

## Eastern Rivers and Mountains Network Park Summaries and Natural Resource Profiles

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The purpose of this document is to provide a brief summary of network park location, history and significant natural resources. Each park summary follows a common format: *Overview, Enabling Legislation, Dominant Ecological Communities, Significant Natural Resources, Natural Resource Issues, Documents Used for the Summary, and a Map of the Park area.*

This document, and the material contained herein, should be considered a work in progress. Over the course of the next year additional data mining/synthesis activities will take place, current inventories and other projects will potentially highlight as yet unidentified significant natural resources and issues, and most importantly, a series of additional scoping and development meetings (including a review of the Phase 1 Report) at the park and network level will take place.

It is also important to note that vegetation mapping is currently planned or underway at all of the parks in the network and once complete, a more detailed and accurate description of the dominant and significant plant communities following the National Vegetation Classification will be available. Until this work is finished, summaries of plant communities are described using other sources.

The objective of the National Biological Survey/National Park Service (NBS/NPS) Vegetation Mapping Program is to develop a uniform hierarchical vegetation classification standard and methodology on a Service-wide basis and, using that classification standard and methodology, to generate vegetation maps for most of the park units under NPS management. This program comes in response to the National Park Service's Natural Resources Inventory and Monitoring Guideline (NPS-75) issued in 1992. The vegetation data are to be automated, in a GIS-compatible format, which will provide great flexibility in map design and production, data analysis, data management, and maintenance activities. Deliverable products will include a digital file of vegetation maps, digital metadata files, textual descriptions and keys to the vegetation classes, hard-copy maps, and map accuracy verification reports.

**ALLEGHENY PORTAGE RAILROAD NATIONAL HISTORIC SITE (ALPO)****OVERVIEW**

State: Pennsylvania

Year established: 1964

2003 Acreage: 1,249

2003 Park visitation: 127,823

Allegheny Portage Railroad NHS was created in 1964 (together with Johnstown Flood National Memorial) to illustrate the significant role of the Allegheny Portage Railroad and Pennsylvania Mainline Canal in the Nation's history. The park is located in the Laurel Highlands of southwestern Pennsylvania near Gallitzin in Blair and Cambria Counties and is currently encompasses approximately 1,249 acres.

The site is divided into two units, the Main Unit, which includes portions of the Pennsylvania Mainline Canal, the Lemon House, the summit of the Allegheny Portage Railroad, the Skew Arch Bridge and Incline Planes 6-10, and the Stable Bend Tunnel Unit. The Main Unit is primarily composed of deciduous forest types although there are some areas of wetlands along a high quality stream that runs through the park named Blair Gap Run. One state threatened plant species is found on park property (more information on this species can be found in the Dominant Ecological Communities section to follow).

The Staple Bend Tunnel Unit is located approximately 4 miles east of Johnstown along the Little Conemaugh River and preserves the first operable railroad tunnel in the history of the United States. Acid mine drainage at the Staple Bend Unit has been a problem due to an abandoned mine on site. There are also potential threats to the streams within the main unit of the park due to mine drainage. As with all of the parks, the spread of exotic and invasive plant species is a prevalent problem that may threaten native resources. Some control measures are being taken at this site to manage target exotic plant species.

**Enabling Legislation:**

This site was established by an Act of Congress on August 31, 1964 which authorized the acquisition of lands and historic features as may be necessary to illustrate the significant role of the Allegheny Portage Railroad and the Pennsylvania Mainline Canal in the Nation's history.

Subsequent legislation identified additional purposes:

- Provide for the interpretation and preservation of the remaining portions of the Allegheny Portage Railroad route not included in the NHS through cooperative

agreements with the state of Pennsylvania, political subdivisions thereof, corporations, associations, or individuals, and to erect markers or tablets in accordance with the Antiquities Act of 1935.

- Participate through the Southwestern Pennsylvania Heritage Preservation Commission in recognizing, preserving, promoting and making available to the public the cultural heritage of the nine county region associated with the iron, steel, coal and transportation industries.

## Dominant Ecological Communities

### Terrestrial

#### ➤ *Forest*

Undisturbed areas are typically deciduous forest dominated by tall, broadleaf trees (constituting eleven distinct terrestrial plant communities) that provide a continuous and relatively dense canopy. The main unit is also intermixed with several herbaceous wetlands and disturbed plant community types. Some of the main forested community types include Northern hardwood forest, red-oak mixed hardwood forest, and hemlock-northern hardwood forest.

### Aquatic

#### ➤ *Wetlands and wet meadows*

Wetlands are not abundant within the park, however, several types do exist along the riparian zone of Blair Gap Run and its tributaries.

#### ➤ *Riverine*

Blair Gap Run and several of its tributaries traverse park property at ALPO to the east. Blair Gap Run is a high quality stream which also feeds into, and in turn is fed from, two municipal reservoirs. Its headwaters originate on and above the park's Summit Unit. Seeps and springs at the Summit Unit also form the headwaters for a second stream that drains northeast into Bradley Run and the Clearfield Creek drainage.

## Significant Natural Resources

#### ➤ *Forest Habitat*

Forest habitat dominates the park (approximately 935 acres) and is comprised of Northern hardwood forest, red-oak mixed hardwood forest, and hemlock-northern hardwood forest. Within the northern hardwood habitat type, many bird species typical of more northerly locations can be found. A dry oak-mixed hardwood forest, which is considered rare for the state, can also be found at the park.

#### ➤ *Species of Special Concern*

The state threatened mountain bugbane (*Cimicifuga americana*) and the state vulnerable ginseng (*Panax quinquefolius*), were found in the most recent survey of rare plants by the Western Pennsylvania Conservancy. Although both species were search targets during a more comprehensive survey, no additional occurrences of either species were found.

Several birds that are considered species of Federal Management Concern, such as the cerulean warbler (*Dendroica cerulea*), Eastern meadowlark (*Sturnella magna*), chestnut-sided warbler (*Dendroica pensylvanica*), field sparrow (*Spizella pusilla*), Louisiana waterthrush (*Seiurus motacilla*), Northern flicker (*Colaptes auratus*), red-shouldered hawk (*Buteo lineatus*), veery (*Catharus fuscescens*), wood thrush (*Hylocichla mustelina*) and worm-eating warbler (*Helminthos vermivorus*) have been documented at ALPO. One state vulnerable species, the Northern saw-whet owl (*Aegolius acadicus*), can also be found in the park.

Although no longer considered a species at a high level of special concern, two Northern myotis (*Myotis septentrionalis*) were observed at the Staple Bend Tunnel during a hibernaculum study by the Pennsylvania Game Commission during 1997. No more recent information has been found that documents additional sightings of the species since that time.

➤ *Blair Gap Run*

Blair Gap Run and several of its tributaries traverse park property at ALPO to the east. Blair Gap Run is a high quality stream which feeds into, and in turn is fed from, two municipal reservoirs. Its headwaters originate on and above the park's Summit Unit. Seeps and springs at the Summit Unit also form the headwaters for Bradley Creek which flows to the North and East into Clearfield Creek.

➤ *Wetlands*

Vegetation mapping is currently underway at ALPO and will help to delineate areas of distinct vegetative communities. Amphibian inventories are currently being conducted for this park and may give a better insight as to use of these wetlands by amphibians and other wetland-dependent species.

➤ *Sandstone Cliff Community*

Outcrops that are found northwest of the Muleshoe curve area are considered an unusual habitat near the park. The area above the outcrops was recently logged, potentially threatening the integrity of this ecosystem. All of this area is not owned by The National Park Service and management would require working with the landowner.

### **Natural Resource Issues:**

➤ *Acid Mine Drainage*

The Staple Bend Unit of ALPO is located in an area of extensive coal mining. Numerous abandoned deep coal mines underlie park property and adjacent lands. Acid mine drainage (AMD) and runoff from associated coal tailings contribute heavily to the pollution of nearby Little Conemaugh River. Low pH associated with iron and aluminum deposits in this river prevents most lifeforms from living in this waterway. Although the Little Conemaugh River is listed as an impaired (303(d)) waterway, the drainages within the Staple Bend Unit do not qualify as streams

eligible for listing because they consist solely of the drainage from the mine openings and would not otherwise exist.

Within the main unit of the park, Blair Gap Run is currently considered a high quality waterway, although there may be threats to this system from AMD. Four sites along Blair Gap Run are currently being monitored by members of the Environmental Alliance for Senior Involvement (through PA DEP). Additional sites are currently being assessed by a Pennsylvania State University cooperator conducting a Level 1 Water Quality Assessment for the park.

➤ *Exotic vegetation*

Repeated disturbance of woodlands has provided the opportunity for exotic species to establish themselves, and in some cases they have become a management concern. These exotic plants include giant and Japanese knotweed (*Polygonum sachalinense* and *P. cuspidatum*), garlic mustard (*Alliaria petiolata*), spotted knapweed (*Centaurea maculosa*), teasel (*Dipsacus fullonum*), crownvetch (*Coronilla varia*), Japanese honeysuckle (*Lonicera japonica*), exotic bush honeysuckles (including Morrow's, tartarian and hybrids), Asiatic bittersweet (*Celastrus orbiculatus*), Japanese barberry (*Berberis thunbergii*), and multiflora rose (*Rosa multiflora*). Tree of heaven (*Ailanthus altissima*) was recently rediscovered at the Staple Bend Unit and is being controlled through management action. A recent invasive plant to be observed in the state, Japanese Stiltgrass, has been found along a planned hiking/biking trail. Small populations of the stiltgrass can be controlled without the use of pesticides, however, large infestations will require more focused management attention.

Dense populations of Giant and Japanese knotweed are found in the Staple Bend Unit (SBT). They occur in small clusters throughout the other units of ALPO and JOFL, but not at the high density found at Staple Bend. Steps have been taken to control knotweed at developed areas of SBT, but it must be monitored and treated on a regular basis to prevent reoccurrence.

Control programs have been started at the Summit Unit for Japanese barberry, Japanese and exotic bush honeysuckles, Asiatic bittersweet and garlic mustard. Control programs are planned for teasel, spotted knapweed and multiflora rose. These species are also found in other areas of the park and are common on lands adjacent to the park. Continuous monitoring and control is necessary to slow the spread of these species further into park lands.

➤ *Forest Health*

The forests at ALPO are made up of a variety of community types (see dominant ecological communities). These forests provide habitat to a variety of special concern bird species, such as the cerulean warbler (mammal and herp inventories have not been completed yet). Potential infestations from a variety of forest pests, such as the gypsy moth, eastern tent caterpillar and cherry scallop moth may damage these forests. The combination of these three insects may have caused

significant mortality to black cherry trees at ALPO in the past. Annual monitoring of the gypsy moth (*Lymantria dispar*) based on aerial surveys is conducted by the US Forest Service. The Hemlock woolly adelgid (*Adelges tsugae*), another forest pest of concern at ALPO, has not yet been found in the park, but has been found in other areas of Pennsylvania and West Virginia.

➤ *Adjacent land use*

Allegheny Portage is a narrow, linear park, which makes the park susceptible to external impacts such as activities on adjacent properties. Though steep terrain and compatible neighboring land uses (state game lands, water authority lands) border much of the park, resource extraction such as coal mining and logging frequently take place on neighboring private and public property. These activities, as well as internal park developments, can have negative impacts on the park's natural resources.

➤ *Species of Special Concern*

Several desirable bird species associated with early successional habitat can be found at the park, although they may be negatively affected by other species such as the brown-headed cowbird. The current population status of the cowbird and its effects on other bird species of the park is unknown.

Allegheny Portage Railroad is home to a number of relatively healthy forest ecosystems and the organisms that they support such as the State threatened mountain bugbane (*Cimicifuga Americana*) and the state vulnerable ginseng (*Panax quinquefolius*). However, these species may be negatively affected by invasive and exotic plant and animal species that have established in the park.

**Documents used for this summary:**

National Park Service. 2000. Strategic Plan. Allegheny Portage National Historic Site.

National Park Service. Resources management plan. 1998. Allegheny Portage Railroad National Historic Site /Johnstown Flood National Memorial.

Western Pennsylvania Conservancy. 2003. Plant community mapping and surveys for species of special concern at ALPO, JOFL, FONE, FRHI, Final Report.

Yahner, R. H., Klute, D. S., Keller, G. S., and Ross, B. D. 2001. Comprehensive inventory program for birds at six Pennsylvania National Parks. University Park, PA: The Pennsylvania State University. Technical Report NPS/PHSO/NRTR-01/084. 231p.

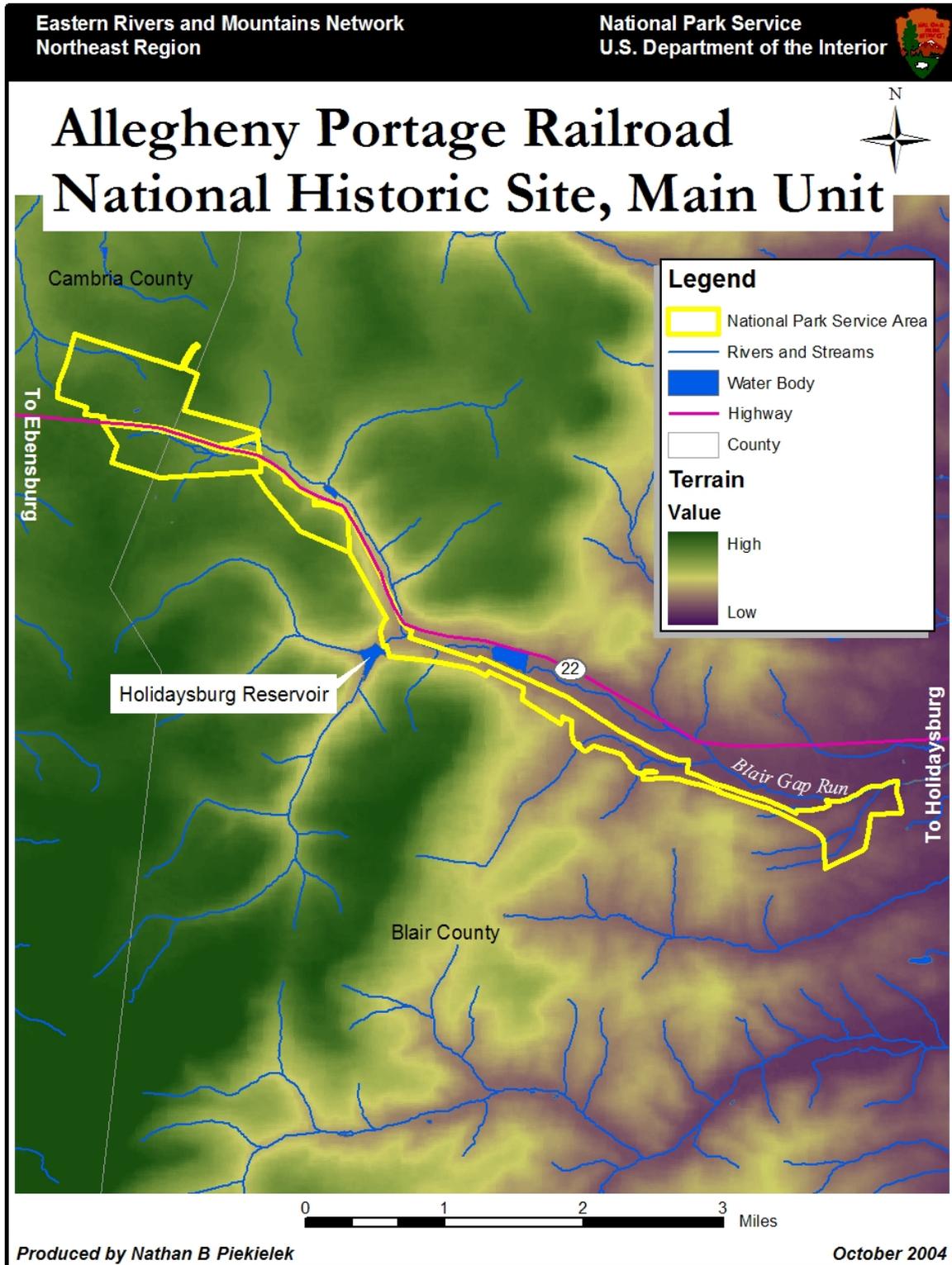


Figure 1: Map of Allegheny Portage Railroad National Historic Site

## JOHNSTOWN FLOOD NATIONAL MEMORIAL (JOFL)

### OVERVIEW

State: Pennsylvania

Year established: 1964

2003 Acreage: 164

2003 Park visitation: 117,179

Johnstown Flood NM, the smallest park in the network, was created in 1964 (together with Allegheny Portage Railroad NHS) to commemorate the events of the Johnstown Flood of 1889. The park is located in Cambria County in the Laurel Highlands section of southwestern Pennsylvania near the city of Johnstown and contains the remnants of the South Fork Dam, and a portion of the historic Conemaugh Lakebed. The main body of water on the park property is the South Fork of the Little Conemaugh River, which runs through the remnants of the South Fork dam. The area is primarily forested, with areas of early successional habitat and wet meadows. One state endangered plant species is found on the park property.

The Little Conemaugh River has historically been polluted with acid mine drainage and other contaminants that detract from the visual and natural integrity of the park. However, cleanup of this section of the river will require a major collaborative effort among many partners. Invasive plant species have also been a problem at the park, although control methods are being used with some species in designated areas.

### Enabling Legislation

Enabling legislation was passed in 1964 authorizing the acquisition of lands sufficient to preserve the remnants of the South Fork Dam and interpret the events leading up to and including the Johnstown Flood of 1889.

In addition, the park is to:

- Enter into cooperative agreements with the Commonwealth of Pennsylvania, political subdivisions thereof, corporations, associations or individuals, and to erect tablets and markers in accordance with the Historic Sites, Buildings and Antiquities Act in commemoration of the Johnstown Flood.
- Provide technical and financial assistance to mark, restore, operate and maintain the Johnstown Flood Museum. Participate cooperatively with other organizations in recognizing, preserving, promoting and making available to the public the cultural heritage of southwestern Pennsylvania associated with the iron and steel, coal and transportation industries.

### Dominant Ecological Communities

## Terrestrial

### ➤ *Forest*

Within JOFL, there are five main forest community types: a hemlock-northern hardwood forest, northern hardwood forest, black-cherry-northern hardwood forest, red maple forest and black locust forest.

### ➤ *Early successional/Scrubland*

The historic lakebed is managed for viewshed purposes and currently consists of herbaceous, early successional habitat. Areas of successional herbaceous openings can also be found in other areas within the park.

## Aquatic

### ➤ *Riverine*

The main body of water on the park property is the South Fork of the Little Conemaugh River, which runs through the remnants of the South Fork dam abutments at JOFL. Physically this river system appears to be healthy, providing good habitat for aquatic organisms with a good pool-riffle sequence, well connected floodplain and healthy riparian vegetation; however, as mentioned earlier it suffers from significant AMD and other pollution thereby preventing most aquatic life from living here. Incidentally, anecdotal evidence of abundant and diverse aquatic life exists in tributaries to the South Fork that are not impacted by AMD.

### ➤ *Wetland, wet meadows and riparian zones*

Some wetland areas are found along the riparian zone of the South Fork of the Little Conemaugh and its tributaries including areas of mixed shrub/wet meadow/early successional habitat in and around the historic lakebed.

## Significant Natural Resources

### ➤ *Early successional/Scrubland/Wet meadow habitats*

The historic lakebed consists of herbaceous, early successional habitat with several wetlands and areas of wet meadow along the South Fork of Little Conemaugh River. Vegetation mapping is currently underway at the park and will help to delineate these areas more definitively.

### ➤ *Species of special concern*

The Appalachian blue violet (*Viola appalachiensis*), considered a globally rare as well as a state endangered species, was found on the property during a recent rare plant survey between an area of black cherry forest and the river.

Several birds associated with the historic lakebed's scrubland habitat and considered Federal species of Management Concern were found at the park. These include the blue-winged warbler (*Vermivora pinus*), chestnut-sided warbler, Eastern meadowlark, field sparrow, grasshopper sparrow (*Ammodramus savannarum*), and Henslow's sparrow (*Ammodramus henslowii*). Other bird species of management

concern found in the park and associated with forested habitats included Northern flicker, red-shouldered hawk and wood thrush.

Mammal, reptile and amphibian inventories for this area are underway.

### **Natural Resource Issues**

#### ➤ *Water Quality*

A significant problem facing park management is the mitigation of the severe water pollution from the South Fork of the Little Conemaugh. The river is contaminated primarily with AMD and is listed as a 303(d) impaired waterway. Although the sources of AMD begin upstream beyond the park property, the severe pollution of this river detracts from the natural and visual integrity of the park. Cleaning up the river will likely require the park to work cooperatively with other partners such as the Stoney Creek and Conemaugh Rivers Improvement Project (SCRIP), which has completed other projects in the area, and the State of Pennsylvania DEP. Although the river has also historically had problems with sewage inputs, completion of a sewer line and wastewater treatment plant has aided significantly to the clean-up of this problem. A long-term sampling and monitoring program must be implemented to demonstrate the effectiveness of any future mitigation or restoration efforts.

#### ➤ *Lakebed Management*

In 1988 and 1991, the historic lakebed of Conemaugh Lake was cleared of trees and brush to give visitors a better visual view of the size of the lake that flooded the city of Johnstown in 1889. However, continual monitoring and control of exotic plants and woody vegetation must be done to prevent invasive species from re-establishing the area as well as to prevent natural succession from reverting the area back to a forested state. This habitat may be significant for scrubland bird populations and could be managed for viewshed and bird (and butterfly) populations simultaneously.

#### ➤ *Exotic vegetation*

As with all of the parks in the network, the spread of invasive plant species into the park is an issue at JOFL. Currently, invasive species are monitored and managed in the lakebed area of the park only (see above). Control programs have been started for giant and Japanese knotweed, exotic bush honeysuckles (including Morrow's tartarian and hybrids) and multiflora rose. Other exotic plants include common mullein (*Verbascum thapsus*) and teasel. Exotic plants in other areas of the park include exotic honeysuckles and multiflora rose.

#### ➤ *Species of Special Concern*

Many of the bird species of concern found within the park depend on a grassland/scrubland habitat. Responsible and informed management action is needed to perpetuate this habitat. Stressors including exotic animals such as the brown-headed cowbird may negatively affect bird species of special concern. However, the current population status of the cowbird and its effects on other bird species of the park is unknown. Those species that are dependent on forested

habitat may be negatively affected by stressors such as the gypsy moth or other exotic animals as well as acid deposition or exotic plants.

**Documents used for this summary:**

National Park Service. 2000. Strategic plan. Johnstown Flood National Memorial.

National Park Service. Resources management plan. 1998. Allegheny Portage Railroad National Historic Site /Johnstown Flood National Memorial.

Western Pennsylvania Conservancy. 2003. Plant community mapping and surveys for species of special concern at ALPO, JOFL, FONE, FRHI, Final Report.

Yahner, R. H., Klute, D. S., Keller, G. S., and Ross, B. D. 2001. Comprehensive inventory program for birds at six Pennsylvania National Parks. University Park, PA: The Pennsylvania State University. Technical Report NPS/PHSO/NRTR-01/084. 231p.

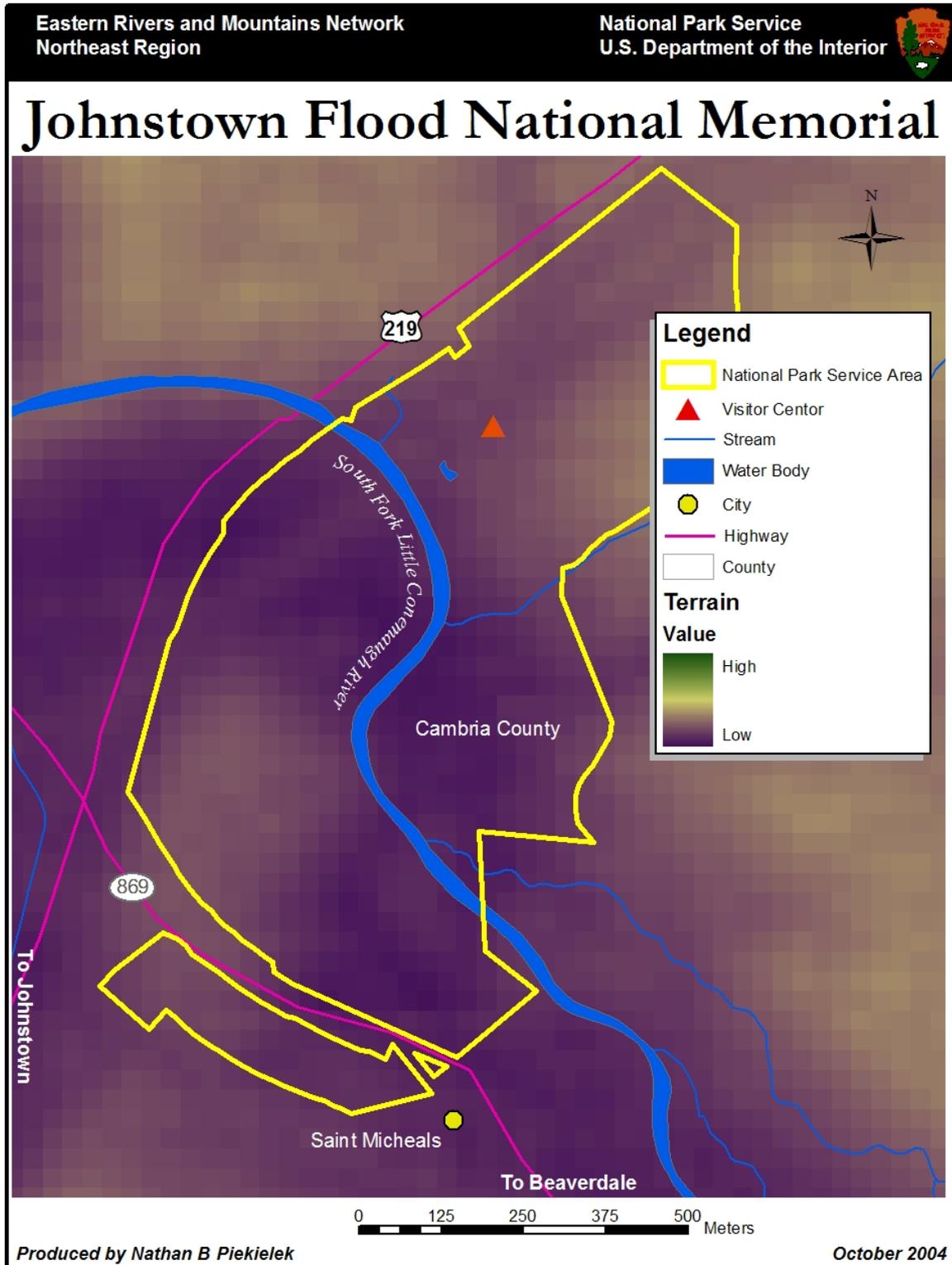


Figure 2: Map of Johnstown Flood National Memorial

**FORT NECESSITY NATIONAL BATTLEFIELD (FONE)****OVERVIEW**

State: Pennsylvania

Year established: 1931

2003 Acreage: 902

2003 Park visitation: 93,649

Fort Necessity NB was created in 1931 to commemorate the Battle of Fort Necessity and the early events that shaped George Washington's career as a military leader. It is located in southwestern Pennsylvania adjacent to the western ridges of the Appalachian Mountains (the Laurel Highlands) in Fayette County near Farmington, PA. The park is divided into three units; the main unit, which is the largest at 345 hectares, contains a replica of the Fort as well as a visitor center. This area is primarily forested, with areas of planted coniferous forest throughout the site as well as areas of grassland/open space, including the Great Meadow, where the battle was fought. At this site there are two perennial streams that were channelized in the late 19<sup>th</sup> century for drainage purposes (trenches and drainage tiles were installed later), which interfered with the hydrology of the site and likely created the meadow that is there today. The two other smaller units are the Jumonville Glen (11 hectares) and the Braddock's Grave sites (10 hectares), and are located a few miles west of the park. Jumonville Glen is largely forested and contains one intermittent stream, while the Braddock's Grave site contains one permanent stream that is considered a high quality cold-water fishery.

Although there are no particular threats to the water quality at the park, there are areas, especially the Great Meadow, where the hydrology has been significantly altered. Over time, this has created a significantly different plant and animal community than what was originally in this area. As with the other parks in the Network, exotic plants are also a prevalent problem, and overbrowsing by deer may threaten the native plants within the park. Of potential concern is the construction and opening of a "wild animal zoo" adjacent to park property in the headwaters of Great Meadow Run. If not managed properly, water quality could be affected.

**Enabling Legislation**

The US Congress enacted legislation on March 4, 1931 (46 Stat. 1522) for the purpose of commemorating the Battle of Fort Necessity in the state of Pennsylvania on July 3, 1754. This authorized not less than one acre of land, which included the site of the Fort. In furtherance of the purposes of the Act of March 4, 1931, additional lands were provided (not to exceed 500 acres), including acquisition of the detached Braddock Monument, and the name of Fort Necessity National Battlefield site was changed to Fort Necessity Battlefield (P.L. 75 Stat. 336) on August 10, 1961. Finally, the Jumonville Glen Unit was acquired through legislation providing for increases in

appropriation ceilings and boundary changes in certain units of the National Park System (88 Stat. 1455) (P.L. 93-477).

## Dominant Ecological Communities

### Terrestrial

#### ➤ *Plant Communities*

Within the three units of FONE, there are 209 ha. of deciduous forest, 106 ha. of pasture/meadow and 35 ha. of coniferous forest. Six different distinct natural terrestrial plant communities are found within the three units of the park. At the main unit, the dominant natural communities are red oak-mixed hardwood, red maple and tuliptree-beech-maple forest. In addition, there are approximately 14 ha. of palustrine wetlands, wet meadows and several other disturbed plant communities types, including herbaceous openings and early successional forest. This includes several areas of manmade conifer plantations throughout the main unit of the park that were planted by the CCC in the 1930's and the YCC in the 1950's. Within the Braddock Grave site, only one natural forest community, a red-oak mixed hardwood forest, is the dominant vegetation type, with additional acreage of conifer plantations and early successional forest. At the Jumonville Glen site, the area is dominated by areas of red-oak mixed hardwood forest and black cherry-northern hardwood forest with a small area of sandstone outcrop.

### Aquatic

#### ➤ *Riverine/Lacustrine/Wetland*

Three perennial streams (Great Meadow Run and Indian Run in the Great Meadow and Braddock Run at the grave site), 5 ponds/ impoundments, various intermittent streams and vernal pools are also found at the park.

## Significant Natural Resources

#### ➤ *Forests*

The tuliptree-beech-maple forest located at the main unit along the picnic loop is a large, varied and floristically diverse area. A small section of a forest type considered a state-ranked rare community, a rich-hemlock-mesic hardwoods forest, can also be found at the base of the picnic loop.

#### ➤ *Wet meadows*

Wet meadows and vernal pools supports a wide variety of plant and animal species at the main unit of the park. Great Meadow, the site of the Fort, has two streams that transect the site, and the meadow itself was likely originally a wetland area. However, alterations to the meadow (channelization of the streams and installation of drainage tiles/pipes to drain areas of the Great Meadows for parking facilities in the past), have altered the hydrology of this site (and likely the associated species as well).

#### ➤ *Streams*

There are two 1<sup>st</sup> order streams in the park (Indian Run and Braddock's Run), one 2<sup>nd</sup> order stream (Great Meadow Run) as well as several unnamed and intermittent waters. All of the streams are classified as high quality-cold water fisheries by the PA DEP. These waters attain this designation because of their excellent quality waters that require protection. Waters that are given this designation must be suitable for the " maintenance and/or propagation of fish species including the family Salmonidae and additional flora and fauna, which are indigenous to cold water habitat."

➤ *Species of Special Concern*

Two plant species of special concern can be found at the park. Bushy St. John's wort (*Hypericum densiflorum*), a Pennsylvania threatened species, was found at the main unit of the park and consisted of two colonies, one in a depressional wet meadow and one within a powerline right-of-way. The second, purple bluet (*Houstonia purpurea* var. *purpurea*) (currently ranked as Tentatively Undetermined within Pennsylvania), was found at the main unit of the park and consisted of three colonies of 4-15 plants each.

The yellow-bellied flycatcher (*Empidonax flaviventris*), a state threatened species, has been observed during spring migration. Three state vulnerable species, the Northern goshawk (*Accipiter gentilis*), Northern saw-whet owl and Swainson's thrush (*Catharus ustulatus*) have all been detected at the park during the non-breeding season. There are also several birds considered species of Federal Management Concern or are on the Audubon Watch List that have been found at the park during some point in the year, including the cerulean warbler, Louisiana waterthrush, Northern goshawk and wood thrush.

Although mammal inventories are still underway, the recently reintroduced fisher (*Martes pennanti*) has been observed at the park. Other fishers have also been seen at the park by staff since 1994.

Thirty-five different species of amphibians and reptiles can be found at the park, many within the areas designated as wetland and streams, although many can also be found in vernal pools throughout the woodland areas.

## Natural Resource Issues

➤ *Exotic plants*

There is a high prevalence of invasive exotic plant species in the open areas of the park and in some of the younger forest communities. Tartarian honeysuckle is the main invading species of concern, especially in the Great Meadows area although Japanese barberry, multiflora rose, crown vetch and winged euonymus (*Celastrus alatus*) are also potential problem species in some areas. Some areas near the main visitor center have had areas of honeysuckle bushes removed and some areas of the park are currently having areas of exotics mapped by GPS.

➤ *Forest management*

The southern half of the main property (along the picnic loop) includes a large and diverse forest of several plant community types. This is also an area in which many species of special concern can be found. This is a significant patch of forested landscape and represents an important biodiversity resource.

➤ *Wet Meadow and Wetland Management*

Although there appear to be no immediate threats to water quality in the park (with the exception of possible fecal contamination from a local “animal park”) there are other water issues. In particular, Great Meadow contains two permanent streams that were channelized in the 19<sup>th</sup> century to facilitate drainage. There is currently an effort to restore the cultural aspects of this area, which includes reforesting an area above the Fort and, potentially, to restore the natural hydrology of the streams within the Great Meadow, which would also be in keeping with the cultural history of this area. This action would also benefit the many wetland plant and animal species that prefer this type of habitat. However, there are concerns by park personnel that this action may be unfavorable to visitors using the area.

➤ *White-tailed Deer*

Like many national parks, an overpopulation of deer is a problem at FONE as well. Although there are no comprehensive surveys, deer browsing is a concern for many of the rare plant species.

**Documents used for this summary:**

Kimmel, W. G. and T. Clark. 2000. A level I water quality survey of Fort Necessity National Battlefield, Braddock’s Grave and Jumonville Glen. Technical Report NPS/PHSO/NRTR-00/083.

National Park Service. Natural Resource Planning Assistance. 2002. Fort Necessity National Battlefield.

National Park Service. 1982. General management plan. Fort Necessity National Battlefield.

Western Pennsylvania Conservancy. 2003. Plant community mapping and surveys for species of special concern at ALPO, JOFL, FONE, FRHI, Final Report.

Yahner, R. H., Klute, D. S., Keller, G. S., and Ross, B. D. 2001. Comprehensive inventory program for birds at six Pennsylvania National Parks. University Park, PA: The Pennsylvania State University. Technical Report NPS/PHSO/NRTR-01/084. 231p.

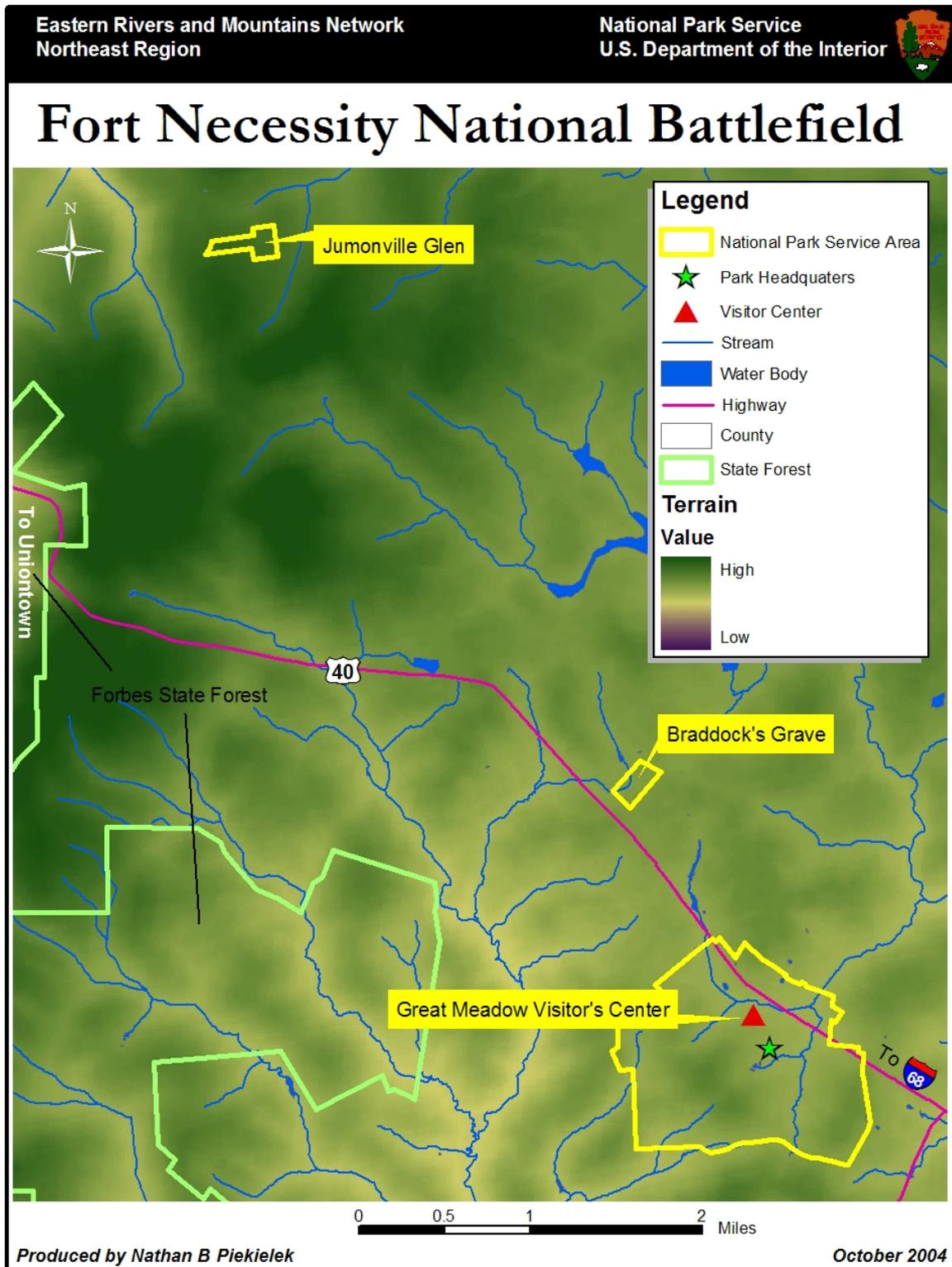


Figure 3: Map of Fort Necessity National Battlefield

## FRIENDSHIP HILL NATIONAL HISTORIC SITE (FRHI)

### OVERVIEW

State: Pennsylvania

Year established: 1978

2003 Acreage: 675

2003 Park visitation: 34,558

Friendship Hill NHS was created in 1978 to preserve the home and surrounding area of Albert Gallatin, Secretary of the Treasury under Thomas Jefferson. It is located in southwestern Pennsylvania near Uniontown in Fayette County and borders the Monongahela River. All of the 273 hectares are owned by the National Park Service, with the exception of 5 hectares owned by the Monongahela Railroad Company. The park contains areas of forest cover, grassland habitat and is bordered by the Monongahela River to the west.

Water sources within the park have historically been plagued by problems with acid mine drainage due to past land uses. Efforts at remediation have been somewhat successful, but would require additional, long-term money and resources. Exotic plants and browsing by deer are the primary threats to the native plants at the park.

### Enabling Legislation

Friendship Hill was created by an Act of Congress (PL 95-625) in 1978 to preserve the home of Albert Gallatin, who was Secretary of the Treasury under Thomas Jefferson.

### Dominant Ecological Communities

#### Terrestrial

##### ➤ *Forest*

FRHI is approximately 273 ha. of deciduous and coniferous forest. Dry-oak heath forest and red oak – mixed hardwood forest are on top of the plateau and upper slopes while a mixed mesophytic forest community and a sycamore-(river birch) – box elder floodplain forest community are located on the lower slopes and floodplain. The park also has a single wet meadow (emergent wetland). There are also several areas of early successional forest and other herbaceous openings (19 ha. of mowed hayfield and 51 ha. of abandoned drift mines).

#### Aquatic

##### ➤ *Riverine*

The park borders the Monongahela River and there are several tributaries that run through the park.

➤ *Wetlands/Wet Meadow*

A seepage area located above an old pond on Ice Pond Run is a unique patch of vegetation for the area and for the park. In addition, there are two ponds (Sophia's and a constructed AMD pond), a wetland (although it is impacted by AMD), a 1.2 ha. wetland at the mouth of Ice Pond Run and other small wetlands and riverine wetlands along the river.

## Significant Natural Resources

➤ *Terrestrial and Palustrine Forests*

The mixed mesophytic forest, found on the lower slopes of the Monongahela River, is listed as critically imperiled/imperiled in the state due to its rarity since it is generally a more southern forest type and other areas of forested river slopes have been degraded. The palustrine forest type is also considered an imperiled forest type and is found within the floodplain of the Monongahela River. This community is typical of the river valley and includes scattered channel wetlands along the river.

➤ *Species of Special Concern*

Many rare plants are found within the park. Nuttall's hedge-nettle (*Stachys nuttallii*), a Pennsylvania endangered species, had been documented at the park in 1989, but was not found during the most recent inventory. Harbinger-of-spring (*Erigenia bulbosa*), found along the lower slope of the Monongahela River, and blue monkshood (*Aconitum uncinatum*), found in the red oak-mixed hardwood forest are both considered state threatened species. Although the harbinger-of-spring population appears to be doing well, the blue monkshood colony has been subjected to heavy deer browse. In addition, the impact from spring rains bringing tires, old washing machines, refrigerators, etc. down from the neighbor's salvage yard has also most likely impacted this colony of blue monkshood. This area of park trail is closed and under investigation as an environmental crime scene.

Two other species, sourwood (*Oxydendrum arboreum*) and wild oats (*Chasmanthium latifolium*), have tentatively undetermined status. Although the wild oat population, which was documented on the shores of the Monongahela River, appears to be thriving, flooding and dredging of the river may threaten this species. The two colonies of sourwood found in the park may be threatened by deer browsing. Finally, mistflower (*Eupatorium coelestinum*; no official status, but a species of concern), which was found in two areas of the park, may be threatened by a variety of stressors, including flooding, mowing, herbicides and invasive species.

The federally protected bald eagle both breeds and winters within the limits of the park. Other bird species considered of Federal Management Concern, such as the blue-winged warbler, cerulean warbler, chestnut-sided warbler, and Louisiana waterthrush, all breed at the park. The state threatened osprey (*Pandion haliaetus*) was detected during spring migration, and two state vulnerable species, the northern bobwhite (*Colinus virginianus*) and summer tanager (*Piranga rubra*), have been detected as spring migrants.

Mammal surveys are still underway, however, the recently reintroduced fisher has been observed at the park.

➤ *Wet Meadow and Wetlands*

The seepage area is located above an old pond on Ice Pond Run and is a unique patch of vegetation for the area and for the park. In addition, there are two ponds (Sophia's and a constructed AMD pond), a swamp (although it is impacted by AMD), a 3-acre wetland at the mouth of Ice Pond Run and other small wetlands and riverine wetlands along the river.

### **Natural Resource Issues**

➤ *White-tailed deer*

Deer browsing may be a potential threat to some of the rare plants on the site.

➤ *Exotic species*

Tree of heaven and Japanese honeysuckle are the two major problems at this park. There are currently no removal efforts or mapping of these species.

➤ *Forest management*

There are some limited patches of diverse and natural deciduous forest that should be protected and expanded. The presence of the mixed mesophytic forest is notable as this is the most uncommon plant community on the property and is significant for Pennsylvania.

➤ *Wet meadow management*

The wet meadow (emergent wetlands) at FRHI is a unique habitat for the park, even though it is not an entirely natural plant community. There appears to be some natural seepage hydrology associated with this site, and activities within this boundary should be scrutinized for potential impact to the hydrology of the wet meadow. Hand-cutting of hardwoods may also be needed to impede natural succession.

➤ *Rare species management*

Several species of rare plants are found within the park boundaries (listed above). Nuttall's hedge-nettle, on the PA endangered species list, had been located in 1989 and has not been documented since. Forest succession and siltation from erosion of the minewall upslope may have threaten the occurrence of this species.

There are also several bird species of Federal Management Concern and two state vulnerable species that are found either breeding or migrating through the park. Continued impacts from areas such as the Junkyard on South Run (see below), may negatively impact this species. It is unknown how continued AMD problems from Ice Pond Run may influence species that breed along that stream.

➤ *Acid mine drainage*

Ice Pond Run is significantly damaged by AMD and both passive and active management of this area has been attempted since the 1980's. However, a lack of funds has closed the more recent treatment facility. A major effort (and money) would be needed by an agency outside the park to correct this problem, and it is likely that this will not be done in the near future.

There are also several mine portals that have been closed (as well as some that have opened up recently and required OSM funding to close) associated with the 6 ha. of mine tunnels beneath the knoll on which the Gallatin House sits. Only a small area of the house (a corner of the servant's wing) is over the mine tunnels. This could pose problems in the future.

➤ *Junkyard*

On the southern border of the park property, a large junkyard is posing a water quality hazard to the Monongahela River. South Run, which flows through this area to the Monongahela River, is impacted by fecal matter, which is coming from a cess pool shared by 2—3 dwellings, one of which is located at the salvage yard.

**Documents used for this summary:**

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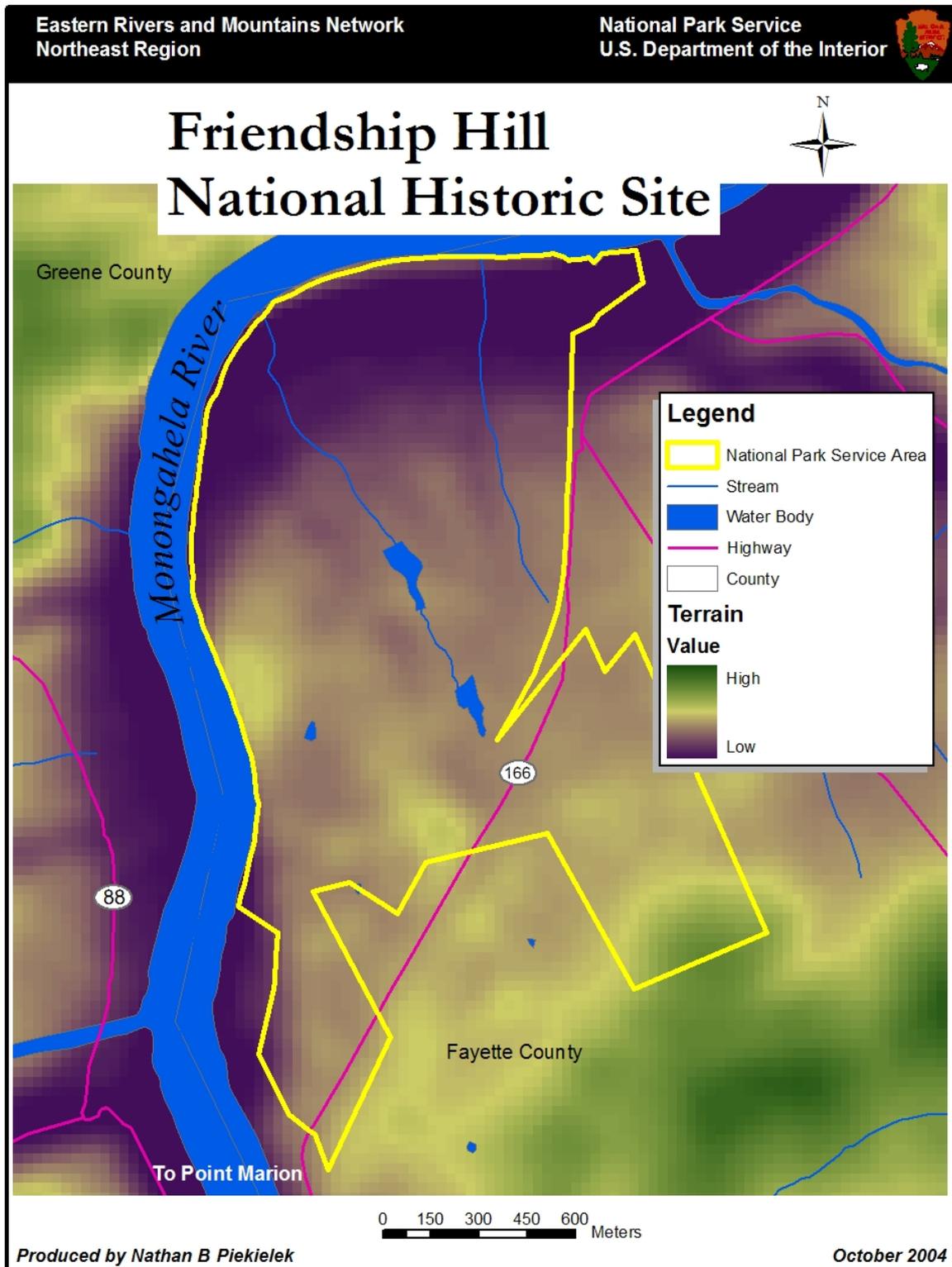


Figure 4: Map of Friendship Hill National Historic Site

**DELAWARE WATER GAP NATIONAL RECREATION AREA (DEWA)****OVERVIEW**

State: Pennsylvania and New Jersey

Year established: 1965

2003 Acreage: 67,192

2003 Park visitation: 4,616,320

The Delaware Water Gap NRA was created in 1965 for the purposes of public outdoor recreation and for the preservation of scenic, scientific and historic resources. The park is located along the Delaware River between Pennsylvania (Monroe, Northampton and Pike Counties) and New Jersey (Warren and Sussex Counties). The northern park boundary is south of Port Jervis, New York and the southern boundary is approximately 41 miles downstream. Although the park was originally established to provide for public recreational use of the proposed Tock's Island reservoir and surrounding areas, the project was ultimately put on hold due to environmental and economic concerns (authorization officially expired in 1992). In 1978, the National Parks and Recreation Act transferred all federal lands within the outer boundary of the National Recreation Area, as well as authority to acquire remaining private lands within the boundary, from the US Army Corps of Engineers to the National Park Service. Also in 1978, as part of the Wild and Scenic Rivers Act, the section of the river from north of Milford to Slateford Creek was named the Middle Delaware Scenic and Recreational River and is included within the park boundaries. Currently, the park receives the highest number of visitors of all of the parks in the Network, primarily due to its proximity to the many major metropolitan areas.

Approximately 80% of the park is owned by the federal government, with approximately 5% in private ownership and an additional 10% in nonfederal public lands. Within the park is a 25-mile segment of the Appalachian Trail, which runs through both Pennsylvania and New Jersey. Natural areas within the park include the Kittatinny Ridge and a segment of the Appalachian Mountains, wetlands, riparian areas surrounding the Middle Delaware Scenic and Recreational River and its tributary streams, hemlock ravines and rhododendron glades endemic to the New Jersey Highlands and the Pocono Plateau, numerous geologic features and several waterfalls, the hogback in Pennsylvania at Bushkill, and upland native grasslands and river valley bottomlands which have historically been farmed and are now maintained as open space and farmland to maintain the pastoral scene under the park's agricultural leasing program.

Water resources are a high priority for the park, and threats to those resources originate primarily from outside the park. Due to the park's proximity to the heavily populated areas along the east coast, the area has become a popular destination for residential and commercial development, as well as high visitor use within the park.

This has and will continue to lead to problems that relate to development such as wastewater treatment, construction and stormwater runoff, as well as a general degradation of the park's headwater resources. Exotic plants and animals are important threats to the terrestrial resources of the park, which include the federally threatened bog turtle, bald eagle and endangered dwarf wedgemussel, as well as many state listed threatened and endangered species.

## Enabling Legislation

The legislative mandate of the park can be found in Public Law 89-158, USC 460o, which states that the park is for "public outdoor recreation use and enjoyment of the proposed Tocks Island Reservoir and lands adjacent thereto...and for the preservation of the scenic, scientific and historic features, contributing to public enjoyment of such lands and water." It also required the Secretary of Interior to "adopt and implement...a land and water use management plan, which shall include specific provision for, in order of priority:

1. public outdoor recreation benefits;
2. preservation of scenic, scientific and historic features contributing to public enjoyment;
3. such utilization of natural resources as in the judgment of the Secretary of Interior is consistent with, and does not significantly impair, public recreation and protection of scenic, scientific and historic features contributing to public enjoyment."

This mandate was further enhanced by the Wild Rivers and Scenic Act (16 USC 1271-1287) which established the Middle Delaware (Milford to Slateford Creek) as a National Wild and Scenic River in October, 1988.

## Dominant Ecological Communities

### Terrestrial

Although the park was historically a climax community of white pine and hemlock with scattered areas of hardwoods, clearing of this forest in the 19<sup>th</sup> century and subsequent forest fires have left a forest of mostly second growth hardwoods. Since that time, some landowners have converted hardwoods back to conifers, primarily due to the chestnut blight. A vegetation map completed in the early 1980's lists that of non-water acreage in the park, approximately 69% is deciduous vegetation, 7.6% is mixed deciduous/coniferous, 5% coniferous, 4.8% herbaceous, 4.5% agricultural and 2.3% is "brush".

Trembley (1963) has identified 8 major plant communities that are found within the National Recreation Area (RMP):

- *Riverbanks and Islands*  
Along the river and lower portions of the tributary streams is found a floodplain forest, which includes sycamore (*Platanus occidentalis*), silver maple (*Acer saccharum*), red or river birch (*Betula niger*), American elm (*Ulmus americana*),

cottonwood (*Populus deltoides*) and willows (*Salix spp.*). Several islands on slightly higher ground contain more mature forest such as a stand of mature tulip poplar (*Liriodendron tulipifera*) on Depue Island. Open areas on the islands are frequently covered with stands of the prostate cherry (*Prunus pumila* var. *depressa*), a species of special concern. Several of the islands were farmed in the past and may account for extensive stands of exotic species.

- *Lowlands*

Most of the level land in the river valley has been farmed since the late 1700's. However, the riverbank tree species tend to invade these areas wherever sufficient moisture and rich soil are present. Black walnut (*Juglans niger*), butternut (*Juglans cinera*), and hickory (*Carya spp.*) also appear in considerable abundance. A small amount of the lowland has been planted in softwoods such as white pine (*Pinus strobus*), red pine (*Pinus resinosa*), scotch pine (*Pinus sylvestris*), white spruce (*Picea glauca*), and larch (*Larix spp.*). Some of the fields that were under cultivation have been allowed to undergo old field succession. Eastern red cedar (*Juniperus virginiana*) and white ash (*Fraxinus americana*) are frequent pioneer species. In addition, throughout the National Recreation Area, abandoned home sites are marked by remnants of domestic landscaping. Invasive exotic species such as tree of heaven, autumn olive, Japanese barberry and multiflora rose are increasing in relative abundance.

- *Slopes and upland forest*

Presently, the mountain slopes and forested uplands are covered primarily with a mix of northern and southern hardwoods. Common trees are white oak, northern red oak, black oak (*Quercus velutina*), chestnut oak (*Quercus prinus*), tulip tree, maple (*Acer spp.*), black cherry (*Prunus serotina*), beech (*Fagus grandifolia*), and hickory. White pine and hemlock dominate in cool damp areas, especially in ravines.

- *Old upland fields*

Native warm season grasslands are found in most of the old, abandoned fields and burned-over areas. While these grasslands can last for 20-30 years without replacement, they are easily invaded by gray birch, aspen (*Populus spp.*) sassafras (*Sassafras albidum*) and scattered pitch pine (*Pinus rigida*), white pine and red cedar. Subsequently, some of these areas are growing oak and hickory. However, in most of the old fields, the usual sequence is changing to a direct take-over by white pine.

- *Scrub oak barrens*

A small amount of this cover type is present in the uplands and usually appears on burned-over areas which have thin, poor, acidic soils. The dominant tree species are scrub oak with scattered sassafras and pitch pine. Aspen thickets may invade the wetter regions and lowbush blueberries are often abundant in open areas.

- *Cliffs*

The dry and almost desert-like cliffs on both sides of the river at Delaware Water Gap, Milford and Matamora support a specialized community of flora found at no other site in the region. The dominant tree of these cliffs is eastern red cedar. Species such as mountain spleenwort (*Asplenium montanum*), Goat's

roe (*Tephrosia virginica*), Rock-harlequin (*Corydalis sempervirens*) and prickly pear, a native cactus, can be found in these areas. Cliff areas which are shaded from the sun and receive some moisture have many ferns, mosses, lichens, liverworts, columbine, rock cress, and other moisture-loving species.

- *Talus slopes*

Talus slope habitat is quite rugged and inhospitable. Vegetation here is very sparse due to summertime air temperatures over the rocks reaching 120 degrees (F) and wintertime temperatures dropping far below freezing. The dominant vegetation is rock-encrusting lichens. Some of the species associated with the cliffs may grow wherever a small amount of soil collects between the rocks. Hemlock and red cedar sometimes invade the area.

- *Ravine banks*

These steep slopes and cliffs are always moist and usually protected from excessive sunlight. Quite often, north and south facing slopes have different flora due to differences in sunlight. Dominant trees of the south facing slopes are often oaks and hemlocks, while white pine tends to be more abundant on north facing slopes. The wet areas of both slopes support mosses, lichens, liverworts and ferns. Due to the steepness of the slopes, much of the forest was not lumbered.

## Aquatic

### ➤ *Riverine*

The Delaware River is one of the last free-flowing rivers in the Eastern United States and 40 miles of the river within the NRA have been designated as the Middle Delaware Scenic and Recreational River. There are a total of 255 miles of permanent surface rivers and streams within the park which includes 37 tributaries to the Delaware River.

Surface water quality in the park is regulated by the Special Protection Water Regulations developed by the Delaware River Basin Commission and adopted in 1993 by the state and federal representatives comprising the Commission. This monitoring based regulatory effort is supported by the Scenic Rivers Monitoring Program, a cooperative program between the DRBC, DWGNRA and Upper Delaware Scenic and Recreational River (UPDE). Multiple sites along the river and its tributaries are monitored for various water quality parameters. Additional sites and/or parameters are monitored through cooperative efforts and partnerships with other Federal agencies, states, municipalities and volunteer organizations.

### ➤ *Lacustrine*

There are also more than 100 lakes, ponds and impoundments in the NRA, the majority of which are in Pennsylvania. Only one of these lakes, Crater Lake, is considered to be natural.

### ➤ *Wetland*

DEWA contains over 6,000 ac. of palustrine wetlands. An inventory of wetlands at the park was completed in the early 1990's, however, there has been no systematic

ground-truthing of these wetlands. There is a need for a more detailed inventory of existing wetlands, as well as the plant and animal communities that are found at each of these wetland areas.

➤ *Vernal Pools*

There is currently no complete map of the existing vernal pools within the park, although some areas have been located by park personnel through satellite imagery. The vegetation mapping effort may successfully delineate numerous vernal pools.

## Significant Natural Resources

➤ *Flora*

Many species of rare and endangered plants can be found within the park. As of 2002 (RRP 2002), 1125 vascular plants (aquatic and terrestrial), 213 bryophytes, 12 rare plant communities and 121 species of concern have been identified (51 state listed threatened or endangered).

The New Jersey Natural Heritage Program (1986) has identified 25 critical habitat sites that are in need of special protection and the Nature Conservancy (1986) also lists 15 protected sites in the Pennsylvania portion of the NRA along with their ecological importance to plants. Some of these sites include:

- 1) *Artic Meadow* – located at the base of the east slope of the Kittatinny Mountains and contains the rare Hammond’s yellow spring beauty (*Claytonia virginica* var. *hammondiae*).
- 2) *Montague site* – located along the Delaware River and contains a number of diverse habitat types, including alluvial woodlands, hemlock-rhododendron woods, wet seeps and springs, muddy shores and dry limestone rock ledges and banks. Approximately 11 species of rare and endangered plants occur in this area.
- 3) *Delaware River* (near Dingman’s Ferry) – this shoreline represents one of the richest botanical areas on the New Jersey side of the NRA and contains 11 rare and endangered plants.
- 4) *Crater Lake* – comprises five separate botanical sites and 13 rare and endangered plant species are recorded in this area.
- 5) *Raymondskill Falls* – Contains Pennsylvania’s only known extant population of Labrador marsh bedstraw (*Galium labridoricum*).
- 6) *Arnott Fen* – An alkaline wetland with Pennsylvania’s only known extant population of shrubby cinquefoil.

A rare plant survey of the Appalachian Trail was also completed in 2000-2001 and many rare species and plant communities were found.

Since the mid-1980’s, maps identifying rare and endangered flora species occurrences for both states were prepared by each state’s Natural Heritage Program. Since then, new locations for the species have been identified during compliance activities for park development.

➤ *Aquatic community*

Both Adams Creek and Toms Creek are listed as Exceptional Value waters under PA Code as well as are portions of Sawkill Creek and Slateford Creek, which are upstream of the NPS boundary. Most of the other waters found within the park boundary are considered High Quality under PA designation. Most of the park water within NJ boundaries are considered Category One antidegradation waterways.

The Delaware River supports many species of native fish, including the brook trout (*Salvelinus fontinalis*), American shad (*Alosa sapidissima*), striped bass (*Morone lineatus*) and American eel (*Anguilla rostrata*). The federally endangered dwarf wedgemussel (*Alasmidonta heterodon*) has been recently documented in areas along Flat Brook, and is found just outside of park boundaries as well (RRP 2002).

➤ *Wetlands*

A basic inventory of all of the wetlands in the park was done in the early 1990's. There are five wetlands that are considered priority by the state of NJ: Arctic Meadows, Dingmans Ferry Rivershore, Mashipicong Island, Smith Ferry Rivershore and Tock's Swamp. Arnott Fen is a globally rare wetland community found on the PA side of the park near Flat Brook.

The PA Natural Heritage Program has discovered an unusual vernal pool atop Kittatinny Ridge, where the substrate consists of large boulders. They observed large numbers of fairy shrimp, dragonflies and other invertebrates and this may be a potentially good site for future rare invertebrate surveys.

➤ *Fauna*

Basic inventories are still underway at the park. As of 2002, 657 species of invertebrates (3 species of concern, 1 state T/E), 25 species of amphibians (10 species of concern, 1 state listed T/E), 24 species of reptiles (7 species of concern, 3 state T/E), 79 resident species of birds (51 species of concern, 11 state T/E), 41 native mammal species (12 species of concern, 3 state T/E) and 37 native fish species (9 of concern, 2 state T/E).

Three federally listed animal species can be found at the park: the bald eagle (*Haliaeetus leucocephalus*), bog turtle and dwarf wedgemussel. The federally endangered bald eagle is monitored during both the winter as well as at spring? nesting sites. The population is considered stable. Monitoring of the winter population is done through the Nationwide Mid-Winter Bald Eagle Count and NJ Fish and Wildlife's Endangered and Nongame Species Program and has occurred since 1986. Nesting bald eagles have been monitored by the park for the past four years. An inventory of habitat for the federally threatened bog turtle was completed in 2001, and current and future work will concentrate on research and long-term monitoring (RRP 2002). Some restoration work is being done at wetland sites to eradicate purple loosestrife in areas that offer suitable bog turtle habitat.

There are at least 50 species of amphibians and reptiles that are found within the area, including the federally threatened bog turtle (see above). An inventory to identify key habitat for the state (NJ) threatened wood turtle occurred in 2001. As with the bog turtle, long-term goals of this program are to conduct research on habitat needs, assess population status, and achieve a population status of stable or improving (RRP 2002). Containment of purple loosestrife in wetland areas and establishment of a grassy buffer strip at a key site are also part of the program. Cooperation with the agricultural leasing program will help maintain corn fields that the turtles appear to prefer for nesting.

The state endangered least shrew (*Cryptotis parva*) (PA), bobcat (*Lynx rufus*) (NJ) and Allegheny woodrat (*Neotoma magister*) (NJ), as well as many other rare mammal species have been recorded in the park. In total, over 43 species of mammals have been reported, including black bear (*Ursus americanus*), river otter (*Lontra canadensis*), red and gray fox (*Vulpes vulpes* and *Urocyon cinereoargenteus*) and many small mammals.

In addition, another globally rare invertebrate, the cobblestone tiger beetle (*Cincindela marginipennis*), was surveyed on islands of the Delaware River in 2001 in cooperation with the NJ Natural Heritage Program. Other invertebrates have not been inventoried, although there are possibilities that other federally listed species such as the regal moth (*Citheronia regalis*), and a freshwater sponge (*Spongila lacutris*) could occur at the park.

#### ➤ *Geology*

The DEWA contains significant remnants of geologic processes in the Northeast United States. This includes the Water Gap, which is a distinctive geologic feature where the Delaware River cuts across the Kittatinny Ridge of the Appalachian Mountain Chain, as well as surficial geologic features, including glacial and alluvial features, and hydrologic processes, among others. The monitoring of geological processes can serve as an indicator of change in greater ecosystem function. (APP 2001).

### **Natural Resource Issues**

#### ➤ *Surface Water Quality and Quantity Protection*

Water resource use and protection are high priorities based in DEWA's enabling legislation, GMP and the Wild Rivers and Scenic Act. There are pressures outside the park for increased residential and commercial development which may affect many aspects of water quality and quantity. Wastewater effluent from rapid residential, resort and commercial development is the largest contributor to point source pollution in the DEWA area. Potential sources of non-point source pollution include erosion and sedimentation from new construction, increased stormwater runoff and septic system failures. Pesticide and herbicide use from areas outside the park also contribute to non-point source pollution. Eutrophication from an increase in nutrient inputs to park waterways has already affected Hidden Lake in the form

of dramatic algal blooms which have altered the scenic value of this natural resource.

Water volume within the mainstem of the Delaware River is largely dictated by dam releases from several New York reservoirs. The frequency and volume of these releases profoundly affect and alter the natural ebb and flow of seasonal baseflow conditions. What's more, the water released from reservoirs rarely has the physical and chemical properties of natural water inputs. Varying temperature, dissolved oxygen content and nutrient loading of reservoir water, among other properties, can dramatically alter conditions in the mainstem. The potential biological effects of these altered conditions are largely unknown, but assumed to be profound.

➤ *Forest Health*

• *Exotic species*

Exotic species such as the hemlock woolly adelgid, which was first documented in 1988, affect over 2,000 ac. of hemlock stands within the park. Some areas around the park have seen extensive mortality due to the insect, and all areas of the park are infested to varying degrees. Within the park, more than 250 hemlock trees were removed in 2002, many of them at Childs Recreation Site. Studies have been started by the CEMRI project to study hemlock decline as it relates to such issues as nutrient dynamics, forest productivity, and fungal and bird communities. (RRP 2002). To control infestations, *Pt (Pseudoscymnus tsugae)* beetles have been released at eight different sites in the park and other options (pesticides) are being considered.

The gypsy moth has also been a problem in the park since 1967 and can cause widespread hardwood tree defoliation and mortality during years of high pest population density. Gypsy moth egg mass surveys are done on the NJ side of the park each year and aerial surveys are done by the US Forest Service each year. However, no systematic study of tree mortality has been done and no areas have been treated within the park.

• *Acid deposition*

Acid deposition is another threat to forest systems, and there is a NADP/NTN monitoring station nearby in Milford, PA. Researchers and volunteers have provided some information on the effects of acid deposition on lakes and streams as well as on red spruce and white pine (RMP). A study completed in 1986 concluded that 5 lakes and ponds were already acidified, although the Delaware River and most of its tributaries had pH readings in the normal range. Problems of low pH may also affect many species of salamanders, frogs and turtles that utilize forested ephemeral ponds in the park.

• *Deer*

White-tailed deer (*Odocoileus virginianus*) are also considered a problem at DEWA. However, regulated hunting seasons within park boundaries may help contribute to the effective management of this species.

- *Other*

Other issues relating to forest health include forest regeneration, poor understory condition due to deer browse and past land uses, and habitat fragmentation due to development.

- *Open space*

About 20% of the land at the park has been designated as open use designation, to maintain the cultural aspects and historical uses of the park. Approximately 3,000 ac. of this land is leased to farmers under the agricultural leasing program, while another approximately 1,500 ac. of the land is maintained as open space or grassland habitat for birds and other species. Many of these fields have problems with overgrowth by exotic species such as autumn olive (*Elaeagnus umbellata*).

- *Exotic plant species management*

Over 241 species of invasive exotic plant species and 28 exotic animal species have been identified within the park. Species such as purple loosestrife are a threat to wetland areas, Japanese knotweed is a problem in riparian areas, and autumn olive and multiflora rose are invasive in open areas. Two hundred acres of invasive exotic vegetation have been identified for management (by 2005) and an additional 500 ac. in NJ were specifically identified as restorable from invasion by autumn olive (APP 2001).

Twenty-one sites where purple loosestrife has infested wetlands have been targeted for control by releasing biocontrol beetles with follow-up monitoring to determine the effectiveness of this technique. Although complete eradication is not expected, an attempt will be made to restore severely degraded areas and reduce the rate of spread to new sites. Monitoring of beetle-release sites is expected for up to five years (RRP 2002).

Seventy-six total acres were treated in 2002, including areas infested with autumn olive, tree-of-heaven and Canada thistle (RRP 2002). Herbicides are being used to control areas of invasive exotic plants throughout the park while some areas in NJ will be cleared of autumn olive entirely. Infestations of tree of heaven are being treated to determine the most effective means of control. Japanese knotweed, which has been found in 54 ac. along the river corridor is being actively controlled at Dingman's Ferry by herbicide spraying and then pulling of new recruits. Additional funds are necessary to identify the most important species to control and to implement appropriate treatment in targeted areas (RMP).

- *Rare species management*

Although the each state's Natural Heritage Program have identified rare and endangered flora at the park in the mid-1980's, the park needs to develop a monitoring program to track these species in addition to continuing to search for both new locations of rare species known to occur in the park, as well as locations of rare species new to park knowledge. Although most sites have not been

revisited, special studies have been initiated at Arnott's Fen and Delaware River shoreline.

Although initial surveys have been completed for many rare species, such as the bog, wood and map turtle, additional funds would be necessary to monitor these species over the long-term.

➤ *Visitor Impacts*

Some areas of the park see heavy usage from day and overnight visitors. Some of these areas, such as Childs Picnic Area which is heavily used by day visitors, is a sensitive site due to the amount of hemlock forest in the area.

Roads throughout the park are also a hazard for species such as the bog turtle, which are periodically killed as they cross roads to reach new wetland areas.

➤ *Restoration of disturbed areas*

Stream and wetland restoration projects are currently ongoing throughout the park. A wetland restoration study is underway in agricultural fields at Hornbeck's Creek, Shimer's Brook and near the town of Flatbrookville. Natural stream restoration techniques are being used at the Pool Colony area, where a dam breach has caused channel erosion and sedimentation into the adjacent stream. Similar stream restoration projects will be undertaken at Sawkill Creek, Raymondskill Creek, Van Campens Brook and Flatbrook (RMP).

Native grassland restoration is also occurring on 27 ac. within the park, mostly in agricultural areas, using local grass cultivars. On restored grassland areas, bird surveys are being conducted to determine use of these areas by animals (RRP 2002).

➤ *Fisheries*

The enabling legislation of DEWA allows for hunting and fishing on the lands and water under the jurisdiction of the park. These legislative provisions clearly establish a need for an active wildlife and fisheries management program at DEWA. In order to achieve the successful management of said wildlife and fisheries, it is imperative that such a program operate with a high level of coordination with the state agencies (RMP).

➤ *Education/Outreach*

Public understanding and support for existing and future management programs is essential for the park to continue to fulfill its management objectives. The prevention of visitor activities that have a negative impact on natural and cultural resources is an important part of education/outreach for a balanced resource management program (RMP). Though not an NPS operation, the Pococno Environmental Education Center is located within park boundaries and provides day and weekend educational programs for schools, church and youth groups.

➤ *Fire*

The ecological role of fire in the region surrounding DEWA in pre-human settlement times is unknown. Although natural fires are a rare occurrence, incendiary fires are common due to the large number of visitors. The use of prescribed fires within DEWA will be evaluated as a tool for landscape management by park staff and scientists. The Allegheny Research Station of the U.S. Forest Service will be conducting a study on fire in parts of the park's oak forest. The vegetation mapping will hopefully delineate areas that have historically been prone to fire or can be targets for future fire management (RMP).

**Documents used for this summary:**

National Park Service. 2001. Annual performance plan. Delaware Water Gap National Recreation Area.

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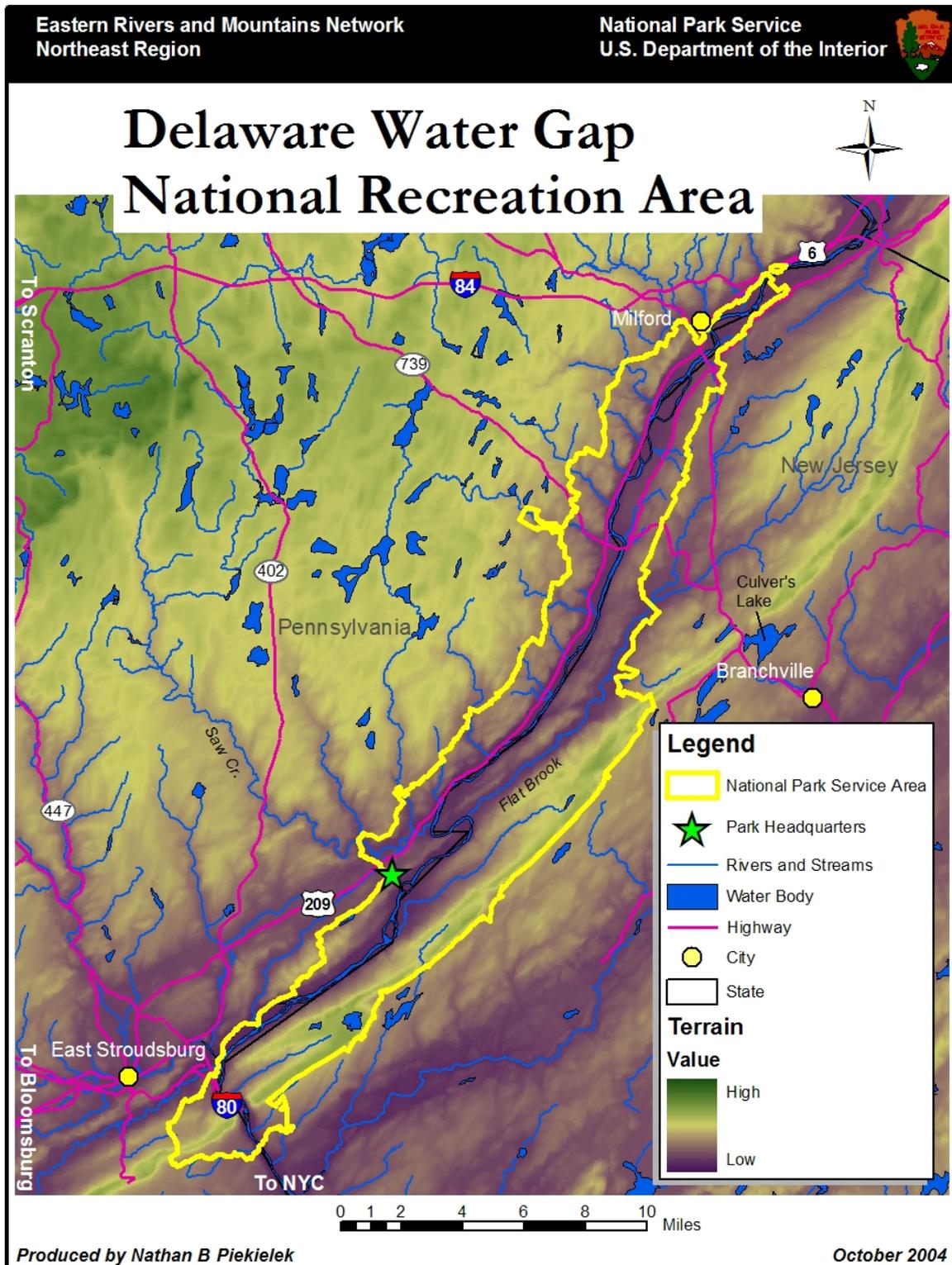


Figure 5: Map of Delaware Water Gap National Recreation Area

## UPPER DELAWARE SCENIC AND RECREATIONAL RIVER (UPDE)

### OVERVIEW

State: Pennsylvania and New York

Year established: 1978

Authorized acreage: 75,000 (30 acres currently in NPS ownership)

2003 Park visitation: 259,713

Upper Delaware NSRR was designated in 1978 as part of the Wild and Scenic Rivers Act, and was designated to protect the outstanding scenic, recreational, geologic, fish, wildlife, historic and cultural resources of this section of the Delaware River; to protect its water quality; and to provide for the enjoyment of present and future generations. The park is located on the border of Pennsylvania (Pike and Wayne Counties) and New York (Delaware, Orange and Sullivan Counties) and follows the path of the Upper Delaware River from Hancock, NY to Sparrowbush, NY. The Delaware River Basin provides drinking water to over 25 million people. This is the largest of the parks in the network (75,000 acres in authorized boundary), although only 30 acres are currently in federal ownership, with the rest in state or private ownership. A landward boundary (an average of 1 to 2 miles along the length of the river) was established to satisfy the resource protection requirements of the Wild and Scenic Rivers Act. Most of this land area is forested, although agriculture is common on the flat floodplain along the river and low density development is spread throughout the river valley.

Because the park was created through the Wild and Scenic Rivers Act, water resources are central to park management. However, since the park only owns a small percentage of the overall protected boundary of the park, all management decisions require coordination with multiple partners in two different states. Problems arise with activities that occur outside the park, but that are negatively impacting resources within park boundaries. Examples of such problems include non-point source pollution from agriculture and failing septic systems, contaminant inputs from industrial and commercial discharge sites and adverse affects on water quality from residential development.

### Enabling legislation

The Upper Delaware SRR was designated by Congress as a unit of the National Wild and Scenic River System on November 10, 1978. The purpose of the Upper Delaware SRR is to preserve and protect, in a free flowing condition, an approximately 73-mile segment of the Upper Delaware River. The river valley is to be protected through land use controls and the cooperative efforts of local governments. It requires management of the area with little federal acquisition of land; working closely with all existing local, county, state, and federal land management authority and specifies the writing of a management plan in cooperation with the states and local political subdivisions.

## Dominant Ecological Communities

### Terrestrial

#### ➤ *Forest*

Approximately 50-75% of the corridor is forested, comprised primarily of riparian and northern hardwood forest types. Various forms of open space, agricultural lands, and fallow fields permeate the river corridor.

### Aquatic

#### ➤ *Riverine*

The Upper Delaware SRR contains 73.4 river miles that have been designated as part of the National Wild and Scenic and Rivers Act. Although it is an undammed river there exist several dams on major tributaries. Consequently, baseflow within the river is largely controlled by coordinated releases from two hydroelectric dams (Wallenpaupack Dam on the Lackawaxen River and the Rio Dam on the Mongaup River) and two water reservoir dams (Cannonsville Dam on the West Branch and Pepacton Dam on the East Branch of the Delaware River) in New York. Overland flow, and precipitation and groundwater inputs constitute the remainder of river flow.

## Significant Natural Resources

#### ➤ *Aquatic community*

The river provides outstanding habitat for trout, smallmouth bass, walleye, and a variety of other fish species. American eels are found throughout the corridor, and the Upper Delaware also provides key spawning and nursery habitat along its entire length for the American shad. The Delaware is the only natural shad river in the Northeast (from Maine to West Virginia) that is sufficiently free of man-made barriers and industrial pollution to allow passage of these migratory fish to their historical spawning habitats in the upper reaches of major east coast rivers. Water quality sampling by the Delaware River Basin Commission (DRBC) has indicated that water quality is good to excellent in the Upper Delaware. Macroinvertebrate sampling at most locations suggest the presence of healthy aquatic insect assemblages with rich and diverse populations of pollution sensitive species. What's more, it is believed that nearly 70% of Pennsylvania's river otter population resides in the Upper Delaware River Basin. Many rare and endangered plant and animal species can be found within the aquatic community of the park.

#### ➤ *Species of Special Concern*

Four aquatic plant species of concern were located in a study by the Nature Conservancy in 1994, although five others that had been previously located within the park were not found. In 1991, the Pennsylvania Nature Conservancy bought approximately 202 ha. of land adjacent to the Delaware River in Wayne County to protect a small cluster of miners lettuce plants, which is a state endangered species in PA.

A mussel survey in 2000 by the USGS found the dwarf wedgemussel, a federally endangered species, the eastern pearlshell (*Margaritifera margaritifera*), a state proposed endangered mussel, and the brook floater (*Alasmidonta varicosa*), a NY threatened mussel within park boundaries. Ongoing projects further understanding of the population dynamics of these and other mussels within the park.

The Upper Delaware river corridor provides some of the most important inland bald eagle wintering habitat in the eastern United States. In 2000, 145 bald eagles were counted along the river within the park. The eagles also nest at the park and in 2000, 4 nests produced a total of 6 young. Other bird species within the park that are of concern include the cerulean warbler, worm-eating warbler, yellow-throated warbler (*Dendroica dominica*), Blackburnian warbler (*Dendroica fusca*) and acadian flycatcher (*Empidonax virescens*).

There is suitable habitat for other rare plants and animals, however, complete inventories are lacking for many taxa due in large part to the logistic complexity of conducting surveys on private lands.

➤ *Geology*

A diversity of unique land forms exist throughout the river corridor. The Delaware River Gorge has been identified by the Pennsylvania Bureau of Topographic and Geologic Survey as one of the outstanding scenic geologic features in the state. The gorge begins above Matamoras and runs north through most river segments, ranging between two and three thousand feet in width. Geologic processes formed many economically valuable deposits, including bluestone, sand and gravel, shale, and peat and left them exposed throughout the river corridor.

### **Natural Resource Issues**

Because the NPS only owns approximately 30 acres of land within the designated legislative boundary of the park, all wetlands, game management, fisheries, mining, solid waste management, sewage and other resource issues affecting the river are coordinated through existing state or federal regulatory programs. Coordination is needed between all of the agencies involved to serve the needs of the Upper Delaware River Basin and responsibly manage its natural resources.

➤ *Water quality*

The lack of coordination of existing water quality monitoring programs in and surrounding UPDE is of concern. The park currently has a monitoring program on the mainstem of the Delaware River and some of its tributaries in cooperation with the Delaware River Basin Commission. However, this program may not currently be meeting all of the park's water quality monitoring objectives. Furthermore, respective state water quality monitoring programs sample only periodically and are ill equipped to identify existing and potential stressors. One neighboring locality Pike County, NY has an active water quality monitoring program, but as is the case with other programs, by itself it's utility is limited. Greater coordination and cooperation among existing water quality monitoring programs is needed before

scientists and managers can effectively identify the source of water quality impairments and promote corrective action.

One of the largest threats to water quality within the park is considered to be non-point source pollution. This is especially evident during times of high flow when nutrient and fecal coliform levels are greatly increased and the later can at times exceed EPA limits (see appendix G for more information).

Toxic sources of pollution are also a problem for the waters within the park and originate from many different sources. Some of the potential factors affecting water quality within the legislated park boundaries are:

- *Agriculture*

There has been a significant build-up of nutrients in the waters of the tributaries to the Delaware River that may be linked to agricultural uses above New York City reservoirs.

- *Sewage and Stormwater*

Although the demand for seasonal and retirement homes within the area has increased significantly each year, only two of the fifteen townships within the federal scenic river designation have built a municipal sewage system. Any water quality monitoring program should be coordinated with state outfall permit systems for stormwater and sewage treatment systems and the load capacity for the entire tributary needs to be known and analyzed each time a new outfall permit application is made or renewed.

- *Unlined landfills and closed municipal or town dumps*

State laws have closed most of the local “dumps”, but little, or no, groundwater monitoring has been conducted at many sites. There are four active state authorized landfills in the region and all have past history of leaching toxics into groundwater. Three closed, unlined landfills pose a direct pollution threat to the Delaware River, including a federal Superfund site near Narrowsburg, New York. Two additional industrial sites that contain large quantities of potentially toxic material are located above the scenic river corridor on the east and west branches of the Delaware River. All of these sites are under state or federal investigation, or currently undergoing remediation.

- *Pesticide and herbicide use*

Herbicides are sprayed along a railroad right-of-way each year for the entire 73.4 mile corridor to prevent the encroachment of vegetation as well as near local signs along major highways adjacent to the river. In addition, right-of-ways for most highways are sprayed by a non-systemic herbicide to reduce the annual vegetative maintenance costs of the state DOT. Some pesticide and herbicide application occurs on farmland adjacent to the Delaware River for corn crops in New York and Pennsylvania.

- *Toxic spills from rail and truck traffic*

There is a significant Hazmat threat to the mainstem and tributaries to the Delaware. Freight service by two train companies that transport toxic chemicals is conducted daily on tracks that parallel the entire 74.3 miles of the scenic river designation of the Delaware River. Several serious, and numerous minor,

derailments have occurred during the past ten years and it seems to only be a matter of time before a catastrophic spill occurs.

- *Gas and oil storage facilities*

There is significant potential for river water contamination from non-point spills, or leaking, from gas and oil storage facilities in the corridor. There are three small fuel oil distributor storage facilities in the corridor and each has above ground storage tanks exceeding the 10,000 minimum capacity that requires additional spill protection. Although each must have a catch basin capable of containing all of the material stored above ground, to date only one of the three has complied with the requirement.

➤ *Residential and Commercial Development*

Because the majority of land that is included in the legislative boundaries of the park is privately owned, development of commercial and residential property is a concern. Urban, suburban and rural development can affect many aspects of terrestrial and water ecology. Negative impacts on ecology can include the loss of habitat as well as possible increases in runoff and sedimentation from construction site and impervious surfaces, sewage and septic failures and other non-point sources of pollution. Although the park continues to work with the surrounding state and local governments to guide future development of the area, many townships still lack effective zoning ordinances to ensure the protection of water quality in the Delaware River and its tributaries.

➤ *Exotic species*

The gypsy moth has caused problems in the forests surrounding the park to varying degrees through time. *Bt* is being sprayed in both Pennsylvania and New York, although the amount of acreage covered each year varies. The woolly adelgid has recently been identified in the park, and *Pt* beetles have been released in an attempt to control this forest pest.

As with all parks in the Network, exotic and invasive plant species are found throughout the park. Aquatic species of concern include water-milfoil (*Myriophyllum* spp.) and curly pondweed (*Potamogeton crispus*) and terrestrial plants considered of special management concern include purple loosestrife, Japanese knotweed, garlic mustard, autumn olive, Japanese barberry, and water chestnut.

Non-native fish species are common within the Delaware River and its tributaries. Many tributaries are stocked with non-native fish species by the Pennsylvania Fish and Boat Commission and the New York Department of Environmental Conservation. Tributary waters now support some of the most prized populations of naturally reproducing non-native wild trout in the eastern United States.

➤ *Deer*

As with the other parks in the Network, deer overpopulation is a persistent problem and is blamed in part for the lack of native forest regeneration in the park. Deer

densities are currently more of a problem on the Pennsylvania side of the park than the New York side.

**Documents used for this summary:**

National Park Service. 2000. (Draft) Resources management plan. Upper Delaware Scenic and Recreational River.

National Park Service. 2000. Strategic plan. Upper Delaware Scenic and Recreational River.

National Park Service. 1986. Final river management plan. Upper Delaware Scenic and Recreational River.

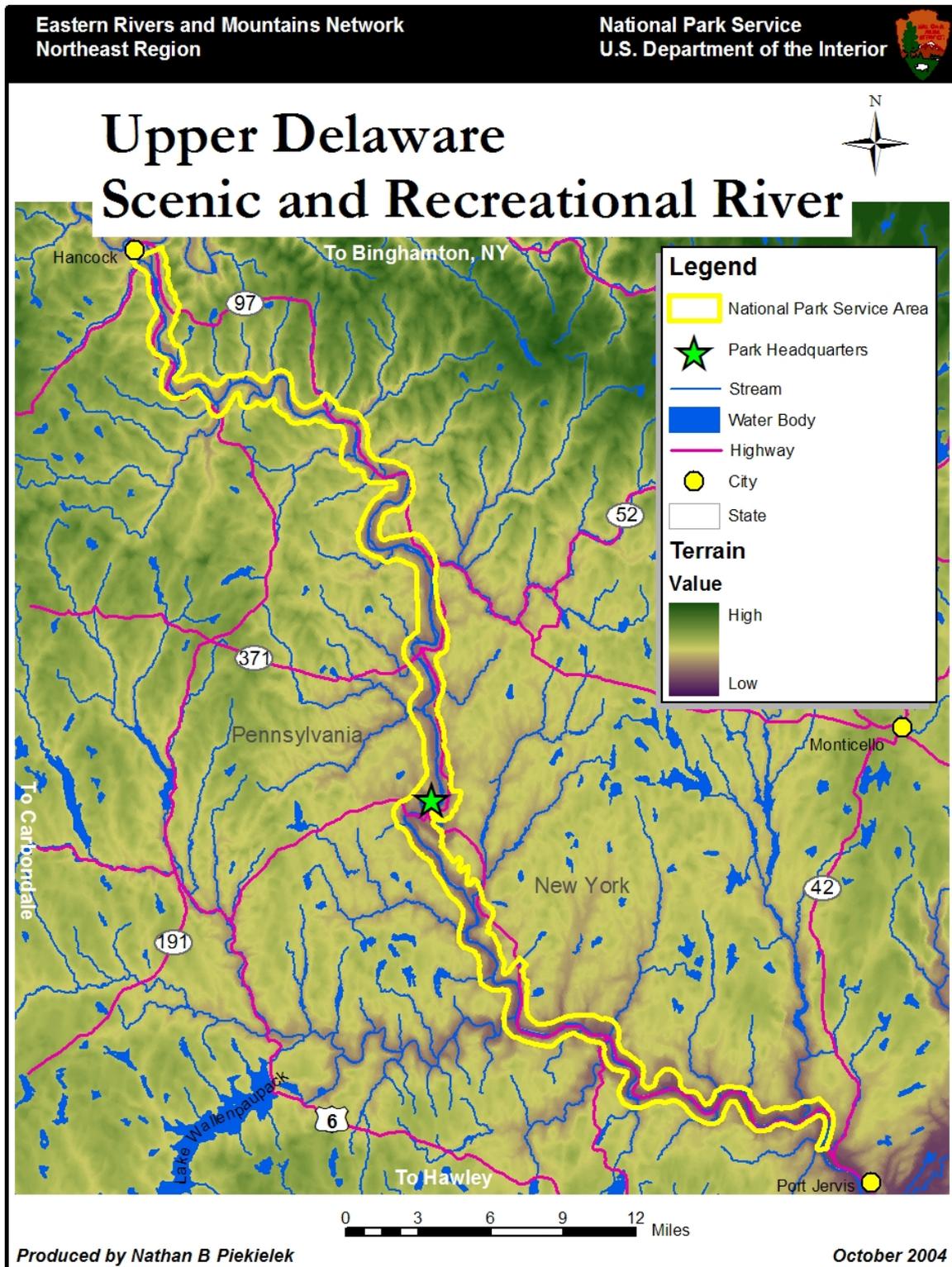


Figure 6: Map of Upper Delaware Scenic and Recreational River

## NEW RIVER GORGE NATIONAL RIVER (NERI)

### OVERVIEW

State: West Virginia  
Year established: 1978  
2003 Acreage: 72,189  
2003 Park visitation: 1,121,416

Congress authorized the New River Gorge National River in 1978 and assigned the National Park Service management responsibility to conserve and interpret the park's resources and preserve the river segment as a free-flowing stream. The New River Gorge National River is 53 miles long and includes a 70,000 ac. river corridor from Hinton, WV to the U.S. 19 bridge near Fayetteville, WV and includes parts of Raleigh, Fayette, and Summers Counties. Depending on how age is determined, the New River could either be the second oldest river in the world (next only to the Nile), or one of the oldest in the Appalachian Mountains. The New River Gorge is home to a diverse array of plants and animals including numerous rare species.

The New River, the gorge, and the Allegheny Plateau offer excellent opportunities for the study and interpretation of geologic processes due to the many exposed geological formations. NERI supports an impressively diverse set of plant and animal species for a variety of reasons. First, the New River serves as a natural migration route for a variety of species. Second, NERI's extreme topography affords an array of ecological conditions from Riverine to Plateau, consequently supporting an array of species. Finally, NERI's position in a more regional context provides both the northernmost habitat for many more typically southern species, as well as the southernmost habitat for typically northern species. The quality of the water in the New River is generally good and the river is considered one of the state's leading warmwater fisheries. There are five endemic species of fish found in the New River.

Among the most prevalent natural resources issues at the park are problems with treated and untreated sewage affecting aquatic resources of the park. In addition, the proliferation of exotic aquatic species (fish, crayfish, and plants) may also be endangering the native aquatic resources of the park, many of which are unique or endemic to the region. The unique terrestrial resources of the park are threatened by both exotic animals and plants, as well as by recreational users, particularly rafters and rock climbers.

### Enabling Legislation

The parks was established by Public Law (PL) 95-625 on November 10, 1978, for "the purpose of conserving and interpreting outstanding natural, scenic, and historic values and objects in and around the New River gorge and preserving as a free-flowing stream an important segment of the New River in West Virginia for the benefit and enjoyment of present and future generations."

The legislation that established Gauley River National Recreation Area (see below) also made boundary adjustments to NERI in 1988.

## Dominant Ecological Communities

### Terrestrial

#### ➤ *Forest*

The New River Gorge is an impressive and floristically diverse area with plant communities ranging from the riparian zone along the river, up the steep gorge slopes, to the plateaus, rims and shoulders above the gorge. These plant communities include:

- *Virginia pine/pitch pine*. Occurs primarily at the top of cliffs and are linear in nature. The understory is dominated by heaths such as blueberry and huckleberry (*Vaccinium* spp.).
- *Riparian*. Exists primarily in the flood plain along the New River and its tributaries.
- *Flatrock*. Exists on river scour areas and are globally significant. They are primarily comprised of cedars and pines that grow on these soils. The disturbance regime of periodic, scouring floods perpetuates these early-successional communities by both inhibiting later successional species from establishing, as well as providing consistent inputs of material and energy to these systems.
- *Xeric oak*. Exists on the xeric sites within NERI and probably historically always supported an oak community.
- *Oak-hickory*. Occur on more mesophytic sites and are probably an artifact of past disturbance regimes. There is probably more of this community type at NERI today than there was historically.
- *Mixed mesophytic forests*. Dominated by basswood, sugar maples and other non-oak hardwoods. This community type was probably more prevalent at NERI prior to the widespread extraction of coal in the area. This community type is currently increasing in NERI in the absence of an industrial disturbance regime.

### Aquatic

#### ➤ *Riverine*

The park includes 53 miles of the New River and portions of 77 tributaries to the New River. The river itself may be the second oldest in the world or one of the oldest on the continent.

#### ➤ *Wetland*

The National Wetlands Inventory, started in 1975, delineates 299 wetlands total in the three West Virginia parks (NERI, GARI and BLUE). Riverine wetlands were the most dominant type (37.5%). A National Park Service wetland delineation study (unknown date) was also completed for some of the same areas as the NWI,

however, many more wetlands were identified in this study which was likely due to more intensive ground-truthing efforts.

### Significant Natural Resources

#### ➤ *Landscape-level biodiversity*

NERI is designated as a “matrix block portfolio site” by the Nature Conservancy’s Ecoregional Planning Program due to its regional significance of high biological and ecological diversity, large size and good to restorable condition.

#### ➤ *Aquatic community*

The New River drainage (including the Gauley River and its tributaries), has a native fish and mussel population that is distinct from those of the rest of the Ohio River system and is composed of relatively few species with a high proportion of those fish species being endemic. The uniqueness of the New River fauna is attributable to the relative isolation of the New River system from adjacent river systems due to the formidable Kanawha Falls which provided a barrier to faunal migration.

The New River within NERI is one of the most important warm-water fisheries in West Virginia. Most of the game fish found within the New River system were deliberately introduced, and only four game species (American eel, channel and flathead catfish (*Ictalurus punctatus* and *Pylodictis olivaris*), and green sunfish (*Lepomis cyanellus*)), are considered native.

#### ➤ *Fauna*

Regionally significant (state rare) species of small mammals such as the rock vole (*Microtus chrotorrhinus*), rock shrew (*Sorex dispar*), pygmy shrew (*Sorex minutus*) and water shrew (*Sorex palustris*) all may occur at NERI since the park supports suitable habitat. The NERI also contains a globally significant population of Allegheny woodrat which is fairly large and appears to be stable. Several species of federally endangered bats or identified as rare or critically imperiled use abandoned mine portals as roosting sites and may use cliff lines and other habitats for foraging. Both the federally listed Indiana bat (*Myotis sodalis*) and the Virginia big-eared bat (*Corynorhinus townsendii virginianus*) have been seen or captured within the park. Recently, Rafinesque’s big-eared bat (*Plecotus rafinesquii*) was located in an abandoned mine portal at NERI as well. This is only the third record of this species in the state. In general, NERI supports a diverse assemblage of bat species that is regionally significant.

The abundance and diversity of breeding neotropical migratory birds within NERI is considered a globally important natural resource. The cerulean warbler, which is a potential candidate for federal status as threatened, has a large and secure population within West Virginia with numerous breeding pairs within the park.

Several species of frogs, turtles, snakes and a globally significant diversity and abundance of salamanders are found within the many types of riverine, wetland, riparian and forested habitat within the park. This includes the timber rattlesnake (*Crotalus horridus*), green salamander (*Aneides aeneus*), black-bellied salamander (*Desmognathus quadramaculatus*), northern map turtle (*Graptemys geographica*), river cooter (*Pseudemys concinna*) and the co-occurrence of two subspecies of painted turtle.

➤ *Flora*

The topographic diversity of the parks has led to the development of an unusual distribution of flora, including species with southern or northern affinities and disjunct populations of plants from other regions. The area serves as a distributional corridor for plants between the eastern coastal plain and the Mississippi Valley, and contains plants common in either or both of those regions, but uncommon elsewhere in the central Appalachians.

Many rare species have been identified throughout the park. These include several globally rare and imperiled species such as Virginia mallow (*Sida hermaphrodita*) and Torrey's mountain-mint (*Pycnanthemum verticillatum*). In addition, at least two dozen species that are listed as critically imperiled throughout the state are found on park property.

➤ *Forest Communities*

Large, continuous, unfragmented blocks of forest are important at NERI and should be maintained, although the percentage coverage of each vegetation community may change due to natural successional processes. Several forest types are considered unique or rare:

- *Mixed mesophytic forest*

This forest type at NERI is regionally significant for size, integrity and protection. The continuous span of this forest type in NERI is approximately 60 miles long by approx. 2 miles wide making it one of the largest tracks of this forest type in the nation. Mixed mesophytic forests are one of the top three resources at NERI in that this forest type supports the greatest overall biodiversity, including great vertical, structural and compositional diversity.

- *Red Ash Community*

This is a remnant floodplain community forest type of regional significance.

- *Hemlock ecosystem*

Although this only comprises 5% of the NERI forest cover, it is locally significant for certain species.

➤ *Cliff habitats and ledges*

Cliff tops are dominated by pine communities and cliff faces are dominated by lichens. Many of these areas appear to have escaped logging and development due to their inaccessibility. This habitat is used by a variety of species, including peregrine falcons (although they have not yet been observed to nest within the park), bats, timber rattlesnakes, green salamanders and Allegheny woodrats.

➤ *Riverscour and flatrock communities*

These are globally significant communities and are of a high rock and low rock community type and comprise about 4.5 ha. in the park. These sites are dominated by Virginia pine (*Pinus virginianus*) and Eastern red cedar (*Juniperus virginiana*) as well as Big Bluestem and Switch grasses. Both high and low rock communities are early successional and are maintained by flooding and periodic scouring.

Appalachian Rivers Flatrock Communities represent riverside exposures of parent rock resulting from the intersection of the river with massive, nearly flat-lying sandstone strata (RMP). This community occurs on flat sandstone ledges at three locations within NERI and includes several rare sedges (WRMP 2002). These communities are also very susceptible to invasion by exotics as well as damage by recreational rafters.

➤ *Geologic features*

The New River Gorge is an erosional feature that is important from geologic, historic and natural perspectives. In addition to being one of the oldest rivers in the world, the so called ‘Sewell’ coal seam found in this area is of global significance due to its low sulfur content, high heat value and the fact that it contains few metal impurities. Consequently, sulfur contamination of water resources is not a problem at NERI as it is in many other areas that have rich coal deposits. In fact, much of the water draining abandoned mines in NERI is drinkable by EPA drinking water standards. The coal resources available in the New River area fundamentally affected the demographics, settlement patterns and history of this nation.

The gorge itself is one of the deepest in the East. What’s more, the lower gorge provides the best example of a large thick sandstone exposure tied to a large river in the entire Appalachians. In fact, the New River area is home to many of the geologic type localities for the state. An important plant fossil that indicates the separation between two geologic time periods is also prevalent in the gorge. Geology is perhaps the most significant feature of the New River Gorge National River.

## Natural Resource Issues

### Terrestrial

➤ *Exotic plants*

The invasion of exotic plants is one of the biggest threats to maintaining a healthy forest at NERI. Some of the exotic plants that have the potential to be particularly deleterious are: Japanese knotweed, kudzu (*Pueraria lobata*), purple loosestrife, Japanese honeysuckle, garlic mustard, tree of heaven, privet (*Ligustrum sinense*) and paulownia (*Paulownia tomentosa*). Several of these exotic plants are commonly found today in flatrock communities, a rare community type of high preservation priority. Japanese knotweed has created a monoculture in many acres of riparian habitat and purple loosestrife has invaded areas where Virginia spiraea (*Spiraea virginiana*) is found at the Bluestone National Scenic River (BLUE) and the Gauley

River National Recreation Area (GARI) (see below for more information). Garlic mustard and Japanese stilt grass (*Microstegium vimineum*) have also invaded bottomland habitat, which is home to many rare species. The invasion of exotic plants in seeps and wetlands as well as in riparian areas may also adversely affect breeding habitats for amphibians.

➤ *Exotic animals*

An infestation of the gypsy moth could negatively influence the coverage of the oak-hickory forest type. The hemlock woolly adelgid is another significant forest pest since hemlocks comprise approximately 5% of the forest cover at NERI and play an important role in providing unique habitat for various species. There was a heavy infestation of adelgid at BLUE in 2001. Currently, 36 plots are being monitored for the adelgid at NERI and GARI.

Exotic frogs such as the green and squirrel tree frogs (*Rana clamitans* and *Hyla squirella*) may be moving into NERI by inadvertently being carried into the park on motor homes.

➤ *Loss of terrestrial plant communities*

Oak communities are declining in some areas of the park increasing the hazard tree loading in some areas. An overabundance of deer may also be limiting oak regeneration at the park although the state is currently trying to increase deer populations.

Virginia pine, pitch pine (*Pinus rigida*) and table mountain pine (*Pinus pungens*) are likely more prevalent today than historically. However, they are declining throughout their range, especially along cliffs and within flatrock communities. These pines are an important component of cliff communities at NERI although they are currently threatened by increased visitor use and an absence of fire.

Flatrock communities may be threatened by regulation of water flow in the New River, since the soil layer at these sites has been building up and allowing hardwood species and exotics to invade (see above).

Although hemlock forests make up only a small portion of the forested area at NERI, invasion by the woolly adelgid may threaten this ecosystem. Adelgid outbreaks have already caused significant problems at BLUE, and will likely affect GARI and NERI in the future.

➤ *Maintaining ecosystem processes*

The ecosystem processes associated with specific vegetation communities at NERI should be restored and/or maintained. For example, gap dynamics in mixed mesophytic forest and oak-hickory forest are important to some bird species, bats, woodland salamanders and snakes and should be encouraged by management practices. Natural flooding regimes in riparian forests provide another example as they support an array of birds, herps, mammals and plants. Finally, prescribed fire

applied to cliff-top pine communities and xeric oak communities may play an important role in maintaining these ecosystems as well as others.

➤ *Loss of geological features*

The unique geology of the New River Gorge is threatened by outside sources. Although historic baseline erosion rates are unknown, mountaintop removal mining threatens geology throughout the region through the processes of sedimentation and erosion; although not typically within the park boundaries.

➤ *Air pollution*

Monitoring stations in the Kanawha Valley to the west, and Greenbrier Valley to the east have shown high levels of ozone and other pollutants that exceed federal air quality standards. NERI has a passive ozone quality monitoring station within the park; however, there are no stations that measure acid deposition which could be a pollutant of concern from sources outside of park boundaries.

➤ *Recreational Uses*

The park experiences an abundance of recreational use by rafters, climbers, and anglers. There is some concern that numerous populations of lichens are being impacted by recreational rock climbing in cliff areas as they routinely clean rock faces and crevasses of vegetation and debris including lichens, to improve hand and foot holds. What's more, there are many pullouts and lunch spots used frequently by local boating and rafting outfits where the riparian vegetation has obviously been severely impacted. These are also likely locations of origin for the introduction and dissemination of exotic species throughout the river corridor.

## **Aquatic**

➤ *Water quality*

There are several waters either within or near the three WV parks that are on West Virginia's 303(d) list (see appendix G for a complete listing). The majority of these streams are within or near NERI, and are impaired due to elevated levels of fecal coliforms, dissolved metals, or low pH readings.

Nineteen streams within the Gauley River drainage are impacted by AMD, as well as 7 streams in the Lower New River watershed and 1 stream in the Upper New River watershed. Eighteen streams in the Gauley River watershed are impacted by acid rain.

• *Sewage*

Issues of treated and untreated sewage are the most predominant problem at the WV parks. Fifteen wastewater treatment plants discharge almost nine million gallons per day of treated wastewater into tributaries of the New River within NERI. Eight wastewater treatment plans discharge almost six million gallons of water per day of treated wastewater into waters draining to the Bluestone River. Two combined sewer overflow systems in the New River drainage and one combined

sewer overflow system in the Bluestone River drainage release a combination of storm runoff and untreated sewage directly to streams during storm events.

Although the parks monitor fecal coliform levels monthly, this method may not adequately describe the possible pathogens that may be present in rivers and tributaries. There are many improvements to this program that would be desirable to adequately describe the problems of sewage in the waters of the parks. These include: 1) developing and testing methods of collecting representative water samples for analysis of indicator bacteria and pathogens, 2) relating pathogens to indicator bacteria, 3) determining the best type of indicator bacteria for predicting the presence of pathogens in the New River and 4) documenting the possible human health hazards that occur during recreational activities. Ultimately, it would also be helpful to identify the animal sources of fecal bacteria in water and track those bacteria back to their origin. In addition, an increase in the amount of monitoring (intensity in both area and frequency), would help to identify and track sources of bacteria in park waterways.

Currently, level of fecal coliform is the standard measure used by the state, although the EPA suggests that monitoring for *E. coli* is preferable. Some monitoring of *E. coli* levels at the park has begun, and will hopefully be able to be incorporated with existing fecal coliform data. The park has also recently received funding for source-tracking of pathogens, the results of which are hoped to further define contaminate sources.

There is also little information on the affects of water quality on the aquatic biological resources of the parks. Although a trial macroinvertebrate-based rapid bioassessment study has been completed, no follow-up work has occurred and relationships between contaminants found in WV waterways and biological resources remains little understood.

- *Acid Mine Drainage*

There are 115 abandoned mine sites in NERI. Although abandoned mine drainage is a water quality problem in many areas of the country, the low sulfur content of coal in the NERI area generally begets neutral to alkaline mine discharges. In fact, mine discharges at NERI can augment flow in tributary streams, comprising a significant portion of baseflow during dry periods. That said NERI has not completely escaped the deleterious effects of mining activities in the region. A "Gob Pile" of high sulfur, acidic mine processing waste transported to the headwater region of Wolfcreek (a tributary of the New River), from outside of the NERI catchment is currently leaching very low pH water. Wolf Creek was formerly a state stocked trout stream and provided the bulk of the town of Fayetteville's drinking water supply. Now, water immediately downstream of the pile often exhibits a pH reading of less than 3 and there is a distinct lack of evidence of aquatic life forms in this stream reach. What's more, Fayetteville had to find another source of drinking water. One attempt at reclaiming the site has failed and

a second is in the works as a result of a legal settlement that will provide \$375,000 towards the effort.

- *Other problems*

Other water quality problems include logging, which has occurred in and around all three parks. Numerous highways and railroad bridges cross the New River, many of which carry chemicals from factories in the Kanawha Valley. Herbicide spraying occurs along CSX rail lines and can be washed into the New River during heavy rains.

- *Exotic fish*

NERI and GARI have an unusually high number of non-native fishes and recent research has found that several species of non-native fish have significantly expanded their range in the park waters. Demand for recreational fisheries has led to the introduction of many non-native fishes and angling has led to bait-bucket dumping of other non-native species. Some of the native species endemic to the New River system and considered to be species of special concern by WV DNR Natural Heritage Program are thought to be in danger due to competitive exclusion by non-native species. There is little information on how stocking of non-native species may affect native species and stream ecosystems within the park.

- *Dam releases*

Flows of the Kanawha River (to which the New River is a tributary), had been unregulated prior to 1939. 1949 brought the construction of a dam on the Bluestone River (a major tributary to the New River), further regulated flow (WRMP 2002). It is unknown how this regulation may affect sediment movement, bottomland geomorphic features, and aquatic and terrestrial habitat such as the rare Appalachian River Flatrock communities, but this remains an important area of study.

- *Gravel bars*

Many New River and Gauley River species need gravel bars to spawn. Both the construction of the Bluestone Dam and the coal industry have affected the location and composition of gravel bars in the New River. Coal deposited in the gravel bars may affect water quality and mussel communities that depend on this habitat may be affected by changes in both water chemistry and flow dynamics.

### **Documents used for this summary:**

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Wilson, L. and Purvis, J. 2003. Water quality monitoring program 1998-2000. New River Gorge National River, Gauley River National Recreation Area and Bluestone National Scenic River.

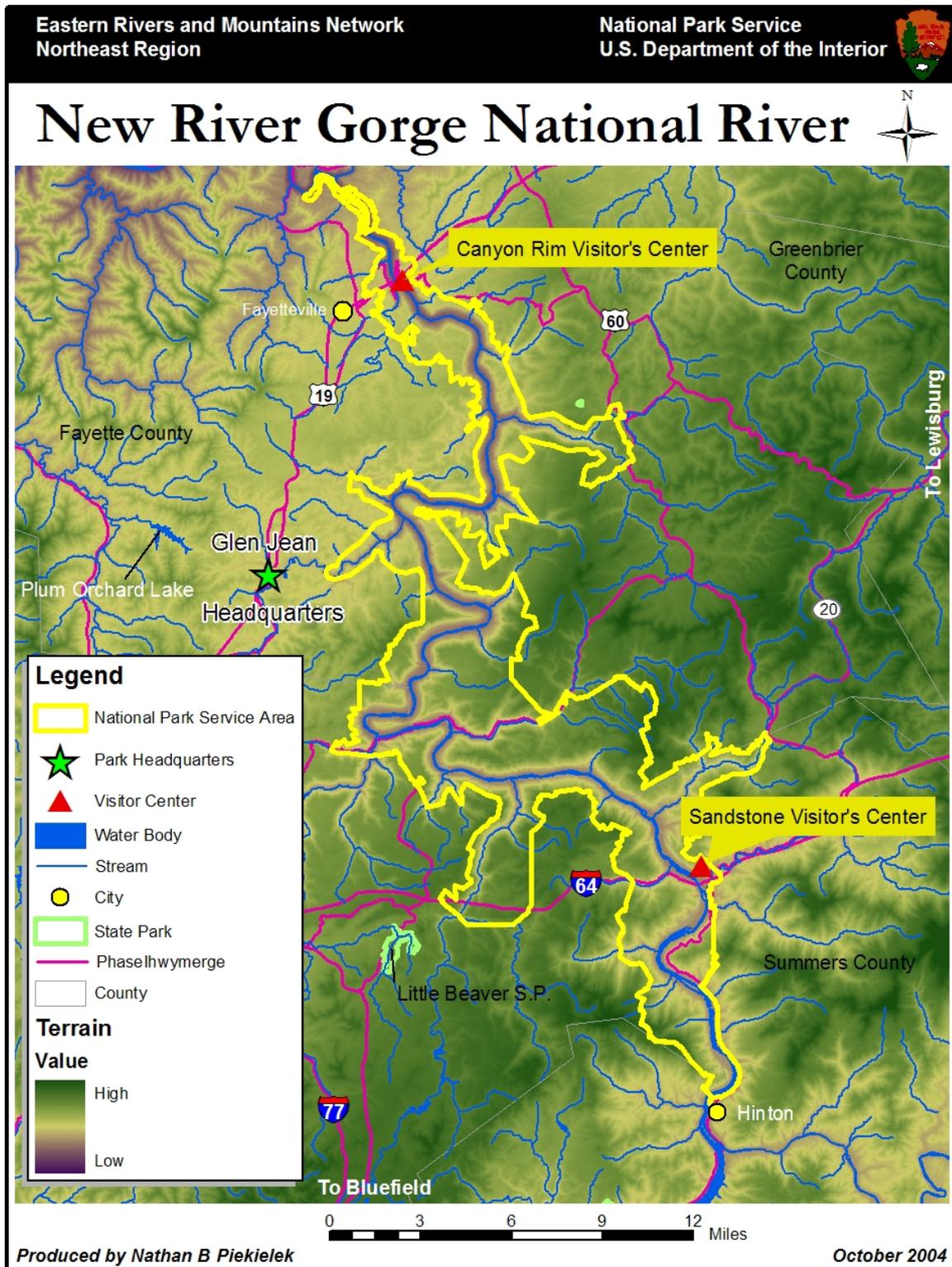


Figure 7: Map of New River Gorge National River

## GAULEY RIVER NATIONAL RECREATION AREA (GARI)

### OVERVIEW

State: West Virginia

Year established: 1988

2003 Acreage: 11,507

2003 Park visitation: 152,706

The Gauley River National Recreation Area was established in 1988 to preserve the natural resources and recreational activities associated with the lower Gauley River and a portion of its major tributary, the Meadow River. The park encompasses 11,095 ac. along a 25-mile corridor of the Gauley River and a 6-mile corridor of the Meadow River and includes parts of Nicholas and Fayette Counties. The Gauley River is immediately downstream of the Sommersville Lake and Dam (both operated for recreational purposes), and is therefore profoundly affected by dam releases.

High knobs and ridges, dissected by streams, have created narrow canyons with steep slopes at GARI. Extremes in topography, elevation, and microclimate have provided habitat for a tremendous variety of plant life. Most of the recreation area is below 2,000 feet and contains a central hardwood forest that supports a wide variety of wildlife as a result of the diversity of habitats available. A recent field study has documented many rare, threatened, or endangered plant species, including the federally threatened Virginia spiraea. The Gauley River is recognized as one of the most technically demanding and popular whitewater rivers in the nation and the scenic and natural landscapes of the gorge are an integral part of the outdoor recreational experience.

Mining activities and sewage problems appear to be the most prevalent water quality problems within the park, although overall water quality is good. As with the other parks in the network, exotic animals and plants are a problem in GARI as well, and the park saw a significant outbreak of hemlock woolly adelgid in 2001. Because the park is a popular destination for whitewater rafting, visitor impacts on the vegetation of the riparian corridor, which is home to many rare species, is also a concern.

### Enabling Legislation

The park was created on October 26, 1988 by Public Law (PL) 100-534 to protect and preserve scenic, recreational, geological and fish and wildlife resources of the Gauley River and its tributary, the Meadow River.

### Dominant Ecological Communities

#### Terrestrial

##### ➤ *Forest*

Because of the dramatic changes in topography within the park, the forest types range along a moisture gradient from xeric (oak-pine-mountain laurel) to mesic

(cove hardwoods and mixed mesophytic forest) to hydric (riparian). The majority of forest is second and third growth due to repeated logging, although some uncut areas do exist within the park. There are thousands of acres within GARI that are recovering naturally from dramatic upheavals resulting from coal extraction practices that removed soils, altered drainage patterns and dramatically affected the structure and composition of plant communities that are now largely composed of exotic or invasive species.

### **Aquatic**

#### ➤ *Riverine*

The Gauley River NRA encompasses a 25 mile section of the Gauley River and a 5.5 mile section of the Meadow River. These rivers provide habitat for semi-aquatic snake species and likely several turtle species. Fish inventories along the mainstem of the river are currently underway.

In addition, there are numerous 1<sup>st</sup> – 3<sup>rd</sup> order streams within the park that provide habitat for many species of fishes, salamanders, and other aquatic or semi-aquatic organisms.

#### ➤ *Wetlands and vernal pools*

Although there are few permanent and ephemeral pools at the park, there are several pools formed by rock scar depressions in the riparian zone and are due to the erosive quality of the river during high flow events. These habitats provide potential habitat for some frog species and possibly some turtles.

### **Significant Natural Resources**

#### ➤ *Flora*

The topographic diversity of the park has led to the development of an unusual distribution of flora, including species with more southern or northern affinities along with disjunct populations of plants from other regions. The area serves as a distributional corridor for plants between the eastern coastal plains and the Mississippi Valley, and contains plants common in either or both of those regions but uncommon elsewhere in the central Appalachians.

The federally endangered Virginia spiraea is found in rocky river bank habitat along the river. The extremely regulated flow of the Gauley has eliminated peaky flow events from the natural process of this system and upon which this habitat likely relies, potentially threatening this species of special concern. Barbara's buttons (*Marshallia mohrii*), which is considered a globally imperiled species, is also found in similar habitat within the gorge and occurs sporadically throughout the riparian areas of the gorge. Both the Appalachian violet and sand cherry are globally rare species that have been documented within the park. Although sand cherry is common along the Great Lakes, GARI has the only known population in West Virginia.

#### ➤ *Aquatic community*

The New River drainage (including the Gauley River and its tributaries), has a native fish and mussel population that is distinct from those of the rest of the Ohio River system and is composed of relatively few species with a high proportion of those fish species being endemic. The uniqueness of the New River fauna is attributable to the relative isolation of the New River system from adjacent river systems due to the presence of a significant physical obstacle, Kanawha Falls.

➤ *Fauna*

There are several state listed rare species at the park. Fish species include the globally rare finescale saddled darter (*Etheostoma osburni*). Amphibians such as the green salamander, which is typically found in forested habitat with many emergent rocks or boulders or in rock outcrops along the river, and the black-bellied salamander which can be found in third-order streams within the park. Rare reptile species include the Northern map turtle, the broad-headed skink (*Eumeces laticeps*), the Eastern wormsneak (*Carphophis amoenus amoenus*) and the timber rattlesnake. Bird species of concern include the Swainson's warbler (*Limnothlypis swainsonii*), which breeds at the park, is considered imperiled within the state of West Virginia; the cerulean warbler, which is a potential candidate for federal listing status as threatened, has a large and secure population within West Virginia and breeds within the park. A mammal of concern is the small-footed myotis (*Myotis leibii*), which is both state and globally rare and has been seen within the park.

➤ *Cliff habitats and ledges*

Cliff tops are dominated by pine communities and cliff faces are dominated by lichens. Many of these areas appear to have escaped logging and development due to their inaccessibility. The rim of GARI that borders Carnifex Ferry Battlefield State Park holds one of the best examples of virgin forest remaining in West Virginia. This habitat is used by a variety of species, including peregrine falcons (although they have not nested in the park yet), bats, timber rattlesnakes, green salamanders and Allegheny woodrats.

➤ *Riverscour and flatrock communities*

These are globally significant communities and are of a high rock and low rock community type and comprise about 11 ac. at the park. These sites are dominated by trees species Virginia pine and Eastern red cedar, and grass species big bluestem and switchgrass. All are early successional species maintained by flooding and periodic scouring. Appalachian Rivers Flatrock Communities represent riverside exposures of parent rock resulting from the intersection of the river with massive, nearly flat-lying sandstone strata (RMP). These communities are also very susceptible to invasion by exotics through disturbance and introduction from recreational rafters at pullouts and lunch spots along the river. The NPS could work with local boating and rafting outfits to coordinate the planning of these pullouts around the locations of riverscour and flatrock communities.

## Natural Resource Issues

All three West Virginia parks share many of the same or similar natural resource issues. However there are some issues distinct to GARI that should be addressed individually.

## Terrestrial

### ➤ *Maintaining ecosystem processes*

As has been mentioned, dams serve as an impediment to river flow and interrupt natural flow regimes within which many species and communities of concern have evolved. At GARI, the riparian zone has become increasingly more choked with woody vegetation in the absence of periodic flashy flows. As a result, early successional species have the potential to be out competed in an environment dominated by a new set of ecosystem processes. At GARI, however, the Sommersville dam is operated exclusively for recreational purposes, for boaters and anglers on Sommersville Lake, and boaters and rafters on the Gauley River. Both recreational groups are large in size and have significant lobby at least in part through the local tourism industry that has been built around these unique and popular outdoor recreational experiences. There is clearly a lot at stake and natural resource managers are in dire need of better information on the affects of dams on these species and communities of management concern.

### ➤ *Recreational Uses*

The Gauley River is widely regarded as the most technically difficult river to raft or boat in the eastern U.S., and even the country. Fall releases of water from the Sommersville Dam provide river runners a destination when many other popular rivers have flows that are too low to run. As a consequence the Gauley River receives an even greater number of boaters than many other river destinations. Many formal and informal pullouts and lunch spots have been established throughout the river corridor, damaging vegetation, introducing exotics and introducing refuse and contaminants into the river itself. However, with some coordination with commercial rafting outfits the risk of damage to the most significant riparian natural resources could likely be averted.

## Aquatic

### ➤ *Water quality*

Coal with higher sulfur content in the Gauley drainage is likely responsible for several problems with abandoned mine drainage in and around GARI. Nineteen streams within the Gauley River drainage are impacted by AMD including Peter's Creek, a major tributary, which is WV 303d listed for elevated iron and manganese levels. What's more, eighteen streams in the Gauley River watershed are impacted by acid rain. Other water quality problems at GARI are similar to those throughout the region. The Meadow River (another major tributary of the Gauley), is 303d listed for fecal coliforms as is the Gauley itself. Finally, Sommersville Lake, which is the primary source of water in GARI, is 303d listed for abnormally high mercury levels, likely from atmospheric sources.

**Documents used for this summary:**

Mahan, C. 2004. A natural resource assessment for New River Gorge. National Park Service, Northeast Region. Philadelphia, PA. Natural Resources Report NPS/NERCHAL/NRR-04/006.

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National Park Service. 1997. General management plan/final environmental impact statement/land protection plan. Gauley River National Recreation Area. **1**.

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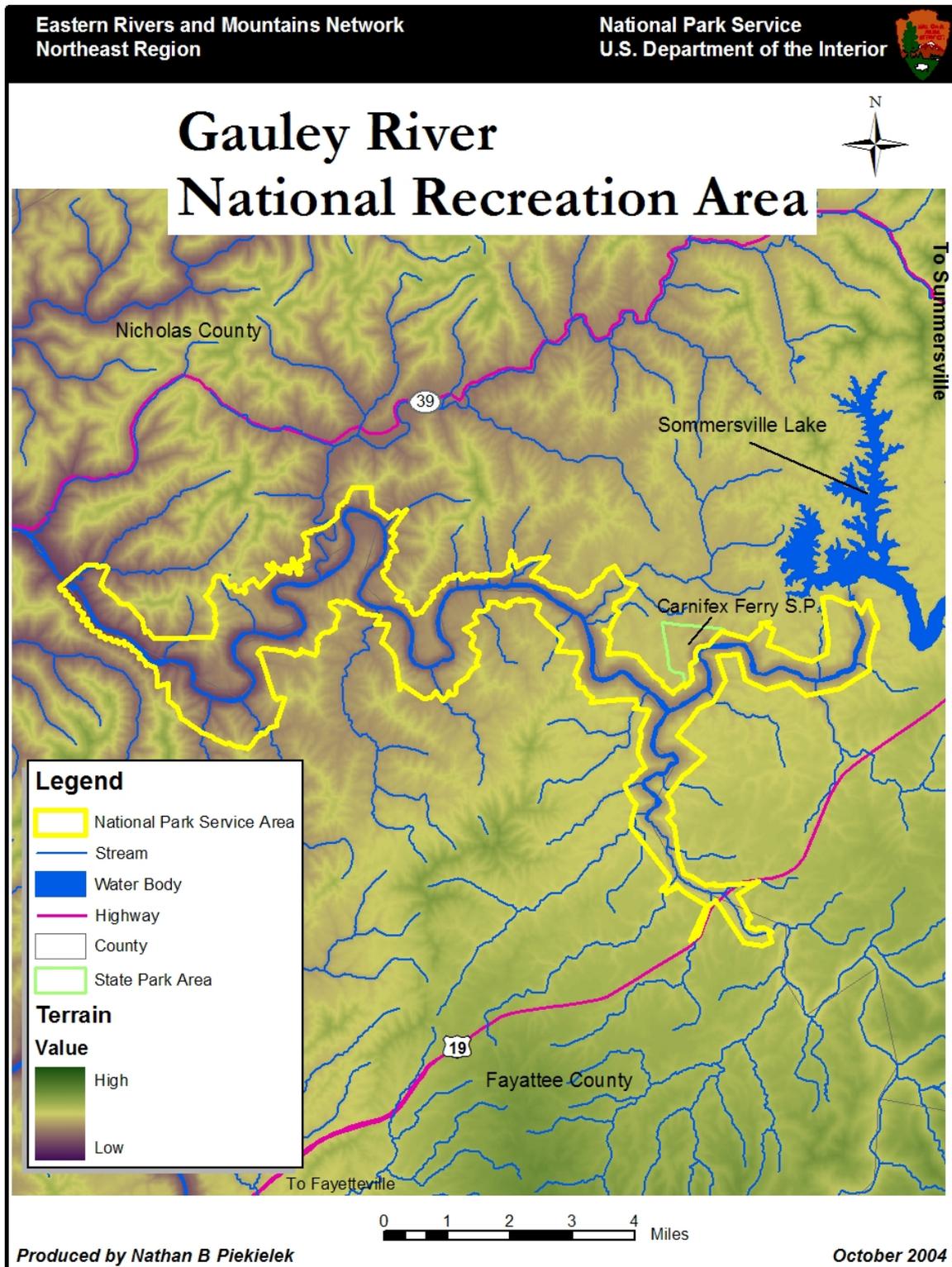


Figure 8: Map of Gauley River National Recreation Area

## BLUESTONE NATIONAL SCENIC RIVER (BLUE)

### OVERVIEW

State: West Virginia

Year established: 1988

2003 Acreage: 4,310

2003 Park visitation: 50,384

The Bluestone National Scenic River was established in 1988 by an amendment to the Wild and Scenic Rivers Act. The park encompasses 4270 ac. along a 10.5-mile corridor in the Kanawha-New River Watershed and includes parts of Summers and Mercer Counties. The Bluestone River is one of the larger tributaries to the New River and joins the New about 3.5 miles upstream of the city of Hinton.

The Bluestone River is surrounded by a gorge noted for its scenic quality, a rich variety of vegetation, and significant regional archeological sites (both pre-historic and historic). Exposed rocks of shale, limestone, and sandstone add to the impressive landscape. Nearly all species of warmwater game fish known in West Virginia are present in the river; diverse populations of non-game fishes also occur here due to conducive water quality and habitat diversity. The gorge also has a distinctive array of flora compared to both the NERI and GARI flora, and several plant species are only found in this region. The federally threatened Virginia spiraea is also found within the park along the riverbanks of the river.

The park has many of the same water quality issues that NERI and GARI do, however, BLUE is located in an area of more intense agriculture which may contribute to increased nutrient runoff. The city of Bluefield is located upstream of the park and contributes a large amount of waste from sewage outfalls located in or adjacent to the river.

### Enabling Legislation

The park was established on October 26, 1988, through an amendment of the Wild Rivers and Scenic Act to designate the park. This designation was made to protect and enhance the natural, scenic, cultural and recreational values of a free-flowing segment of the Bluestone River for the benefit and enjoyment of present and future generations.

### Dominant Ecological Communities

#### Terrestrial

##### ➤ Forest

Three basic forest types were identified by Fortney et al. (1997). Xeric sites, which comprised over half of the sites sampled, were dominated by chestnut oak (*Quercus prinus*), with a combination of scarlet oak (*Q. coccinea*), white oak (*Q. alba*) and

black oak (*Q. velutina*). Mesic, mixed Appalachian oak communities were dominated by red oak (*Q. rubra*) and white oak with some white pine (*Pinus strobus*) and other drier oaks. Finally, mixed mesophytic sites were dominated by tulip poplar (*Liriodendron tulipifera*), with sugar maple (*Acer saccharum*), buckeye (*Aesculus octandra*), hemlock (*Tsuga canadensis*) and basswood (*Tilia americana*) as co-dominants.

A shale barren-like community composed of white ash, red cedar (*Juniperus virginiana*), post oak (*Q. stellata*) and mockernut hickory (*Carya tomentosa*) was found at one site in BLUE.

## Significant Natural Resources

### ➤ *Flora*

The topographic diversity of the WV parks has led to the development of an unusual distribution of flora, including species with southern or northern affinities and disjunct populations of plants from other regions. The area serves as a distributional corridor for plants between the eastern coastal plains and the Mississippi Valley, and contains plants common in either or both of those regions but uncommon elsewhere in the central Appalachians (RMP). The BLUE also has many plants that are not found at GARI or NERI such as the northern white cedar (*Thuja occidentalis*), downy arrowwood (*Virburnum rafinesquianum*) and wild onion (*Allium oxyphilum*) (Fortney et al. 1997).

The federally threatened Virginia spiraea is found along the river at BLUE. Several other rare species of plants can be found at BLUE, including many state critically imperiled species.

### ➤ *Fauna*

The small-footed myotis and longtail shrew, both species of special concern in West Virginia, were found during the most recent mammal surveys at BLUE.

The cerulean warbler, which is a potential candidate for federal listing status as threatened, has a large and secure population within West Virginia and breeds within the park.

### ➤ *Cliff habitats and ledges*

Cliff tops are dominated by pine communities and cliff faces are dominated by lichens. Many of these areas appear to have escaped logging and development due to their inaccessibility. A study on the BLUE found old growth trees along the cliff tops (RMP). This habitat is used by a variety of species, including peregrine falcons (although they have not yet nested in the park), bats, timber rattlesnakes, green salamanders and Allegheny woodrats.

### ➤ *Riverscours and flatrock communities*

These are globally significant communities and are of a high rock and low rock community type and comprise about 11 ac. at the park. These sites are dominated

by Virginia pine, Eastern red cedar, and big bluestem and switch grasses. All are early successional species and are maintained by flooding and periodic scouring. Appalachian Rivers Flatrock Communities represent riverside exposures of parent rock resulting from the intersection of the river with massive, nearly flat-lying sandstone strata (RMP). These communities are also very susceptible to invasion by exotics as well as recreational rafters.

### **Natural Resource Issues**

All three West Virginia parks share many of the same or similar natural resource issues. As has been discussed in more detail in the natural resource sections of NERI and GARI, natural river flow regimes, exotic and invasive plant and animal species, and AMD and fecal coliform impacts to water quality comprise the most significant and pressing natural resource issues at BLUE. See other aforementioned sections for more information.

### **Documents used for this summary:**

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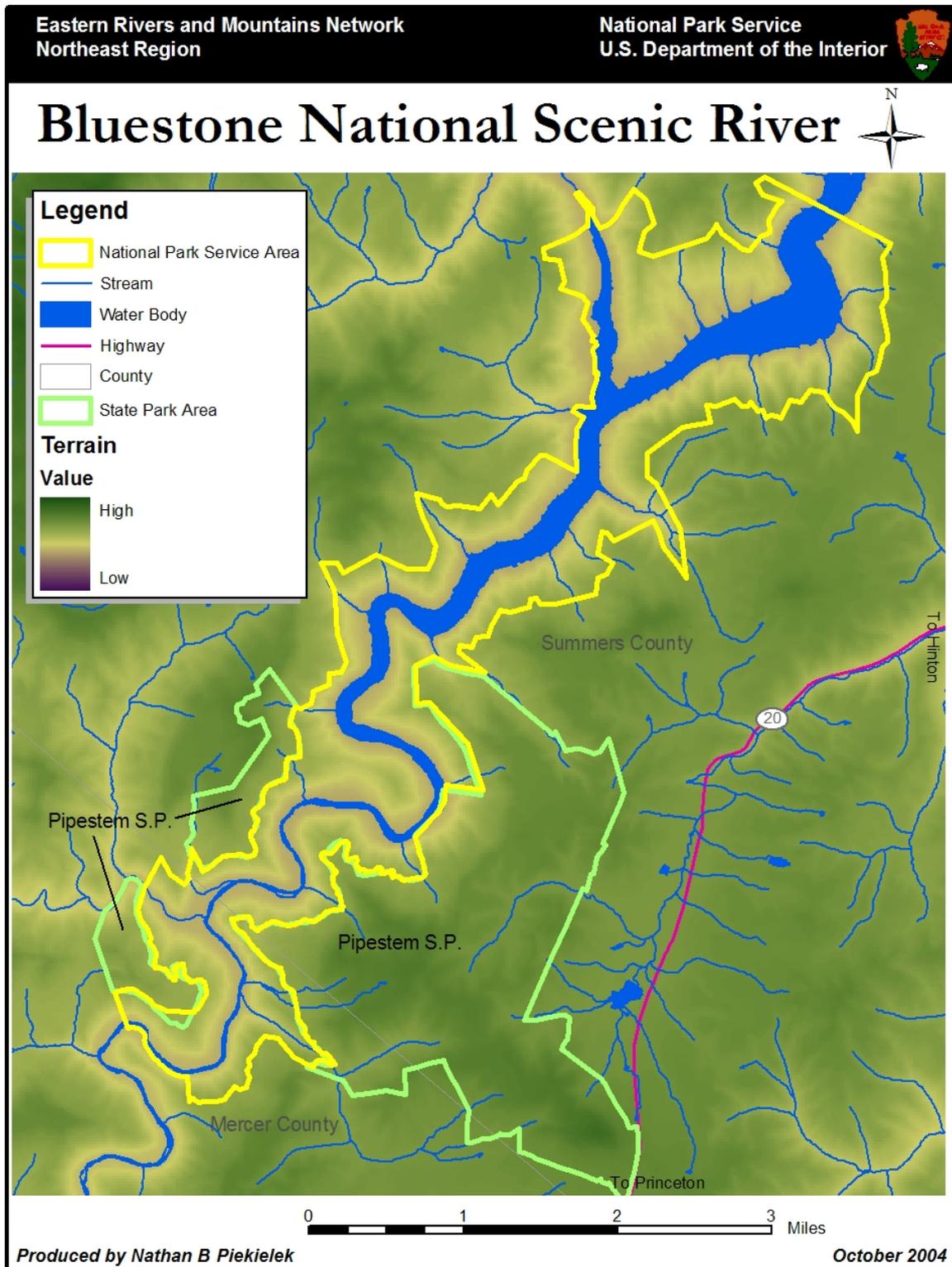


Figure 9: Map of Bluestone National Scenic River