maintained by volunteer overseers who are recruited, obtained, and trained by the PATC. Routine maintenance work is funded entirely by the PATC.

AT Ridgerunner and Trail Patrol programs

In cooperation with other AT partners, the Appalachian Trail Conference and the NPS Appalachian Trail Park Office, the PATC provides SHEN with Ridgerunner and Trail Patrol programs to support backcountry visitors and Park managers. The PATC provides the service of patrolling Park backcountry trails, providing additional trail services and support using a volunteer work force, the Trail Patrol program, and a paid PATC workforce, the Ridgerunner program. Patrols of SHEN trails are conducted to provide general assistance to backcountry visitors, educate visitors in *Leave No Trace* minimum impact backcountry use ethics and techniques, provide light maintenance of trails and designated backcountry campsites, conduct outreach outdoor education programs to the public, and to observe and report on specific backcountry and

wilderness conditions. The Ridgerunner is recruited, hired, administered and funded by the PATC.

The Ridgerunner and Trail Patrol programs have recently embarked on a closer relationship with the SHEN Division of Interpretation and Education to cooperatively promote and conduct public education programs essential to the NPS mission. In recent years the Ridgerunner conducted several successful public presentations at Park facilities to interpret the Appalachian National Scenic Trail and *Leave No Trace* backcountry use ethics. Trail Patrol frequently conducts public and Club *Leave No Trace* presentations and workshops on- and off-site and assists the Park's Wilderness Weekend celebration. This extensive education effort by the PATC is very important in providing information to help the public manage it's own wildland use behavior and activities to protect Park backcountry and wilderness resources. These efforts greatly benefit the Park and many other regional land management agencies.

Park boundary access and lands

PATC strives to protect public trailhead accesses on the Park's boundaries to preserve the visitor's backcountry experience. PATC's partnership with SHEN to protect visitor access has culminated in two situations to secure valuable long-term, guaranteed public access in the past couple of years. PATC, using its own funding resources and in consultation with the Park, has purchased significant boundary area properties to assist the Park to establish visitor vehicle parking and hiker trailhead access. The PATC also maintains a negotiated 5-year agreement with a private landowner on Park boundary to maintain a temporary public right-of-way for a popular trail access. PATC's willingness and ability to provide the necessary resources to secure Park boundary access has made seemingly impossible trailhead access protection situations quite attainable.

Benefits of PATC activities to SHEN

The partnership between the Potomac Appalachian Trail Club and Shenandoah National Park has resulted in an extensive but well-maintained trail system to serve the backcountry visitor and to protect resources from visitor impacts. PATC's substantial service to maintaining and managing the Park trails system continues to be absolutely essential to sustaining the extent and quality of the trails program. The properly maintained trail system is necessary to protect resources from visitor impact and subsequent vegetation loss and soil erosion, and to preserve or enhance the backcountry visitor experience. The PATC actively contributes to several other programs with long-range benefit to park resources and the visitor experience.

Nearly all of SHEN's backcountry structures are maintained and operated by the PATC. All but a couple of these structures are historic and are preserved primarily through PATC efforts. Presently, the attention to structural maintenance provided by PATC volunteers and expenditure of PATC funds to protect and preserve backcountry structures for visitor use is all that prevents their deterioration and eventual loss.

The Ridgerunner and Trail Patrol programs provide additional backcountry "presence" and essential public contacts on Park trails which SHEN Protection staff are no longer able to provide. These programs provide valuable on-site information to backcountry visitors emphasizing protection of Park resources and a positive visitor experience. Volunteer patrollers contribute to a sense of security for trail users and their subsequent observations and reports supply important information to Park and PATC managers about backcountry, wilderness and trails conditions. Public education about Park and regional natural, cultural and wilderness resources and the public's role in protecting and conserving resources is the focus of PATC's fledgling education program initiative. The Trail Patrol and Ridgerunner programs lead in this PATC effort; their backcountry patrol efforts and recent public presentations conducted in partnership with the Park provide outstanding, albeit somewhat intangible, support for the NPS and Park mission. The PATC supplements and extends the Park's public education efforts and helps to fill gaps in limited NPS funding and staffing.

PATC President, Tom Johnson, receives the 2003 Northeast Region Conservation Partnership Award from Superintendent Doug Morris on September 16, 2003 at the PATC Headquarters in Vienna, Virginia.

PATC efforts to support the Park in securing guaranteed public access at boundary trailheads is of exceptional merit. Using Club funding and lands planning personnel resources, the PATC has accomplished lands protection on Park boundary with resources otherwise unavailable to Park management. It is due to recent PATC achievements in this area that two Park boundary access sites are protected indefinitely for present and future hikers and one protected at least temporarily through PATC negotiation.

Summary

Recent Potomac Appalachian Trail Club partnership accomplishments have contributed substantially to the conservation, preservation, and protection of valuable natural and cultural resources, designated wilderness and visitor experience conditions in Shenandoah National Park and the mid-Atlantic region. Employing extensive volunteer resources and funding, the PATC supports Park operations and management in the areas of trails maintenance and management, operations and maintenance of more than a dozen historic backcountry structures, volunteer patrols of trails, public education in visitor wildland use ethics and wilderness, and protection of Park boundary public trail access. Much of PATC's support is of immeasurable and intangible benefit to the Park, and the estimate of cash and in-kind value of services to the Park in just the past three years approaches $900,000.

Steve Bair is a Supervisory Biologist.

George Freeman Pollock and Conservation

By Reed Engle

At the dedication of Pollock Knob just south of Skyland, Senator Harry F. Byrd eulogized George Freeman Pollock: "[he] seems almost from the beginning to have felt . . . [the beauty of the Blue Ridge Mountains] deeply and very speedily to have determined both to conserve as much as he could of what the Creator had supplied and to make it possible for others to share his enjoyment."[1]

Pollock's reputed environmental ethic, at least as judged by modern standards, is self-generated, like many other legends that have grown around the man. In his autobiography, *Skyland,* Pollock states that the "Blue Ridge land appealed to my father from the standpoint of its forest and mineral resources, but instead of profiting from these, I preferred to retain the natural attractions of the place."[2] In Pollock's "Why Skyland" article, published in the 1935 Potomac Appalachian Trail Club *Bulletin,* he makes this claim:

> From the date of my arrival until the park area was decided upon by the Southern Appalachian National Park Commission *[sic]*, my whole program in the mountain was one of conservation. The battle with the elements and human agencies, which were despoiling the land, was always with the purpose of saving the area for future generations.

The truth is much closer to Pollock's earlier statement in *Skyland*: "Then and there I made up my mind to consecrate my life to the *development* [italics by author] of this, my father's land."[3] Even before he gained ownership of the Stony Man tract, Pollock and his then-partners had established a sawmill and planing mill to manufacture window sash, doors, and boards to build cabins at the Camp. They had purchased the lumber (stumpage) rights to 5,371 acres of the Stony Man tract in order to have a regular source of raw materials. But a poor choice of business partners caused that early effort to fail and, perhaps, saved hundreds of acres of trees from "development."

A close study of Pollock's real estate transactions in the early years of his management of the Stony Man property fails to identify a strong conservation ethic. Rather, the transactions show a willingness to sell land or resources to improve cash flow. On October 2, 1902 he sold Peter Sours of Luray the rights to "all chestnut bark . . . on all land in the #3 Shirley survey, Madison County," some several thousand acres just over the Blue Ridge from Skyland. In the two-year contract, Pollock was to receive "50 cents per ton of 2,240 pounds for all bark removed," with his profits legally assigned to pay off loans made by Sours to his mother, Louise Pollock, and to J. F. Lucas—loans secured by the Skyland real estate. Typically, repayment of both loans held by Sours was two years late.

Far more serious to the preservation of the mountains were Pollock's transactions in 1901 and 1902 with the Trimbath brothers and Henry F. Brinton. Although casually dismissed in Pollock's *Skyland* as a one-year option on potential copper rights, the agreements and deeds registered in both the Madison and Page County Courthouses reveal another story. In November 1900, Pollock gave to J. W. Trimbath, Walter P. Trimbath, and Henry F. Brinton "an option . . . to purchase" all mineral, wood, and water rights, the rights to build pipelines, roads, and railroad lines, and the right to use Stony Man Road on the entire 5,371-acre Pollock property. For a total payment of $3,000 with interest from June 1, 1899, and to be paid by June 1, 1901, the Trimbaths and Brinton would get all of the said rights except within ¼ mile of Stony Man Camp.[4] These are the same lumber and bark rights leased to Peter Sours for 1903 and 1904.

As of June 1, 1901, the option was not exercised by the Trimbaths and Brinton, and it lapsed. Two days later, however, Pollock gave Brinton alone the same option with the understanding that he pay $250 every six months to the Court Commissioner in Charlottesville to resolve Pollock's outstanding debts on the Stony Man property. After payment of $3,000, Brinton would gain permanent ownership of all mineral, water, timber, and development rights to everything beyond ¼ mile from Skyland.[5] The same day, Brinton transferred the option to A. C. Ellis of Pittsburgh "for the purposes of a certain Agreement made and entered into of even date" with three other investors.[6] Henry Brinton permanently acquired the rights in fee simple on November 15, 1905, having paid Pollock the $3,000.[7]

In 1907, one year after Pollock had received clear title to the Skyland acreage based on Brinton's payment of Pollock's court debt, and in consideration of $1.00 paid by Pollock, Brinton agreed to increase the radius of his mineral and lumber rights from 1320' from the Skyland Post Office to 1620'. In November 1907 Henry Brinton mortgaged his mining rights and privileges for "5,371 acres" to his daughter Eleanor Brinton for $5,000. This was six days after Pollock's brother-in-law, Harrison G. Dyar, had paid Brinton $3,450 to repay loans made by Brinton to Pollock in 1901. Brinton repaid his daughter in February 1912, and the mineral rights reverted to him. There is no legal record in either Page or Madison Counties that Brinton ever relinquished his mineral and other rights. Small-scale mining by Brinton of the copper at Stony Man continued at least until 1912.

On December 16, 1905, in receipt of $197.00, Pollock sold 247 acres "north of and just below Little Stony Man Mountain" to William and H. C. Fox of Luray, Virginia. He reserved the right of Stony Man Camp guests to travel across the property and to drink from the springs thereon. He also noted that as the mineral and timber rights had already been sold (to Brinton), they were not included in the sale.[8] This property included much of the land visible today from the Stony Man and Hughes River Overlooks on Skyline Drive.

It is difficult to reconcile the factual, recorded legal history of Skyland land transactions with Pollock's statement in the April 1937 Potomac Appalachian Trail Club *Bulletin*:

> It was true that I had to cut enough timber to provide firewood for Skyland, and that in the very beginning of my life in the mountains I had to assist myself by selling some chestnut bark. The felling for my personal needs, however, was trifling, and the sale of chestnut bark was necessary only to get started and was resorted to with great regret in the realization that, surrounded with thieves as I was, if I did not get the bark myself it would be taken out anyway.

These less-than-conservationist transactions continued until his marriage to Addie Nairn Hunter in 1911, a full 18 years after his "very beginning" to have legal standing at the Stony Man Camp in 1894. Until his loss of the resort in 1935, he continued to burn up to 300 cords of wood at a time, several times a year, at the Skyland Pow-Wows and other events and 200-300 cords of wood yearly in the dining hall and cabins: this was the "firewood" for Skyland, as was the split timber needed to fuel the fireplaces of over 40 cabins and cottages during the season.

The "Information Bulletin" hyping the Blue Ridge Mountains published over Pollock's name by the Northern Virginia Park Association in 1924 clearly reflected Pollock's concept of recreational conservation:

> The important question of tourist accommodation would present no problem here. Development possibilities in the mountain park site are boundless. The contours of the great hills seem almost designed by nature for broad roads—winding sylvan boulevards—from end to end and back along the opposite slopes. Riding trails through the loveliest of its scenery only await cutting away the tangled laurel. Natural settings abound for spring-fed lakes in high valleys, where summer and winter sports for the multitudes would be provided.

George Freeman Pollock (Ca. 1898).

Thus did Pollock propose to conserve the natural wonders of the proposed Park area? In retrospect, Pollock was a 19th-century man, predating the concepts of ecologically sound stewardship and wilderness conservation. His values were similar to Theodore Roosevelt's:

> It is entirely our power as a nation to preserve large tracts of wilderness . . . as playground for rich and poor alike, and to preserve the game . . . . Or,
>
> Conservation means development as much as it does protection. I recognize the Right and duty of this generation to develop and use the natural resources of our Land, but I do not recognize the right to waste them….

Pollock had no record of conservation except in his land directly needed for the development of Stony Man Camp, and he was willing to compromise the quality of the rustic experience within the Camp when funds were short. From his father's first association with the Stony Man property through Park establishment, 49 years after George first visited, the Blue Ridge acreage was endangered by mineral development, logging, and exploitation. Pollock willingly sold the commercial resources of his larger acreage to raise funds for the developed and the developing Stony Man Camp property. He was willing to sell the resources of the larger acreage to fund his needs and those of resort guests.

Notes

1. Byrd's speech at the dedication of Pollock Knob, Shenandoah National Park, copy in Shenandoah National Park Archives.
2. Pollock, *op. cit.* , p. 256.
3. Pollock, *op. cit.* , p. 10.
4. Page County Deed Book 46, p. 96.
5. Page County Deed Book 46, p. 379.
6. Page County Deed Book 46, p. 382.
7. Page County Deed Book 55, p. 304, and Madison County Deed Book 38, p. 547.
8. Page County Deed Book 55, p. 302.

[NOTE: This article is extracted from *In the Light of the Mountain Moon: An Illustrated History of Skyland,* Shenandoah National Park Association, 2003.]

Reed Engle is a Supervisory Landscape Architect.

Russian Student Intern Volunteers at Shenandoah National Park

By Svetlana Alexandrovna Goudkevitch

First of all I can say that Shenandoah National Park is one of the most beautiful places that I have ever been to in my life. I was struck by the nature. I arrived at this place in the beginning of October, that very time to observe the color changing, it was so amazing that I can't find even words to describe, I thought. It was that very moment I should have lived for, just to enjoy that beauty! And I'm very lucky I had a chance to see that.

Concerning my work, I was surprised to find out that I became a real member of Mid-Atlantic Invasive Plant Management Team. I understand that for most people this term doesn't mean anything. That's why I would like to make a brief introduction what I'm going to talk about. There are 16 Invasive Plant Management Teams around the USA. The main goal of these organizations is destroying non-indigenous plants and preventing their future spreading as these invaders cause damage to natural and agricultural ecosystems, because they have been introduced by human activity into an area where they did not evolve. The ways of treating invasive plants can be absolutely different; it is not just primitive cutting trees and weeds. The most effective way to get rid of them is spraying pesticides to stop and prevent its growing at the same time simultaneously. This kind of treating works perfectly almost in every case and every year monitoring helps to see the tremendous results of people's work.

So, as I said before I was a member of the Mid-Atlantic EPMT in Virginia, and I was involved in all activities they had. Most of the time I spent traveling around Virginia's National Parks, treating different exotic plant sites. There were 4 people of different ages in the team, including me. I was the youngest one, and in addition, I was the only girl. We spent the whole days outside, working in the field, surrounded by gorgeous nature. That was very enjoyable, especially when the weather was great. But at the same time I can say this work was very energy consuming and sometimes I

was in no condition even to go to bed. Most of all in my work I liked visiting different places, including many historical sites, such as Appomattox Court House or Gettysburg Battlefield, famous for the important historical events that happened over there. I've been to 7 different parks, 6 of them are located in Virginia and 1 in Pennsylvania (Gettysburg National Monument Park). This work satisfied my traveling spirit as well. Plus I've expanded my knowledge of plants both native and exotic. That definitely will be very helpful in my study.

In Virginia for the first time in my life, I enjoyed warm winter weather, what is absolutely not typical for Russia, where cold winters last about 5 months. I was surprised to realize 70 degrees on New Year's holidays, I even took a sunbath. I had a wonderful sunny lawn in front of my house. Unfortunately, there were no more students during my internship and I lived alone, but I think it helped me a lot to some extent. I've learnt how to become a more responsible person by not having anybody to rely on. Later I made some friends. I had an opportunity to share my culture with them and of course I got to know a lot about American culture. All people around were very friendly and kind to me, they were cheering me up being very attentive. I'm sure I will miss them all.

I had a perfect 4 working day schedule that allowed me to travel on my weekends around not only Virginia but other states such as: Maryland (Baltimore), Pennsylvania (Scranton, Delaware Water Gap), New York City, Washington DC, and Virginia (Richmond, Charlottesville, Harrisonburg, Culpepper).

The 16 weeks are sadly gone, but I'm happy it happened to me. It was a totally different world, like a new universe. I found quite different values and attitudes and most of them I liked. I've made great friends I would like to stay in touch with for the rest of my life. And finally, I've reached my main goal: I improved my English skills which helps me to feel more confident in this contemporary world.

Contact Information
Name: Goudkevich Svetlana
Email: dhammapada82@mail.ru
Course and University: Geography at Moscow State Teacher Training University

The purpose of the Shenandoah National Park Resource Management Newsletter is to convey information on Shenandoah's natural, cultural, and backcountry/wilderness resources, issues, and programs to Park employees and the interested lay public. We will strive to present a mix of current activities, research and monitoring findings, and basic information about the Park's resources in an informal publication on a annual basis. We welcome short articles meeting this purpose from both Park staff and cooperators. Paper copies of the newsletter will be distributed to Park employees and others upon request, and will be distributed with permission by the Shenandoah National Park Association to its members.

Editor
Debbie Sanders

Chief of Natural & Cultural Resources
Gary Somers

Comments? Write to:
Superintendent
Shenandoah National Park
3655 Highway 211 East
Luray, VA 22835

Editor's Note:
If you wish to be removed from this mailing list, please call Sharon Henry at (540) 999-3493.

National Park Service
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Shenandoah National Park
3655 Highway 211 East
Luray, Virginia 22835