

CHAPTER 3: AFFECTED ENVIRONMENT

INTRODUCTION

This “Affected Environment” chapter describes existing conditions for those elements of the natural and cultural environments at Big South Fork National River and Recreation Area (NRRA) and Obed Wild and Scenic River (Obed WSR) that would be affected by implementing the actions considered in this Oil and Gas Management Plan / Environmental Impact Statement (plan/EIS). The natural environment components that are addressed include air quality, geology and soils, water resources (surface and ground water), vegetation, wildlife and wildlife habitat, federally listed threatened and endangered species, species of special concern, and soundscapes. The cultural components include archeological, historic, and ethnographic resources, as well as cultural landscapes. Visitor use and experience and park operations and management are also addressed.

GEOLOGY AND SOILS

Both the Big South Fork NRRA and Obed WSR are located on the Cumberland Plateau. The U.S. Geological Survey (USGS) categorizes physiographic divisions based on Fenneman and Johnson’s (1946) *Physical Divisions of the United States*, which is based on eight major divisions, 25 provinces, and 86 sections representing distinctive areas having common topography, rock types and structure, and geologic and geomorphic history. Within this classification system, the Cumberland Plateau is a physiographic section of the larger Appalachian Plateau province, which in turn is part of the larger Appalachian physiographic division (USGS 2009a). The following description of general geologic features in the region is taken from Harris (pers. comm., 2009) unless otherwise noted.

GEOLOGY OF THE CUMBERLAND PLATEAU

The Cumberland Plateau is characterized by flat or rolling upland areas, deeply incised river gorges, and a long line of cliffs that separate it from the lower elevations of the Ridge and Valley Province, which begins at the Cumberland Plateau’s eastern escarpment (NPS 1998b). It is along this eastern escarpment, particularly in northern Tennessee and southern Kentucky, where the development of several structural folds and fault systems has had a pronounced effect on local topography. In this region, a great block fault forms the structural basis for the Cumberland Mountains, an area of pronounced elevation and relief. Major drainage systems of the Plateau may be divided into two principal groups, consisting of those that are tributary to the Cumberland River system and those that are tributary to the Tennessee. The Big South Fork is tributary to the Cumberland River system. The Obed River becomes the Emory River which empties into the Clinch River which is part of the Upper Tennessee River Basin.

The sedimentary rocks that comprise the Cumberland Plateau are of the Pennsylvanian (280 to 320 million years ago) and Mississippian periods (320 to 360 million years ago), which together comprise the Carboniferous period. These rocks are composed of near shore sediments transported westward from the old Appalachian Mountains. The Pennsylvanian rocks consist of shale, siltstone, and sandstone and are coal-bearing (NPS 2005a). Some rock layers, including bituminous coal seams, were laid down in swampy environments. These are interlaced with delta deposits of cross-bedded sandstones and occasional conglomerates.

Big South Fork National River and Recreation Area

Big South Fork NRRRA encompasses approximately 125,000 acres (including deferred properties) of rugged terrain on the Cumberland Plateau in northeastern Tennessee and southeastern Kentucky, consisting of prominent rock formations, as well as the massive gorge and accompanying bluffs. The topography at Big South Fork NRRRA is characterized by a dendritic drainage pattern and narrow, V-shaped gorges. Valleys are dotted with huge boulders that have broken off from the rock face. Prominent rock formations, as well as the massive gorge and accompanying bluffs, form the basis for the Sensitive Geomorphic Features (Special Management Area) described for alternative C in chapter 2 and illustrated in figure 11.

The specific geologic units found at Big South Fork NRRRA are summarized in table 11 and shown on figure 11.

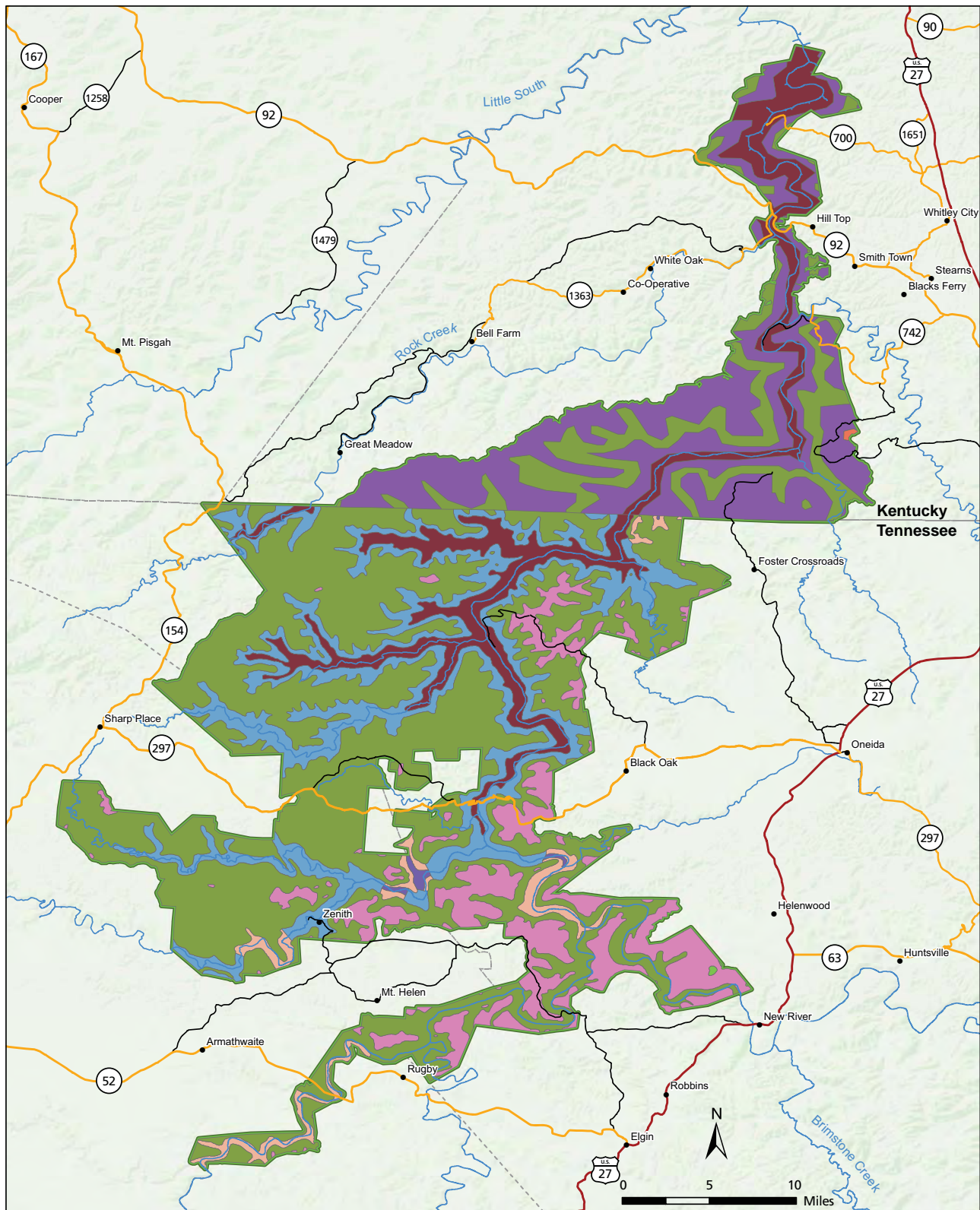
TABLE 11. GEOLOGIC UNITS OF BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

Name	Age	Rock Types
Tennessee		
Crooked Fork Group	Pennsylvanian	Shale, sandstone, siltstone, and thin coal beds; thickness 200 to 450 feet
Crab Orchard Mountain Group	Pennsylvanian	Conglomerate sandstone with thin zone of quartz and shale-pebble conglomerate at base; maximum preserved thickness 35 feet.
Gizzard Group	Pennsylvanian	Sandstone, conglomeratic sandstone, siltstone, shale, and minor coal; thickness 100 to 200 feet.
Pennington Formation	Mississippian	Highly variegated clay shale contains siltstone and locally fine-grained sandstone; thickness 400 to 700 feet.
Kentucky		
Breathitt Formation, lower part	Pennsylvanian	Shale, siltstone, sandstone; coal; conglomerate.
Lee (and Breathitt) Formation (Corbin Sandstone)	Pennsylvanian	Sandstone, conglomerate.
Lee Formation (Rockcastle Conglomerate)	Mississippian to Pennsylvanian	Conglomerate, sandstone, siltstone; shale; coal.
Pennington (Paragon) Formation	Mississippian	Limestone, shale, sandstone.

Source: Nicholson et al. 2007.

Obed Wild and Scenic River

Obed WSR encompasses approximately 5,195 acres of rolling uplands underlain by Pennsylvanian sandstones, siltstones, shales, some conglomerates, and coals. These rocks have a thickness of about 1,500 feet. The resistant nature of the capping sandstone that underlies and maintains the flat to rolling plateau topography is important in determining the landforms that characterize much of the Obed WSR drainage area. Where rivers have eroded through the sandstone caprock, continued erosion of the Pennsylvanian shales has produced the long narrow gorges of the Obed River and its tributaries (Schmalzer et al. 1985).



Legend

Figure 11. Bedrock Geology of Big South Fork National River and Recreation Area

Legend

- U.S. Highway
- State Highway
- Roads
- Park Unit Boundary
- Rivers / Streams
- County Boundary

Geology

Tennessee

- Crooked Fork Group
- Rockcastle Conglomerate
- Crab Orchard Mountain Group
- Fentress Formation
- Grizzard Group (incl. Warren Pt. Sandstone and Racoon Mt. Formation)
- Pennington Formation

Kentucky

- Breathitt Formation, lower part (incl. Livingston Cgl)
- Lee (& Breathitt) Formation (Corbin Sandstone)
- Lee Formation (Rockcastle Conglomerate)
- Pennington Formation, Bangor Ls, Hartselle Fm, and Monteagle Limestone (Kidder Mbr)

The specific geologic units found in Obed WSR are the Crooked Fork Group, Crab Orchard Mountains Group, and Rockcastle Conglomerate, which are summarized in table 11 for Big South Fork NRR, and shown on figure 12.

SOILS

The soils of the Cumberland Plateau, which are predominantly loamy with moderate infiltration rates, are weathered from the broad area of sandstone caprock. Some soils are also formed with additions from acidic shales and siltstone, or combinations of these rock types. The depth of the soil to bedrock ranges from about one foot on steep hillsides to about four to five feet on broad, smooth interstream divides. The soil characteristics for both Big South Fork NRR and Obed WSR are described in detail in the following sections.

Big South Fork National River and Recreation Area

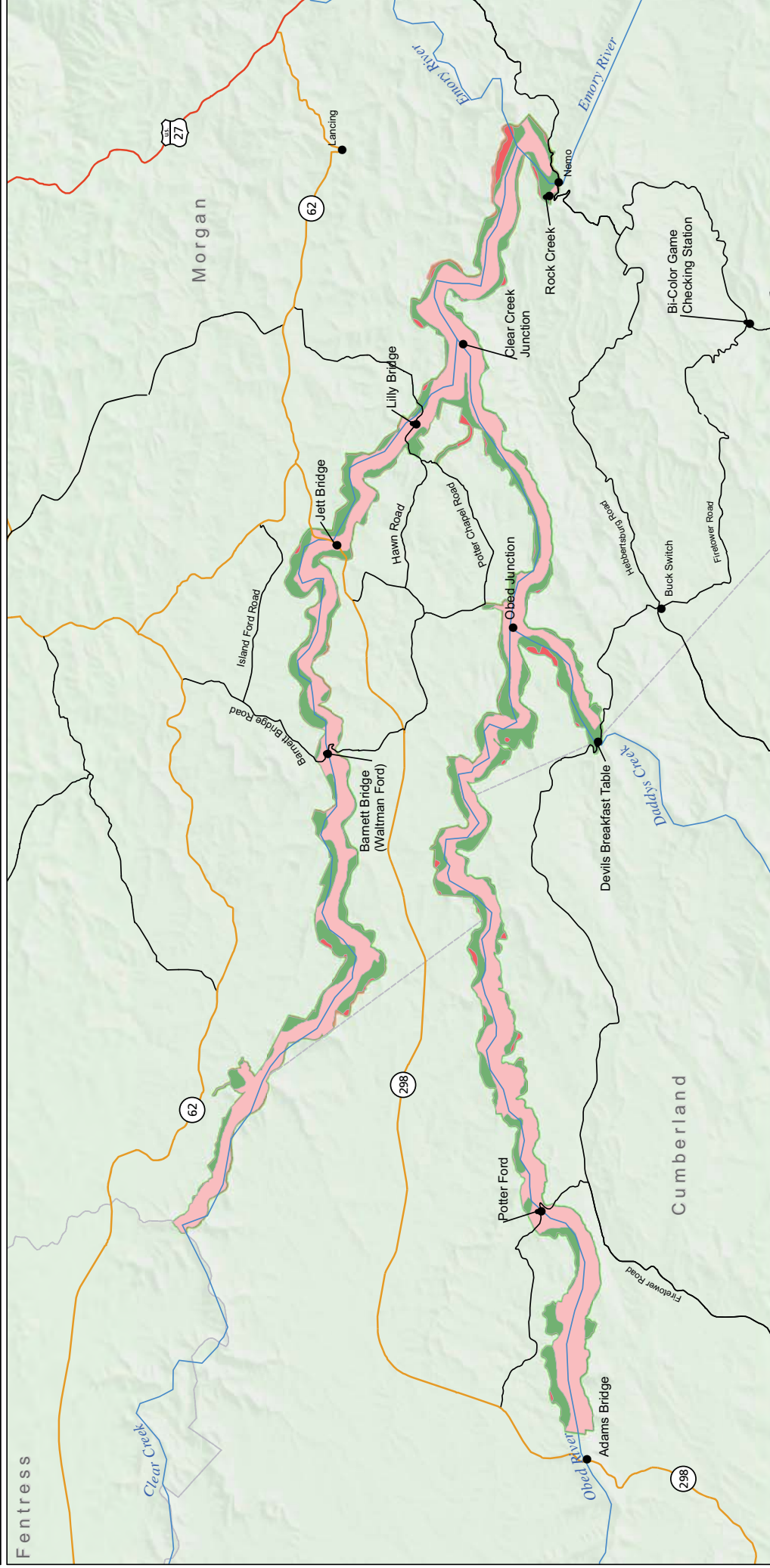
Big South Fork NRR is located within the Tennessee counties of Scott, Morgan, Fentress, and Pickett, and the Kentucky county of McCreary. A soil survey of the Big South Fork NRR categorized soils into 19 map units (see figure 13). These soils identified within the recreation area and, where available, the hydrologic soil groups associated with them (described later in this section) are provided in table 12.

TABLE 12. SOIL ASSOCIATIONS WITHIN BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

Soil Map Unit	Hydrologic Soil Group ¹
Atkins loam	—
Atkins-Lily complex	B
Atkins-Skidmore complex	B
Gilpin silt loam	C
Gilpin-Bouldin complex	B
Gilpin-Bouldin-Petros complex	B/D
Gilpin-Petros complex	D
Gilpin-Sequoia complex	C
Itmann very parachannery loam	C
Lily loam	B
Lily-Gilpin complex	B
Lily-Ramsey complex	B
Lonewood silt loam	B
Pope-Skidmore complex	B
Ramsey-Rock outcrop complex	D
Shelocta silt loam	B
Shelocta-Bouldin complex	B
Skidmore very gravelly sandy loam	—
Wernock silt loam	B

Source: USDA 2009a, 2009b.

¹Classifications are based on the hydrologic soil groups as assigned by the Natural Resources Conservation Service and are provided where available for specific soils contained in the map unit.



Legend

US Highway
State Highway
Paved or Unpaved Roads

Park Unit Boundary
County Boundary
Rivers / Creeks

Crooked Fork Group
Crab Orchard Mountain Group
Rockcastle Conglomerate

Bi-Color Game Checking Station

Devils Breakfast Table

Emory River

Firetower Road

Hebertstown Road

Island Ford Road

Jett Bridge

Lilly Bridge

Obad Junction

Potter Ford

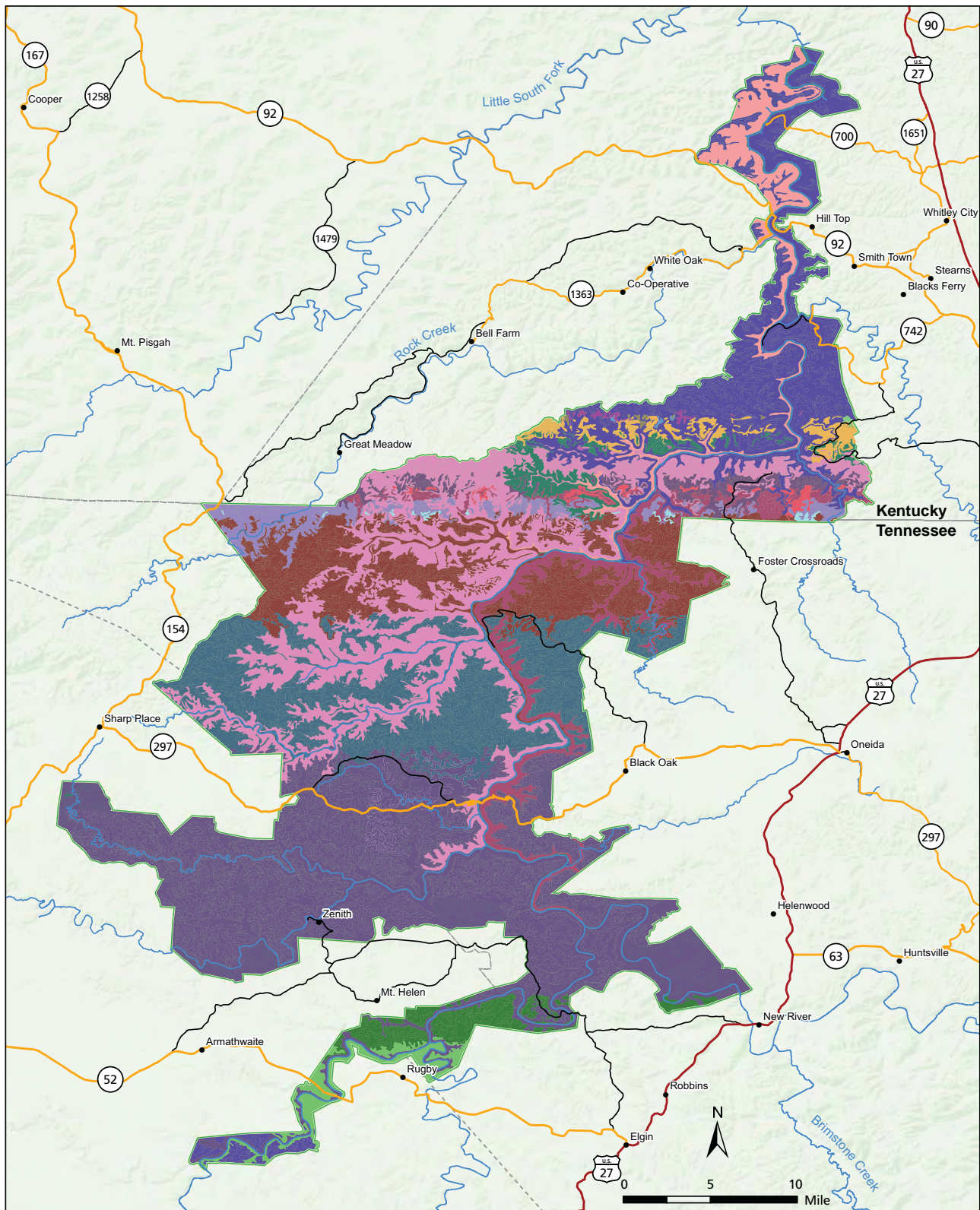
Rockcastle Conglomerate



0 5 10 Miles

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Figure 12. Bedrock Geology of OBED Wild and Scenic River



Legend

Figure 13. Soils of Big South Fork National River and Recreation Area

U.S. Highway	Atkins loam, ponded	Gilpin-Sequoia complex	Rock outcrop-Ramsey complex
State Highway	Atkins-Lily complex	Itmann very parachannery loam	Shelocta silt loam
Roads	Atkins-Skidmore complex	Lily loam	Shelocta-Bouldin complex
Rivers / Streams	Gilpin silt loam	Lily-Gilpin complex	Skidmore very gravelly sandy loam
County Boundary	Gilpin-Bouldin complex	Lily-Ramsey complex	Water
	Gilpin-Bouldin-Petros complex	Lonewood silt loam	Wernock silt loam
	Gilpin-Petros complex	Pope-Skidmore complex	

For purposes of describing the hydrologic characteristics of the soil and evaluating the potential impacts of oil and gas operations, soil associations within the recreation area have been combined into four major classifications based on their infiltration/runoff potential or hydrologic group. Hydrologic group refers to a group of soils having similar runoff potential under similar storm and cover conditions. These classifications are assigned by the Natural Resources Conservation Service (NRCS). The four hydrologic soil groups are A, B, C, and D, where soils in group A generally have the smallest runoff potential, while those in group D have the greatest runoff potential. Table 13 describes common characteristics of these hydrologic groups.

TABLE 13. COMMON CHARACTERISTICS OF HYDROLOGIC SOIL GROUPS

Hydrologic Soil Group	A Soils	B Soils	C Soils	D Soils
Composition	Thick, well to excessively drained, moderately coarse textures (sands, loamy sands, and sandy loams)	Moderately thick, well to excessively drained, moderately fine to moderately coarse textured (silt loams and loams)	High clay content, water retardant layer, moderately fine to fine textured (sandy clay loams)	Fine textured, thin clayey soils with claypan or clay layer near surface
Location	Generally found in upland areas	Generally found in upland areas	Generally found in wetlands and floodplains	Generally found in wetlands and floodplains
Permeability	High	Moderate	Low	Very Low
Erodibility	Low to Moderate	Low to Moderate	Moderate to High	Moderate to High
Compaction	Low	Low	Moderate	High
Shrink/Swell Potential	Low	Low	Moderate	High
Runoff Potential	Low	Low	Moderate	High
Infiltration Rate	High	Moderate	Low	Low

Source: USDA 2009b; NPS 2005d

Soil characteristics that are important in assessing the potential impacts of oil and gas operations include the following:

Soil Erodibility—Most of the soils in classes A and B are low to moderately erodible, while soils in classes C and D are moderately to highly erodible. Erosion also depends on the rainfall energy, slope length, vegetative cover, and site conservation or management practices. Slopes within Big South Fork NRR are variable, and soil erosion control may be necessary whenever vegetative cover is removed or when water is concentrated and flow velocities are high.

Soil Compaction—Typically, soils with a high clay content are most subject to compaction. Soil compaction resulting from foot travel or vehicle use reduces the pore spaces in the soil and impedes the penetration of rainfall and plant roots (Meek et al. 1992). Even though drying and shrinking of the soils and subsequent wetting and expansion will tend to negate some of the adverse impacts over time, clayey soils should not be traversed when saturated. Vehicular travel on clayey soils under saturated conditions will form compacted tracks. These tracks will have the effect in flat topography of changing surface drainage patterns by forming small drainage channels that can locally affect the hydroperiod (frequency

and duration of saturation) of a site. Compaction will also tend to severely reduce the permeability of the soil. Soils within class D are most prone to compaction.

Shrink/Swell Potential—Clayey soils that are composed of expansive clays will tend to expand and contract with seasonal moisture variations. The combined effects of shrink/swell and compaction make road construction difficult in areas where there are clayey soils. Typically, soils in class D are more prone to shrink and swell.

Prime or Unique Farmland Soils—The Farmland Protection Policy Act was passed in order to minimize the amount of land irreversibly converted from farmland due to federal actions. Prime farmland, as defined by the U.S. Department of Agriculture (USDA) National Resources Conservation Service, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. Big South Fork NRR contains seven soil associations that have been identified as prime farmland soils. They are: Allegheny-Grigsby, Lily Loam, Lonewood Clarkrange, Sequoia Silt Loam, Sequoia-Wernock, Sewanee Loam, Wernock Silt Loam (USDA 2009b).

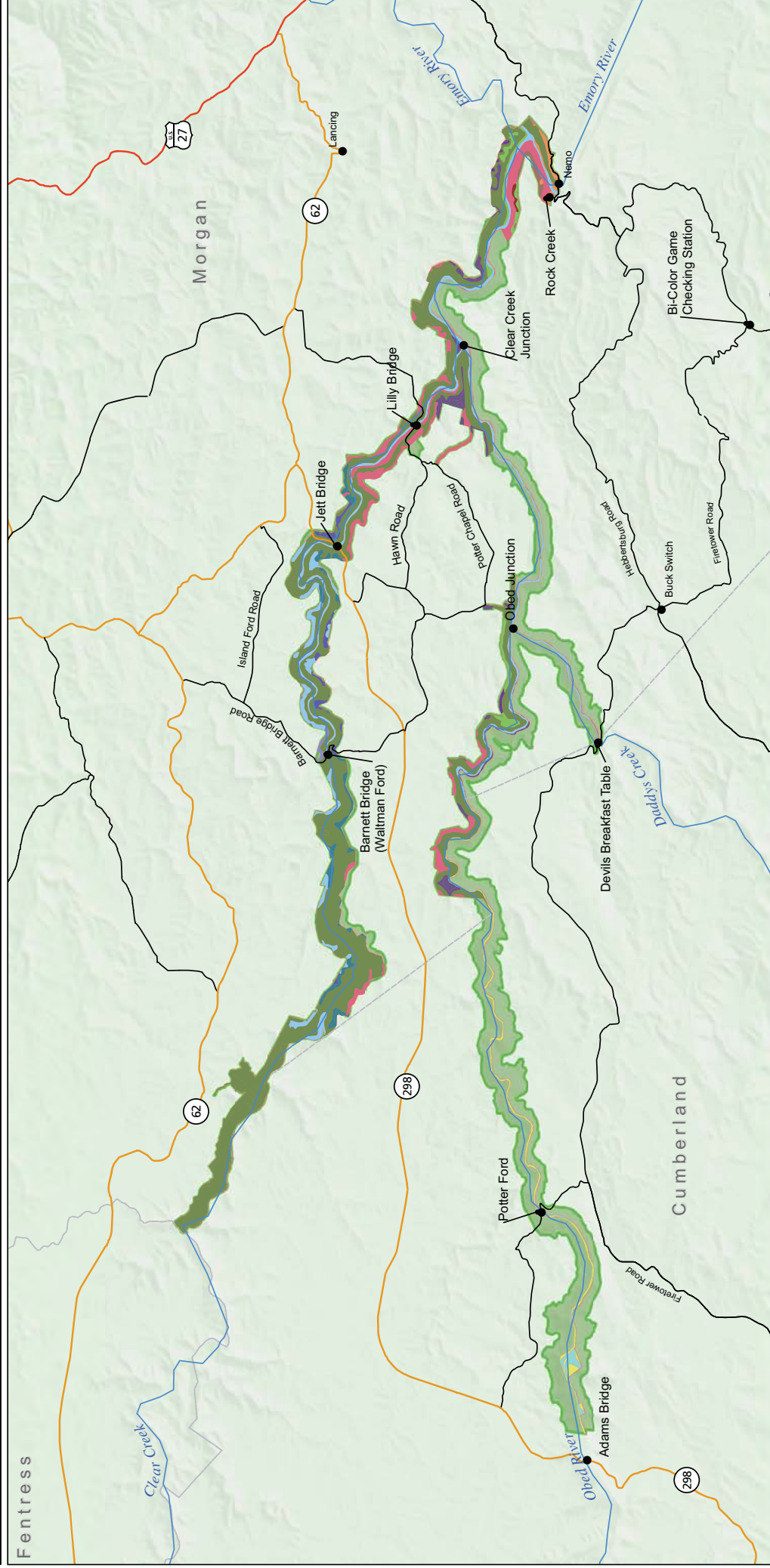
Obed Wild and Scenic River

The Obed WSR is located within Cumberland and Morgan counties. Soil composition characteristics for the Obed WSR are representative of the Cumberland Plateau and similar to those of Big South Fork NRR. The 18 soils found within the recreation area and the hydrologic soil classes associated with them are illustrated in figure 14 and listed in table 14.

TABLE 14. SOIL ASSOCIATIONS WITHIN OBED WILD AND SCENIC RIVER

Soil Map Unit	Hydrologic Soil Group
Bethesda-mines pit complex	C
Ealy-Craigsville complex	B
Gilpin silt loam	C
Gilpin-Bouldin-Petros complex	C
Gilpin-Petros complex	C
Jefferson-Varilla-Shelocta complex	B
Lily Loam	B
Lily-Gilpin complex	B
Lily-Ramsey complex	B
Lonewood Silt Loam	B
Pope-Philo complex	B
Ramsey-Rock outcrop complex	D
Shelocta Silt Loam	B
Wernock Silt Loam	B

Source: USDA 2009a; 2009b



Legend

- Bethesda-mines pit complex
- Ealy-Craigsville complex
- Gilpin silt loam
- Gilpin-Bouldin-Petros complex
- Gilpin-Petros complex
- Jefferson-Vailla-Shelocta complex
- Lily loam
- Lily-Gilpin complex
- Lily-Ramsey complex
- Lone wood silt loam
- Pope-Philo complex, frequently flooded
- Ramsey-Rock outcrop complex
- Shelocta silt loam
- Water
- Wernock silt loam
- Park Unit Boundary
- US Highway
- County Boundary
- State Highway
- Paved or Unpaved Roads
- Rivers / Creeks

Figure 14. Soils at Obed Wild and Scenic River

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Prime or Unique Farmland Soils—Obed WSR contains five soil types that have been identified as prime farmland soils. These are: Lily Loam, Lonewood Loam, Lonewood Silt Loam, Pope Philo, and Wernock Silt Loam (USDA 2009b).

WATER RESOURCES

BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

One of the primary reasons the Big South Fork NRR was established was to preserve the Big South Fork of the Cumberland River as a natural, free-flowing stream for the benefit and enjoyment of present and future generations. The Big South Fork River is formed by the New River and the Clear Fork, and drains the northern portion of the Cumberland Plateau in Tennessee. As the Big South Fork flows from south to north, it is fed by a variety of sources ranging from perennial streams, such as North White Oak Creek, to many ephemeral creeks. Flooding is common during the winter months (December – March) when soils are saturated, frozen, or covered with snow. Springs and ponds can be found scattered throughout the Big South Fork NRR. Enhancing the water quality of the Big South Fork is an important management concern. The following sections generally describe surface and ground water at the park unit. A complete overview of the management of the water resources is contained in the Big South Fork NRR Water Resources Management Plan (NPS 1997).

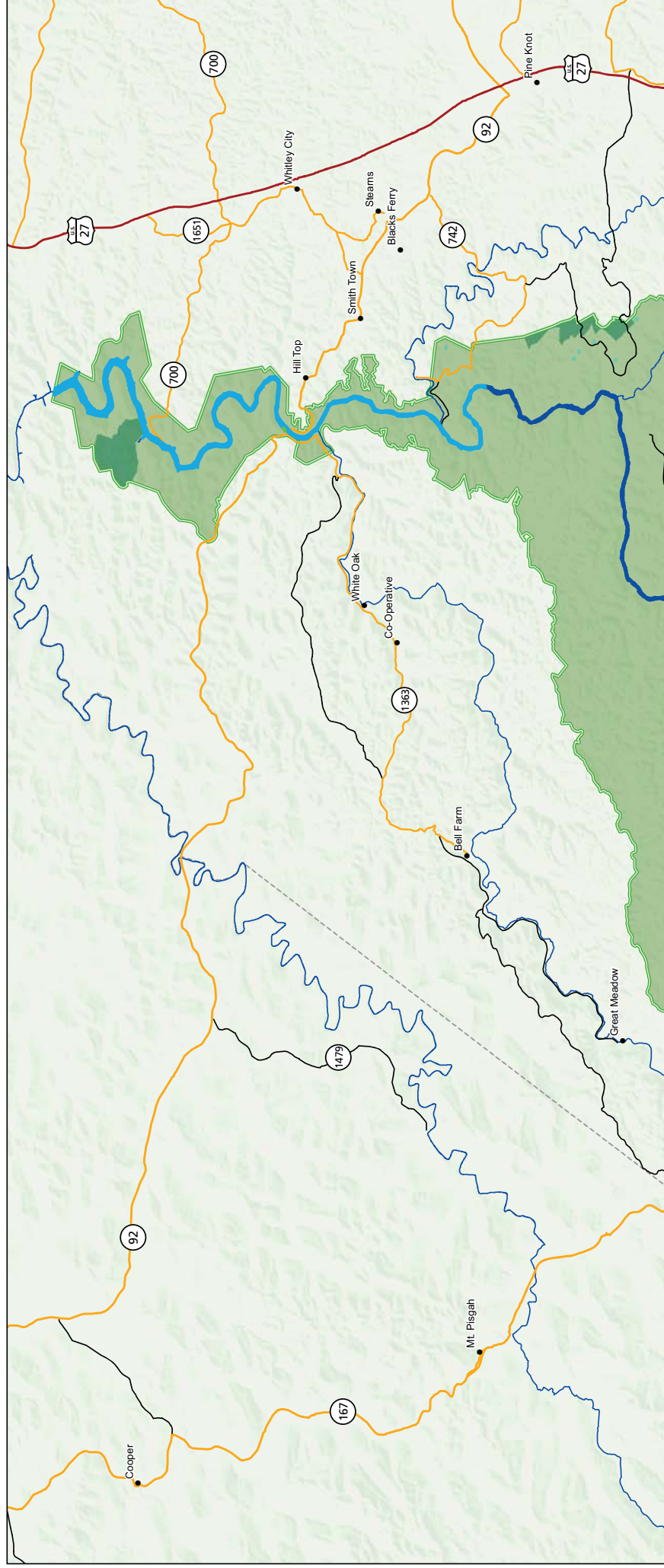
Surface Water

The Big South Fork (also known as the Big South Fork of the Cumberland) River originates at the confluence of the Clear Fork and New River in the southern portion of the Big South Fork NRR. Other major tributaries include North White Oak Creek, Pine Creek, Bear Creek, Station Camp Creek, Williams Creek, Roaring Paunch Creek, and Rock Creek. Major tributaries to the Big South Fork are shown on figures 15, 16, and 17. Table 15 provides the area drained by these major tributaries as well as several smaller tributaries to the river.

TABLE 15. SUB-WATERSHEDS IN THE BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

Sub-watershed River	Sub-watershed Area mi ²	Location Counties
New River	396	Scott, Anderson, Campbell, Morgan
Clear Fork River	283	Scott, Fentress, Morgan
North White Oak Creek	88	Scott, Fentress
Pine Creek	27	Scott
Station Camp Creek	132	Scott, Pickett, Fentress
Bear Creek	23	Scott, McCreary
Williams Creek	24	Scott
Roaring Paunch Creek	50	Scott, McCreary
Rock Creek	163	Scott, Pickett, McCreary

Source: NPS 1997.

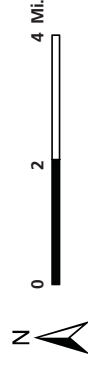
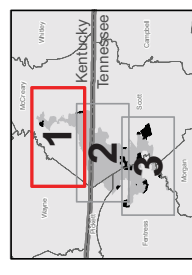


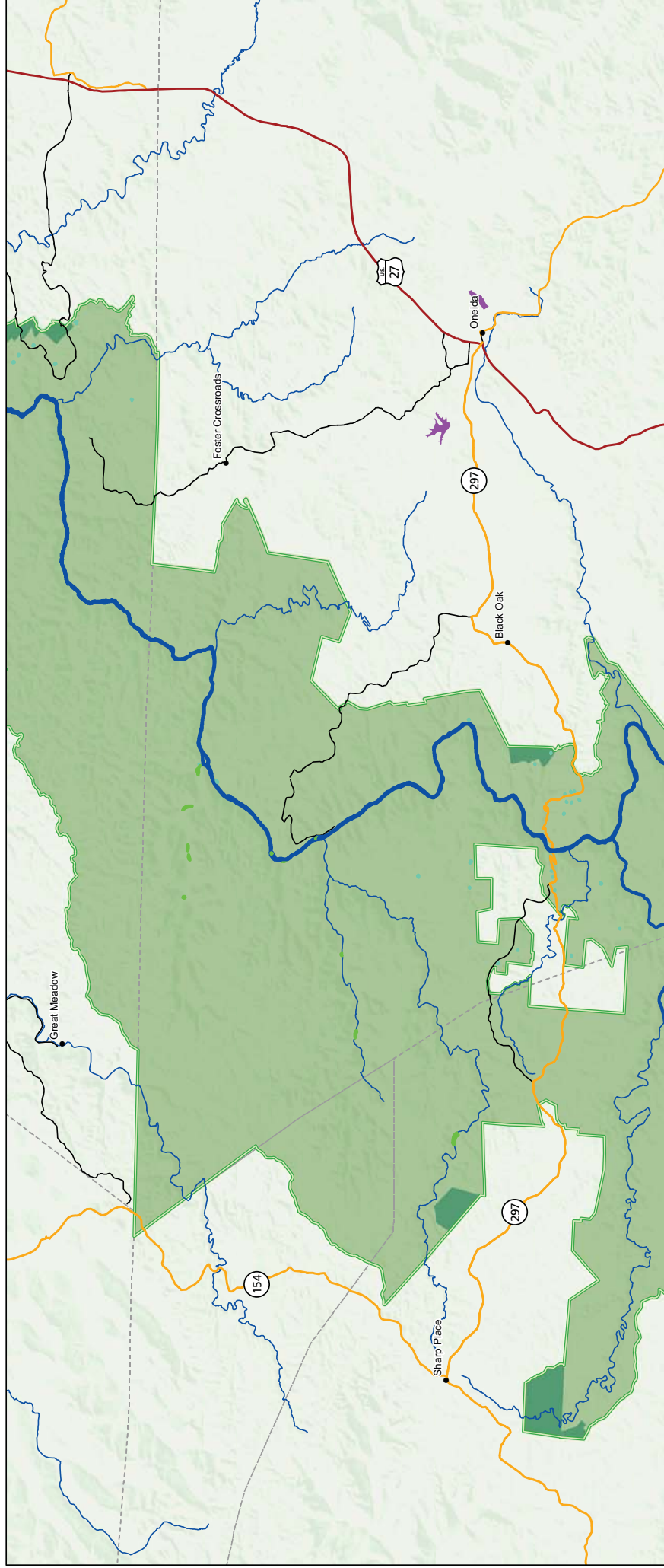
Legend

- U.S. Highway
- State Highway
- Roads
- Park Unit Boundary
- Rivers / Streams
- - - County Boundary

- Freshwater Forested / Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- Reservoirs and Impoundments

Figure 15. Wetlands and Surface Water of Big South Fork National River and Recreation Area (Map 1)





Legend

- U.S. Highway
- State Highway
- Roads

- Park Unit Boundary
- Rivers / Streams
- County Boundary

- Wetlands and Surface Water**
- Freshwater Forested / Shrub Wetland
 - Freshwater Pond
 - Lake
 - Riverine
 - Reservoirs and Impoundments

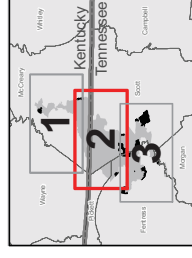
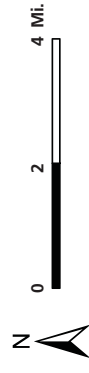
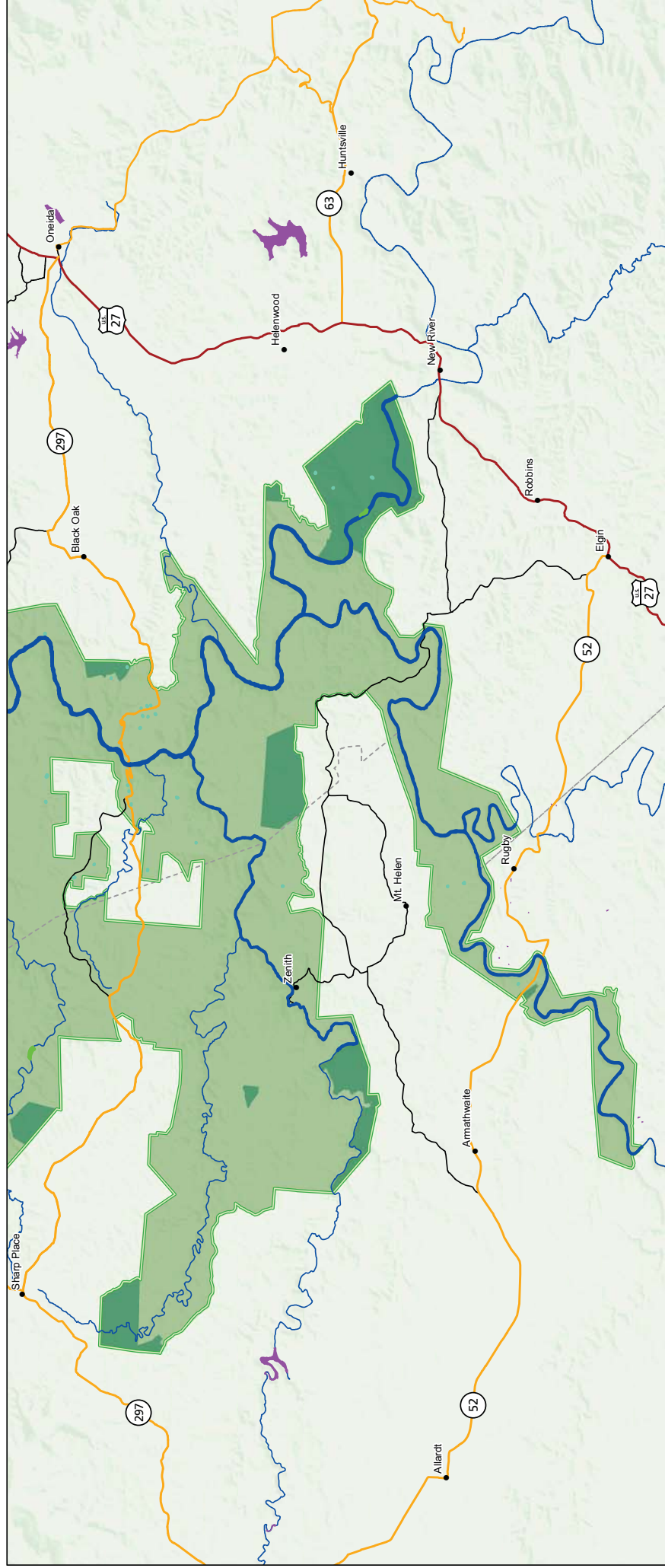


Figure 16. Wetlands and Surface Water of Big South Fork National River and Recreation Area (Map 2)



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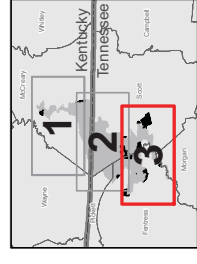
Legend

- U.S. Highway
- State Highway
- Roads
- Park Unit Boundary
- Rivers / Streams
- County Boundary

Wetlands and Surface Water

- Freshwater Forested / Shrub Wetland
- Freshwater Pond
- Lake
- Riverine
- Reservoirs and Impoundments

Figure 17. Wetlands and Surface Water of Big South Fork National River and Recreation Area (Map 3)



The Big South Fork River flows northward through the Big South Fork NRRRA for approximately 49 miles and joins the Cumberland River 28 miles north of the Big South Fork NRRRA's northern boundary at Burnside, KY (NPS 1997). The Big South Fork River watershed, combined with the New River and Clear Fork watersheds, drain approximately 1,123 square miles within the Cumberland Plateau (NPS 2009a). Roughly six miles of the Big South Fork River within the Big South Fork NRRRA boundaries are part of Lake Cumberland at normal pool levels.

A unique feature of surface waters in the Big South Fork NRRRA is their low ionic strength. Ion content of streams and rivers is related to several other potential stressors, including temperature, sediment, pH, metals, other toxic chemicals, and flow alteration. Insofar as conductivity may be taken as an indicator of ionic strength, clean streams in the Big South Fork NRRRA would have an electrical conductivity of 60 microSiemens per centimeter ($\mu\text{S}/\text{cm}$) or less in watersheds with limestone, or 30 $\mu\text{S}/\text{cm}$ or less in watersheds without limestone. When conductivity exceeds 60 $\mu\text{S}/\text{cm}$, this is an indication that the stream is polluted (Rikard et al. 1986). For this reason, brine discharges associated with oil and gas activities should not be allowed to raise the conductivity of the surface water above these acceptable levels. While some surface waters of the Big South Fork River system are contaminated by oil and gas activities (as detailed below), overall surface water quality, as measured by ionic strength, is good.

Streamflow—There are three USGS stream gauge stations within the Big South Fork NRRRA. One is on the Big South Fork River in Kentucky (station no. 03410500), one is on the Clear Fork near Burnt Mill Bridge (station no. 03409500), and the other is on the Big South Fork River in Tennessee (station no. 03410210).

Data is available for streamflow measurements reported for 2004 at station no. 03410600 on the Big South Fork Cumberland River at Yamacraw in Kentucky. Statistics from this reporting year indicate that average daily flow, measured in cubic feet per second (cfs), ranges from 222 to more than 43,500 cfs. Flows are highest during the months from January through April, with peak flows occurring somewhere during this period. Flows during this period average approximately 3,940 cfs. During the May through December period, flows are lower, and average approximately 1,970 cfs (USGS 2004).



The Adams Bridge Stream Gauge located on the Obed River.

Streamflow measurements from the station no. 03409500 on the Clear Fork near Robbins in Tennessee indicate that average flow is from 2 to 3,420 cfs. Flows are highest during the months of January, February, March, and April. During this period, flows average approximately 900 cfs. During the period from May through December, flows are lower and average approximately 260 cfs (USGS 2009b).

Streamflow measurements from the station no. 03410210 on the Big South Fork Cumberland River at Leatherwood Ford in Tennessee indicate that average flow is from 26 to 6,370 cfs. Flows are highest during the months of January, February, March, and April. During this period, flows average approximately 2,300 cfs. During the period from May through December, flows are lower and average approximately 800 cfs (USGS 2009b).

Intakes—There are four public water supply intakes that withdraw water from streams that fall within the Big South Fork River watershed (table 16). The McCreary County intake is located within the Big South Fork NRR boundary; the other three intakes are outside of the park (NPS 2005a).

TABLE 16. INTAKES IN THE BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

Public Water Supply	Year Operation Began	Source	Average Pumpage (10 ⁶ gal/day)	Population Served
McCreary County Water District ^a	2002	Lake Cumberland and Big South Fork River	2.2	18,000
Huntsville Utility District (in Scott County, TN; includes the Sunbright Utility District of Morgan County, TN) ^b	Intermittently Operational (as needed)	New River (Pumped to Huntsville Utility District Reservoir on Flat Creek)	1.3	13,000
City of Oneida, TN	1963	North Fork Pine Creek	1.5	11,000
City of Jamestown (also serves Fentress County Utility District, TN, and the Town of Allardt, TN)	1969	North White Oak Creek	1.6	18,000

Sources: Hench, pers. comm., 2009a, 2009b; Elliston, pers. comm. 2009; Dean, pers. comm., 2009; Keaton, pers. comm., 2009; McCoy, pers. comm., 2009; and Owens 2009.

^aFigures include the Laurel Creek reservoir intake, which supplements the intake at Big Creek.

^bThis intake is not currently in use, and has not been used since 2002.

Impoundments—The northernmost reach of Big South Fork River, approximately 37 miles from the confluence of New River and Clear Fork River, is not free-flowing. It is affected by the levels of Lake Cumberland. This USACE reservoir is formed by the Wolf Creek Dam on the Cumberland River, which was built in 1950 and is outside of the park unit (NPS 1997).

Flat Creek, which is a tributary to the New River, has a large reservoir called the Huntsville Utility District Reservoir. This is approximately 1.6 miles from the confluence with the New River, and approximately 4 miles from the Big South Fork NRR boundary.

There are two reservoirs on North White Oak Creek. However, they are located several miles to the west of the Big South Fork NRR boundary. A small reservoir called Old Jamestown Reservoir, having a total area of 4.9 acres, is approximately 2.5 miles upstream of Jamestown Reservoir, which is a larger reservoir with an area of approximately 60.8 acres. Jamestown Reservoir is approximately 3.1 miles to the west of the Big South Fork NRR boundary.

Surface Water Quality—The states of Kentucky and Tennessee have each declared their portions of the Big South Fork River as an Outstanding National Resource Water (ONRW) (NPS 2005a). An ONRW is a river that is “of exceptional recreational or ecological significance,” per EPA water quality standards at 40 CFR 131.12. The entire length of the Big South Fork River is included in this designation as an ONRW.

Chapter 4 of the Big South Fork NRRRA General Management Plan (NPS 2005a, p. 159) describes the water quality classification process in the following way:

Kentucky and Tennessee have stream use classification systems to protect surface water quality. Water quality criteria values are specified for each stream use. Tennessee has classified all streams within the [Big South Fork NRRRA] for primary contact recreation and fish and aquatic life. Kentucky classifies all [Big South Fork NRRRA] streams for primary contact recreation and for either warmwater or coldwater aquatic habitat. A number of streams in the [Big South Fork NRRRA] do not meet standards, primarily due to acid mine drainage and/or sediment. Some of the streams have been identified as impaired streams, pursuant to the Clean Water Act [CWA].

The report (NPS 2005a) continues to describe the state of water quality within the Big South Fork NRRRA:

[Big South Fork] waters are generally considered good quality; however, acid mine drainage and excessive sediment from logging, substandard road construction, and other past and present ground disturbing activities significantly affect certain tributary streams and to a lesser extent the Big South Fork [River]. Agricultural chemicals also contribute negatively to water quality. In general, streams in the western portion of [Big South Fork] are less disturbed than streams in the eastern and southeastern portions. Impacts in the eastern and southern areas are more frequent and severe because coal mining, logging, and stormwater runoff are concentrated in these areas (NPS 1986). The Big South Fork River has nearly twice the dissolved solids and suspended solids, and 2.5 times greater sulfate yield as a comparable unmined river basin (Evaldi and Garcia 1991 in NPS 2005a). Acid mine drainage impacts are most notable in Bear Creek and Roaring Paunch Creek. Sediment impacts are evident in these streams, New River, and several others (pp. 158–159).

The CWA requires each state in the United States to compile a list of streams that are failing to meet one or more of the “uses” for which they have been designated due to water quality problems. Such a list is called the 303(d) list, named for the section of the CWA that requires these lists to be written. Streams on this list are deemed “impaired” as defined by the CWA, and not by the regulations and policies of the National Park Service (NPS). In the 303(d) lists for Kentucky and Tennessee for the year 2008, there are a total of four impaired streams that fall within the Big South Fork NRRRA (table 17).

TABLE 17. IMPAIRED STREAMS IN THE BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

Stream Name (and Miles)	State	Impairment	Cause	Source
Bear Creek (0.0 to 3.3)	KY, TN	Aquatic habitat, primary contact recreation, secondary contact recreation	pH, loss of biological integrity due to siltation	Subsurface mining, surface mining
Pine Creek (three segments, 10.3 miles)	TN	Water contact advisory	E. coli	Municipal point source collection system failure
Roaring Paunch Creek (0.0 to 7.8)	KY	Aquatic life, primary contact recreation, secondary contact recreation	pH	Acid mine drainage, coal extraction
Rock Creek (0.0 to 4.3)	KY	Fish consumption (partially supports)	Methyl mercury	Source unknown

Source: Based on KY EPPC 2008 and TDEC 2008a.

Surface coal mining does not currently occur inside the Big South Fork NRRRA; however, past coal mining has affected water quality within the area. Degraded water used in past mining efforts re-enters the system and degrades water quality. Mining also has disrupted the flow of underground aquifers. Mining wastes also contribute various elements into the flow of Big South Fork NRRRA streams that negatively impact water quality (NPS 1997).

Seeps and springs, occurring where the groundwater table intersects the land surface, are common in the Big South Fork NRRRA, particularly at the base of ledges and bluff shelters. Springs of moderate yield occur at the base of the Hartsell Formation in Kentucky; other low-yield springs occur at the base of thick sandstone beds and along coal bed horizons (NPS 1997).

Groundwater Quantity—Lack of reliable groundwater in the watershed has resulted in a search for other options of water supply for surrounding communities. This search has included consideration of upstream impoundments (man-made lakes, ponds, or reservoirs) and also direct withdrawals.

There is no published inventory of the Big South Fork NRRRA groundwater resources. The Cumberland Plateau's major regional aquifer is the Cumberland Plateau aquifer, formerly known as the Pennsylvanian sandstone aquifer. This is composed of Pennsylvanian-aged sandstone, shale, and conglomerate. These rocks are not porous, and so groundwater is mostly found in bedrock fractures and faults (NPS 1997). As a result, confined groundwater is under sufficient pressure to rise above the surface of the aquifer where breaks in the upper confining unit occur. The water level rises above the top of the aquifer. Perched aquifers, which are aquifers that are located above the water table, are common. The weathered rock material over most of the plateau surface is too thin to be a substantial aquifer (NPS 1997).

In general, groundwater quantity is variable. Wells in the Cumberland Plateau generally yield 5 to 50 gallons per minute, but can yield more than 300 gallons per minute. Records on 376 wells in the region show that 62% of these wells produce an average yield of 10 to 25 gallons per minute. Water wells generally do not yield enough water to be used for public water supply (NPS 1997).

Groundwater in this system is discharged into streams and also into springs. Recharge occurs primarily via precipitation on the outcrops of sandstones and conglomerates. Estimated mean recharge rate for the Cumberland Plateau is 6.5 inches per year. Groundwater flow in the system is shallow-flow. For most of the aquifer's area, the water level in wells rises to within a few feet of the land surface (NPS 1997). It is not known how the typical depth to groundwater varies within the park.

Groundwater Quality—There is no published data describing the water quality of the groundwater in the Big South Fork NRRRA. NPS (1997) gives the following general description: "moderately mineralized, slightly acidic, and may have high concentrations of iron, sulfate, chloride, and hydrogen sulfide when it flows through sandstone or shale containing pyritic or ferrous compounds." As with the surface waters at the park unit, groundwater also has low ionic strength and low conductivity. Oil, gas, brine, or chemicals associated with the oil and/or gas extraction processes can influence groundwater quality. NPS (1997) notes that groundwater quality has potentially already been affected by contaminated mine drainage and oil and/or gas operations.

OBED WILD AND SCENIC RIVER

Surface Water

The Obed River, Daddys Creek, and Clear Creek have a combined total drainage area of 520 square miles, and comprise a total of 144 miles of mountain streams flowing northeast then east into the southbound Emory River, which joins the Tennessee River system (Bureau of Outdoor Recreation 1976).

The Obed River flows east for approximately 45 miles to its junction with the Emory River, of which it is the largest tributary (NPS 1998b). The Obed River drains approximately 520 square miles at its mouth (NPS 1998b). The two principal tributaries of the Obed River—Clear Creek and Daddys Creek—join the Obed River within the Obed WSR area. These water bodies are shown on figure 18.

Clear Creek drains 173 square miles in the northwest portion of the watershed. The stream flows northeast to a point near the Fentress-Cumberland-Morgan county line, then southeast to its junction with the Obed River approximately 4 miles above the junction of the Obed and Emory rivers (NPS 1998b).

Daddys Creek is the largest tributary of the Obed River, and drains 175 square miles. The creek flows northeast to its junction with the Obed River, approximately 9 miles above the Obed River mouth (NPS 1998b).

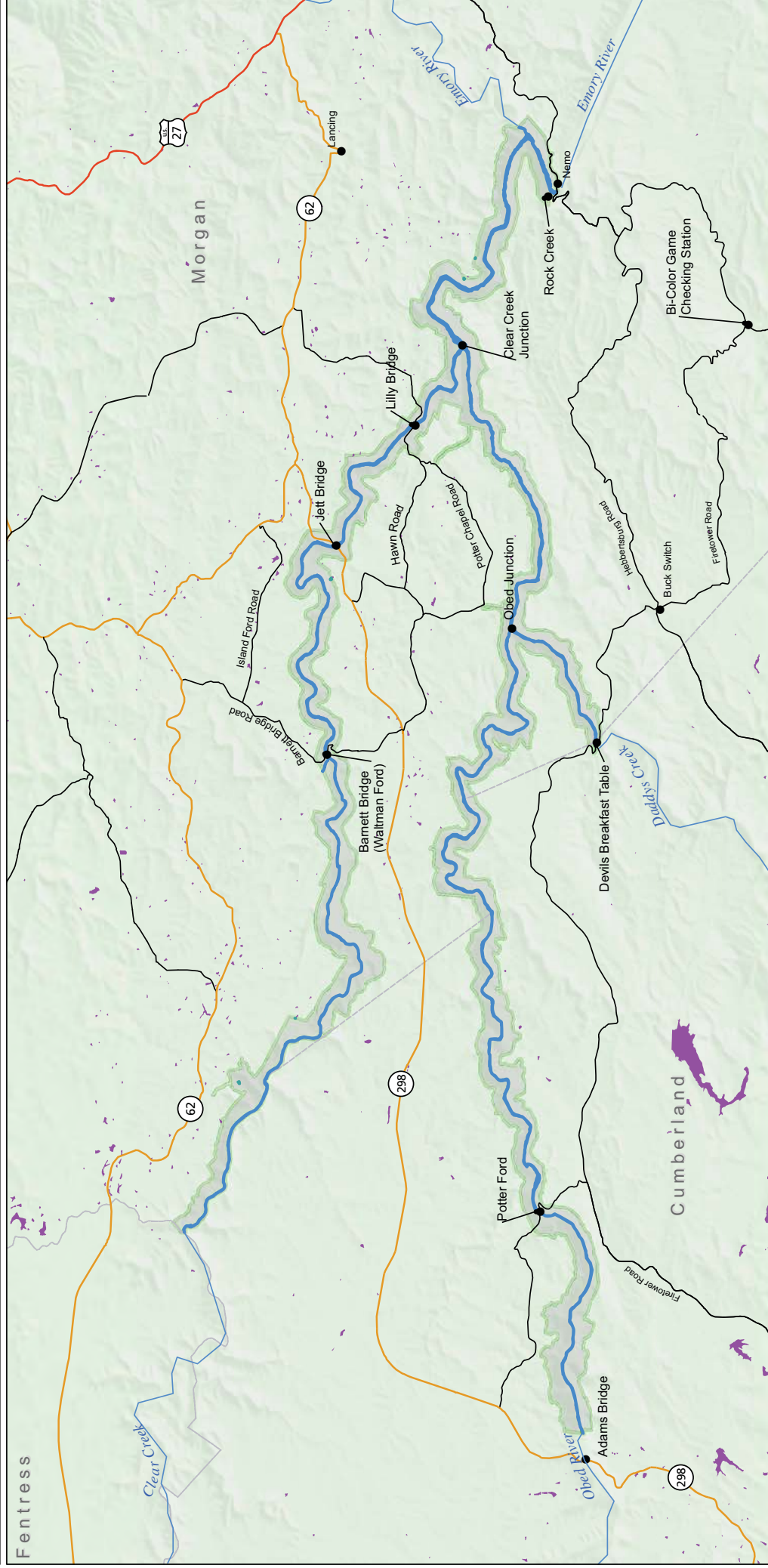
Only a short reach of the Emory River is located within the Obed WSR boundary. This extends from the Emory River confluence with the Obed River at mile 28.4 to Nemo Bridge, mile 27.7. Above mile 28.4, the Emory River drains an area of 91 square miles (NPS 1998b).

As described in the Big South Fork NRRRA “Surface Water” section, the waters of this park have low ionic strength and must be protected from brine discharge impacts associated with oil and gas activities. Surface waters with limestone are polluted when conductivity exceeds 60 umhos/cm, or 30 umhos/cm in waters lacking limestone (Rikard et al. 1986).

Streamflow—There are two USGS stream gage stations within the Obed WSR. One is on the Obed River (Obed River near Lansing, station no. 03539800) and the other is on the Clear Creek River (Clear Creek at Lilly Bridge, station no. 03539778). There is also a third gage located approximately 7 miles upstream of the park boundary on Daddys Creek (Daddys Creek near Hebbertsburg, station no. 03539600). As of December 2009, there are plans to install a new gage on the Obed River which is expected to be operational in the near future. The new gage will be installed at Adams Bridge, just upstream from the park boundary.

Streamflow measurements from station no. 03539800 on the Obed River (USGS 2009b) indicate that average flow, measured in cfs, ranges from 66 to more than 3,300 cfs. Flows are highest during the months from January through May, with peak flows occurring somewhere during this period (typically during the winter months). Flows during this period average approximately 1,600 cfs. During the June through December period, flows are lower, and average approximately 530 cfs.

Streamflow measurements from the station no. 03539778 on Clear Creek (USGS 2009b) indicate that average flow is from 10 to 2,270 cfs. Flows are highest during the months of January, February, March, and April. During this period, flows average approximately 500 cfs. During the period from May through December, flows are lower and average approximately 140 cfs.



Legend

- | | | | |
|---|--|---|---|
| <ul style="list-style-type: none"> US Highway State Highway Paved or Unpaved Roads | <ul style="list-style-type: none"> Park Unit Boundary County Boundary Rivers / Creeks | <p>Wetlands</p> <ul style="list-style-type: none"> Freshwater Forested / Shrub Wetland Freshwater Pond Riverine | <ul style="list-style-type: none"> Reservoirs and Impoundments |
|---|--|---|---|



For Illustrative Purposes Only

Figure 18. Wetlands and Surface Water of Obed Wild and Scenic River Park

Impoundments—According to NPS (2007a), there are over 3,500 impoundments within the Obed WSR watershed. Although these are mostly no larger than 1 acre in size, they may have a cumulative impact on water quality and/or quantity, and this impact is uncertain.

Intakes—There is one intake in the Obed River watershed that would affect surface water flows in the Obed WSR. It is on the Holiday Hills Lake, which is a reservoir on the Obed River.

Surface Water Quality—On June 22, 1999, portions of the Obed River were designated as Tier III Outstanding Natural Resource Waters (ONRWs) under the CWA, due to their high water quality. This includes portions of the Emory River. It also includes Clear Creek and Daddys Creek, although Daddys Creek is designated as Tier II. There are numerous upstream threats to the Obed River’s water quality. Currently, the Cumberland Plateau Regional Water Authority is considering using the Obed River as a source for regional water supply. If it can be found that such a use is necessary, the Obed River would be treated as an “Exceptional Tennessee Water” and designated Tier II. Any permit issued for the river would thereafter be considered under guidance for a Tier II, rather than Tier III, classification.

One water body within the Obed WSR, Clear Creek, was listed in the 303(d) report for the state of Tennessee in 2008, and is described in table 18, below.

TABLE 18. IMPAIRED STREAMS IN THE OBED WILD AND SCENIC RIVER

Impacted Waterbody	County	Miles/Acres Impaired	Cause	Comments
Clear Creek	Morgan	1.41	Oil from Petroleum Activities	Serious oil spill in this section in the Obed WSR. This stream is Category 5, impaired for one or more uses. The stream provides habitat for the listed spotfin chub (<i>Cyprinella monacha</i>) and tangerine darter (<i>Percina aurantiaca</i>).

Source: TDEC 2008a

This stream is listed impaired as a result of an oil spill that occurred on July 19, 2002 when an oil well blew out and released an undetermined amount of crude oil into the stream. Oil began to spill around the well and outside of the containment area at an estimated 200–500 barrels per hour, and flowed downhill from the wellhead into White Creek—at approximately 0.21 miles above its confluence with Clear Creek—and into Clear Creek—at approximately 0.37 miles above Barnett Bridge (OWSRNRTC 2008). The well also caught fire, which followed both oiled paths, burning the vegetation, oil-soaked soils, and oil adjacent to the banks in both creeks. After the initial spill, oil continued to seep from the creek bank into Clear Creek through 2007, with higher rates of release during periods of low river flow (OWSRNRTC 2008). As of 2008, this water body was listed as “Category 5, impaired for one or more uses.”

All of Clear Creek, Daddys Creek, the Emory River, and some sections of the Obed River within the Obed WSR are designated for the following uses: recreation, fish and aquatic life, livestock and wildlife watering, and irrigation (NPS 1998b). The Obed River from river mile 40.1 (near Crossville) to its origin is also designated for domestic and industrial water supply.

The Obed River land base is relatively small considering the size of its watershed. For this reason, water quality is substantially affected by activities occurring on the land outside of the protected area. Principal water quality concerns include alteration of flows, high levels of siltation and suspended solids, contamination by fecal bacteria, low dissolved oxygen content, high nutrient levels, oil and gas spills, and

disturbance of acidic strata. These threats result from activities such as coal mining, oil and gas exploration, quarrying, sewage discharge, agriculture and forestry practices, some residential development, garbage disposal, and construction of numerous water supply ponds and impoundments on tributaries of the Obed and Emory rivers (NPS 1998b). The Crossville sewage treatment plant (STP) discharges treated effluent to the Obed WSR. During extended dry periods, the only flows into the Obed River at Crossville come from the drinking-water plant filter backwash, limited baseflow, and the Crossville STP. During these periods, discharges from the Crossville STP approach or exceed 50% of measured flow in the Obed River near Lansing located about 30 miles downstream (Law et al. 2010).

As shown in table 18, the only river that is impaired for multiple uses is Clear Creek, wherein the impairments have been attributed to oil activities and an oil spill. The Obed River has impairments on one segment in Cumberland County, where a total maximum daily load (TMDL) has already been approved by the EPA. Another Cumberland County section of the Obed River is threatened (not impaired) for multiple uses (TDEC 2008a). None of the Morgan County length of the Obed River is threatened or impaired (TDEC 2008a). Daddys Creek is not threatened or impaired. The Emory River is impaired due to mercury pollution, and a fishing advisory has been enacted. No total maximum daily load has been written for this river as of 2008. The impaired length of the Emory River crosses into Morgan County from Roane County, and does not enter into the Obed WSR (TDEC 2008a).

Groundwater

The Water Resources Management Plan, Obed WSR states that “The Obed River watershed is located in the Cumberland Plateau physiographic province of Tennessee’s Cumberland Plateau” (NPS 1998b, p. 50). Beneath the watershed are “gently dipping Pennsylvanian sandstones, siltstones, shales, some conglomerates, and coals” (NPS 1998b, p. 50). These rocks extend for 1,500 feet beneath the surface.

The Pennington Formation of Mississippian age is a transition from the basal Pennsylvanian sandstone and shale to underlying Mississippian carbonate rocks that are less resistant to weathering. These carbonate rocks are predominantly limestones, calcareous shales, and siltstones, with a maximum thickness of about 1,000 feet. The Devonian Chattanooga shale and Rockwood Formation of Silurian age underlie the Mississippian rocks (NPS 1998b).

The soil over most of the plateau is too thin to be of any regional significance as an aquifer, although soil thickness and permeability at specific locations can produce ample groundwater supplies for domestic purposes. Aquifers within the Obed WSR watershed area include shallow aquifers (<200 feet) within Pennsylvanian sandstone and conglomerates; deeper aquifers (>200 feet) within Pennsylvanian sandstone and conglomerates (and Mississippian rocks); shallow karstic aquifers in cove areas along the Cumberland Plateau; shallow/colluvium and underlying karstic aquifers at the base of the Cumberland Plateau escarpment (NPS 1998b).

Recharge is an important consideration in the potential development of groundwater supplies in the watershed area. The recharge rate for the shallow and deeper sandstone/conglomerate aquifer of the Cumberland Plateau ranges from ~ 4 to 9 inches per year and averages 6.5 inches per year (NPS 1998b).

The primary aquifer system resides within shallow Pennsylvanian sandstones and conglomerates. However, certain Pennsylvanian rock formations are better aquifers than others due to their hydraulic characteristics and recharge attributes. Deeper aquifers also occur within the Obed WSR watershed in Pennsylvanian rocks and Mississippian limestones.

The quality of groundwater from the Pennsylvanian rock aquifers is quite variable, but is generally satisfactory for most purposes or can be made so with minor treatment. Typically, the water is moderately mineralized, slightly acidic, and soft to moderately hard. Most wells and springs in this area exhibit iron concentrations in excess of the recommended limit.

The quality of groundwater from Mississippian rock aquifers is generally good. Characteristically, the water is a calcium bicarbonate type and slightly alkaline. In some areas, hardness may be a problem, and iron and chloride concentrations may exceed the recommended limits. There are reports of hydrogen sulfide gas in the water from some wells in the area (NPS 1998b). As with the surface waters at the park unit, groundwater also has low ionic strength and low conductivity.

FLOODPLAINS

Floodplains are areas next to a river that experience periodic inundation by flooding. These areas provide habitat for plants, fish, and wildlife, and thus are important for ecological reasons as they sustain ecosystem integrity and biodiversity. In addition to their scenic value, floodplains can also be of use for educational and/or recreational activities. They provide groundwater recharge or discharge, and can improve water quality. Floodplains may also benefit agricultural lands, manufacturing, and transportation activities.

BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

According to the Final General Management Plan and Environmental Impact Statement, Big South Fork NRR (NPS 2005a), floodplains have not been delineated in the park unit. However, this plan generally describes the floodplains as narrow in the gorge area, and small throughout the rest of the property. In the headwater areas of the major rivers within the area, slopes are steep, and floodplains are therefore not well-formed. Minor floodplains increase in occurrence farther downstream (NPS 2005a).

OBED WILD AND SCENIC RIVER

As with Big South Fork NRR, floodplains have not been delineated within Obed WSR. However, the extremely narrow, confined nature of this valley, and the associated high-energy water regimes, place a firm limit on the extent of natural floodplain development within the Obed WSR. Seasonally flooded habitat does exist, but it is on alluvial point bars, rather than on floodplains (USGS 2007).

WETLANDS

Section 404 of the Clean Water Act defines Wetlands as areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Important wetland functions and values are provided protection under NPS regulations, orders, and policies (in particular, Director's Order #77-1: Wetland Protection [NPS 2002b]), as well as USACE regulations. In general, wetlands must first be avoided, and then, if no practicable alternatives exist, impacts must be mitigated. This section will describe the wetlands and deepwater habitats found in the Big South Fork NRR and the Obed WSR, as identified by the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory Data (USFWS 2009b). All descriptions are based on the Cowardin system of wetlands classification (Cowardin et al. 1979) and provide general information about the wetland types found in each park unit.

BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

Table 19 summarizes the wetland and deepwater habitat types in Big South Fork NRR and their acreage. These types, which are classified as Lacustrine, Palustrine, and Riverine, are described in more detail in the following sections. The Palustrine system, which accounts for a fraction of the wetland/deepwater habitat acreage (less than one-tenth of 1%), only includes wetlands and upland seeps found within the park unit. Most of the wetland and deepwater habitat acreage falls within the Lacustrine type (96%), which is generally associated with the backwaters of Lake Cumberland. The Riverine types (4%) are associated with the rivers/streams of Big South Fork NRR. The Lacustrine, and much of the Riverine, systems would likely be considered deepwater habitats, which are “permanently flooded lands lying below the deepwater boundary of wetlands. Deepwater habitats include environments where surface water is permanent and often deep, so that water, rather than air, is the principal medium within which the dominant organisms live, whether or not they are attached to the substrate...The boundary between wetland and deepwater habitat in the Riverine and Lacustrine systems lies at a depth of 2 meters (6.6 feet) below low water; however, if emergents, shrubs, or trees grow beyond this depth at any time, their deepwater edge is the boundary” (Cowardin et al. 1979).

TABLE 19. WETLANDS/DEEPWATER HABITATS OF THE BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

USFWS Mapping Code	Description	Total Acreage
L1UBHh	Lacustrine, Limnetic, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded	4,483.12
PFO1A	Palustrine, Forested, Broad-leaved Deciduous, Temporarily Flooded	15.45
PFO1Ah	Palustrine, Forested, Broad-leaved Deciduous, Temporarily Flooded, Diked/Impounded	0.83
PFO1C	Palustrine, Forested, Broad-leaved Deciduous, Seasonally Flooded	1.66
PSS1A	Palustrine, Scrub-Shrub, Broad-leaved Deciduous, Temporarily Flooded	3.28
PSS1C	Palustrine, Scrub-Shrub, Broad-leaved Deciduous, Seasonally Flooded	7.01
PUBH	Palustrine, Unconsolidated Bottom, Permanently Flooded	0.97
PUBHh	Palustrine, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded	13.54
PUBHx	Palustrine, Unconsolidated Bottom, Permanently Flooded, Excavated	0.39
R3RB2H	Riverine, Upper Perennial, Rock, Rubble, Permanently Flooded	1,156.15
R3RBH	Riverine, Upper Perennial, Rock, Permanently Flooded	98.28
R3UB1H	Riverine, Upper Perennial, Unconsolidated Bottom, Cobble/Gravel, Permanently Flooded	273.86
R3UBH	Riverine, Upper Perennial, Unconsolidated Bottom, Permanently Flooded	338.87
R3USA	Riverine, Upper Perennial, Unconsolidated Shore, Temporarily Flooded	3.15
R3USC	Riverine, Upper Perennial, Unconsolidated Shore, Seasonally Flooded	6.16
TOTAL		1,919.60

Source: USFWS 2009b.

Palustrine Wetlands

Palustrine wetlands are “nontidal wetlands dominated by trees, shrubs, emergents, mosses, or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt” (USFWS 2009b).

The Big South Fork NRRRA is a nontidal system; therefore, the classification under this wetland type would be due to the nature of the dominant vegetation. There are three different types of palustrine wetlands that occur within the Big South Fork NRRRA:

- **Forested**—Forested palustrine wetlands have woody vegetation that is approximately 20 or more feet tall (USFWS 2009b).
- **Scrub-shrub**—Scrub-shrub wetlands are wetlands that have vegetation that is less than approximately 20 feet tall. Common plants might include shrubs, saplings, or stunted trees (USFWS 2009b).
- **Unconsolidated Bottom**—The unconsolidated bottom wetlands group includes all wetlands and deep-water habitats that have “at least 25% cover of particles smaller than stones (less than approximately 3 inches) and a vegetative cover of less than 30%” (USFWS 2009b).

Palustrine wetlands of various types make up a total of approximately 4.3% of the total areal wetlands in the Big South Fork NRRRA. Within this group, some are seasonally flooded, some are temporarily flooded, and some are permanently flooded:

- **Seasonally Flooded**—Seasonally flooded wetlands are those where the surface water extends onto land for long periods of time, particularly during the growing season, but recedes by the end of the growing season in the majority of years (USFWS 2009b).
- **Temporarily Flooded**—In temporarily flooded wetlands, “surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface” (USFWS 2009b).
- **Permanently Flooded**—In permanently flooded wetlands the entire land surface is covered by water for the entire year, in all years (USFWS 2009b).

Lacustrine, Limnetic Wetlands

These wetlands are located in a “topographic depression or dammed river channel” (USFWS 2009b). They do not have any trees, shrubs, or emergent vegetation that covers more than 30% of the area; the total area of the wetland must be greater than 8 hectares (USFWS 2009b). These systems are typically “bounded by upland or by wetland dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens” (USFWS 2009b).

This is the dominant wetland type within the Big South Fork NRRRA, accounting for over 95% of the total park wetlands. The particular type of lacustrine limnetic wetland found within the Big South Fork NRRRA is unconsolidated bottom, permanently flooded (as described under the “Palustrine Wetlands” section). It is also described as diked/impounded:

- **Diked/Impounded**—Diked/impounded wetlands are those that are “created or modified by a man-made barrier or dam which obstructs the inflow or outflow of water” (USFWS 2009b).

Riverine, Upper Perennial Wetlands

Riverine wetlands are contained in channels (either natural or artificial), and flow between two bodies of standing water. A riverine system is bounded by upland on the landward side, and the channel bank on the water side. Vegetation may be trees, shrubs, mosses, emergents (persistent), and/or lichens. Riverine upper perennial wetlands are riverine wetlands that have a high gradient, fast water velocity, rocky or gravelly substrate, and little floodplain development (USFWS 2009b).

In the Big South Fork NRRRA, there are 1,876.48 acres of riverine upper perennial wetlands. Approximately 99.5% of these are permanently flooded, yet a small proportion is temporarily or seasonally flooded (as described under the “Palustrine Wetlands” section). Approximately 61% of all of the riverine upper perennial wetlands within the Big South Fork NRRRA have a rock and/or rubble substrate:

- **Rock**—This is also called “rock bottom.” It includes wetlands that have substrates of stones, boulders, or bedrock of more than 75% of their total area, and vegetative cover for less than 30% of their total area (USFWS 2009b).
- **Rubble**—Wetlands that are associated with this type have bottoms that are less than 75% covered by bedrock, but wherein stones and boulders (either alone or in combination with bedrock) cover 75% or more of the surface (USFWS 2009b).

The remainder is unconsolidated bottom substrates (as described in the “Palustrine Wetlands” section), or a cobble/gravel substrate:

- **Cobble/Gravel**—In wetlands with a cobble/gravel substrate, there are particles that are unconsolidated, are smaller than stones, and are predominantly cobble or gravel, although finer sediments may be present (USFWS 2009b).

As part of the recent American Recovery and Reinvestment Act-funded well-capping project undertaken at Big South Fork NRRRA, an assessment of wetland functions and values was conducted to facilitate evaluation of the recent well-capping project’s potential impacts on wetlands and to determine appropriate actions as required by the USACE for Section 404 permits and by the NPS for compliance with Director’s Order #77-1. As a result, a wetland delineation was conducted for Beatty Well A, Beatty Well B, and well site 151-02 to document any wetlands occurring within the project area and to assess wetland functions and values. A detailed description of wetland characteristics for these well sites can be found in the Wetlands section of the Environmental Assessment for Well Plugging and Reclamation; Big South Fork National River and Recreation Area (NPS 2010a).

OBED WILD AND SCENIC RIVER

Table 20 summarizes the wetland types in Obed WSR and their acreage. These types are described in more detail in the following sections.

TABLE 20. WETLANDS OF THE OBED WILD AND SCENIC RIVER

USFWS Mapping Code	Description	Total Acreage
PFO1A	Palustrine, Forested, Broad-leaved Deciduous, Temporarily Flooded	5.53
PSS1A	Palustrine, Scrub-Shrub, Broad-leaved Deciduous, Temporarily Flooded	1.72
PUBHh	Palustrine, Unconsolidated Bottom, Permanently Flooded, Diked/Impounded	2.35
R3RB2H	Riverine, Upper Perennial, Rock, Rubble, Permanently Flooded	855.16
R3RSC	Riverine, Upper Perennial, Rocky Shore, Seasonally Flooded	2.27
TOTAL		867.03

Source: USFWS 2009b.

Palustrine Wetlands

In the Obed WSR, palustrine wetlands of various types make up approximately 1.11% of the total areal wetlands. These wetland types are described above in the “Big South Fork National River and Recreation Area” portion of the “Wetlands” section.

Riverine Upper Perennial

Riverine upper perennial wetlands constitute the dominant wetland type within the Obed WSR, where they account for approximately 98.9% of the areal wetlands. Approximately 99.7% of these are rock, rubble, permanently flooded wetlands. The remaining 0.27% of these wetlands are rocky shore, seasonally flooded:

- **Rocky Shore**—Rocky shore wetlands are high-energy shorelines “characterized by bedrock, stones, or boulders which singly or in combination have an areal cover 75% or more and an areal coverage by vegetation of less than 30%” (USFWS 2009b).

VEGETATION

BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

Vegetation at Big South Fork NRRA was classified and mapped in October 2006 (NatureServe 2007). Based on the draft data, approximately 35 vegetation types were classified using the National Vegetation Classification System (NVCS); eight land use / land cover types were also identified. For the purposes of this plan/EIS, the vegetation types were grouped into eight broad mapping units, including pine forest, hemlock–white pine forest, lowland/submontane cold deciduous forest, mixed pine–oak forest, temporarily flooded forest, successional forest, shrubland, and herbaceous vegetation. The vegetation types that make up each of these map units are described in the following sections, and distribution is shown in figures 19, 20, and 21. The land use / land cover types have also been grouped for this plan/EIS

into three mapping units, including fields/early succession, developed/disturbed areas, and water. Although not described in detail below, these types are graphically depicted in figures 19, 20, and 21.

Timber harvesting, agriculture, coal mining, oil and gas extraction, fire, grazing, exotic forest diseases, recreational activities, and invasive nonnative plants have all shaped or continue to shape the plant communities within Big South Fork NRRRA (NPS 2006f). Because of logging in the early to mid-20th century, most of the forest areas are second or third growth, and mature forests are rare. Due to inaccessibility, several small areas containing impressive examples of second growth floodplain, mixed-mesic, and hemlock forests still exist, mostly in the more northern coves of the park unit. Also of note is the widespread damage caused between 2000 and 2002 by pine beetles. Dead standing and fallen trees remain virtually everywhere in Big South Fork NRRRA where shortleaf pine (*Pinus echinata*) and Virginia pine (*Pinus virginianus*) stands existed prior to the infestation (NPS 2005a).

Pine Forest

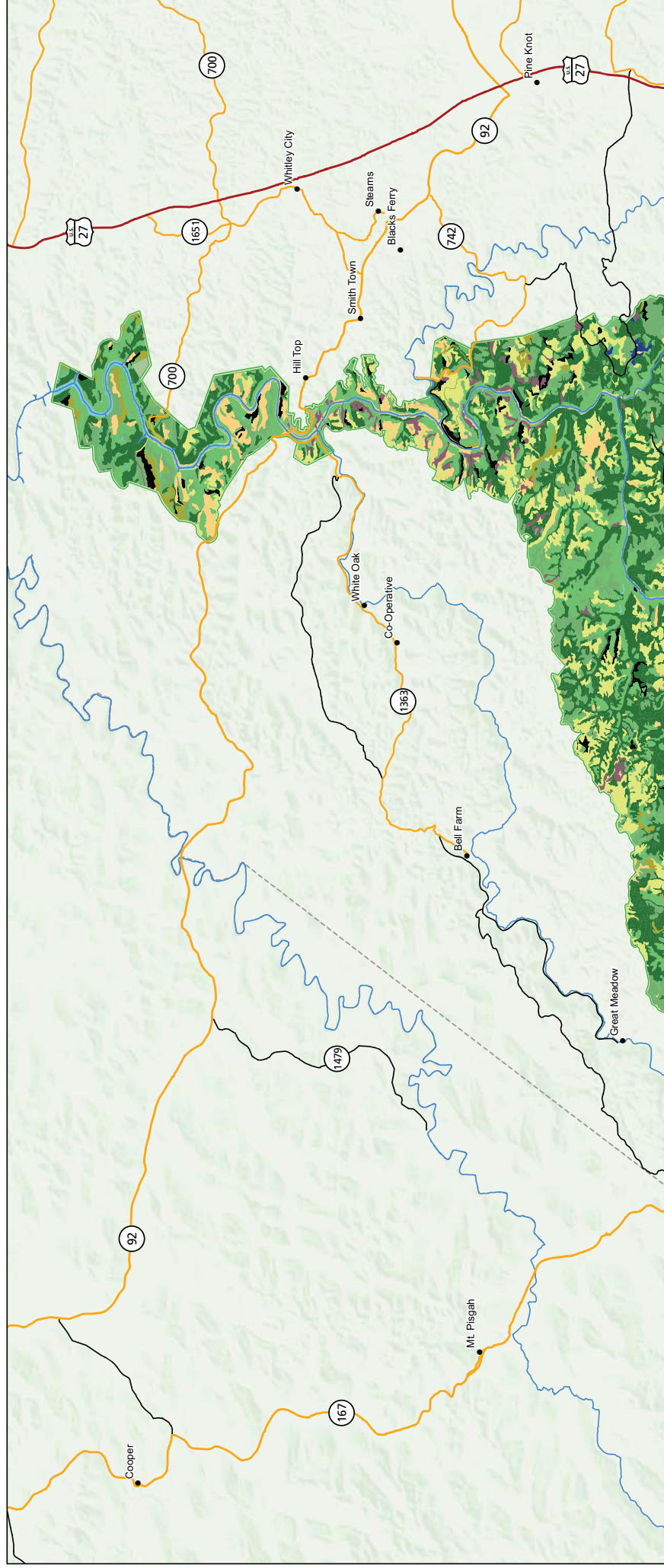
This mapping unit is the most extensive vegetation category present within Big South Fork NRRRA and includes two NVCS types: Appalachian Low-elevation Mixed Pine / Hillside Blueberry Forest and Southern Appalachian White Pine Forest. The canopy of the Appalachian Low-elevation Mixed Pine / Hillside Blueberry Forest, which can be open or closed, may contain several pine species (*Pinus* spp.) but is dominated by Virginia pine. Generally, this type is found on narrow ridges and knobs, steep upper slopes, bluff and cliff tops, and other exposed sites (NatureServe 2007). The Southern Appalachian White Pine Forest is dominated by eastern white pine (*Pinus strobus*) and contains other minor canopy species such as pitch pine (*Pinus rigida*), scarlet oak (*Quercus coccinea*), and red maple (*Acer rubrum*). It generally occurs at elevations below approximately 2,900 feet, on upper slopes and ridgetops protected by higher landforms (NatureServe 2007).

Hemlock–White Pine Forest

Two NVCS types make up the hemlock–white pine forest map unit, including the Cumberland / Appalachian Hemlock–Hardwood Cove Forest; and Southern Appalachian Hemlock Forest (White Pine Type). The Cumberland/Appalachian Hemlock–Hardwood Cove Forest typically occurs in coves, valleys, bases of cliffs, and lower slopes. It is dominated by eastern hemlock (*Tsuga canadensis*) and may include mesic deciduous species, such as American beech (*Fagus grandifolia*), American basswood (*Tilia americana* var. *heterophylla*), tuliptree (*Liriodendron tulipifera*), birch (*Betula* spp.), northern red oak (*Quercus rubra*), white ash (*Fraxinus americana*), shagbark hickory (*Carya ovata*), and cucumber-tree (*Magnolia acuminata*) (NatureServe 2007). The Southern Appalachian Hemlock Forest (White Pine Type) is an evergreen forest association typically found on creek and river margins and on lower or protected slopes. The tree canopy is dominated by eastern white pine, which is sometimes codominant with eastern hemlock (NatureServe 2007).

Big South Fork National River and Recreation Area
Kentucky and Tennessee

National Park Service
U.S. Department of the Interior



Legend

- U.S. Highway
- State Highway
- Roads
- Park Unit Boundary
- Rivers / Streams
- County Boundary

Vegetation

- Agriculture
- Developed or Disturbed
- Hemlock - White Pine Forest
- Herbaceous
- Lowland or Submontane Cold Deciduous Forest
- Mixed Pine - Oak Forest

- Pine Forest
- River
- Shrubland
- Successional Forest
- Temporarily Flooded Forest
- Water



0 2 4 Mi.

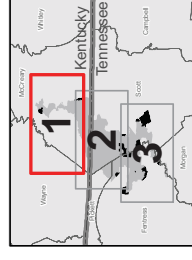
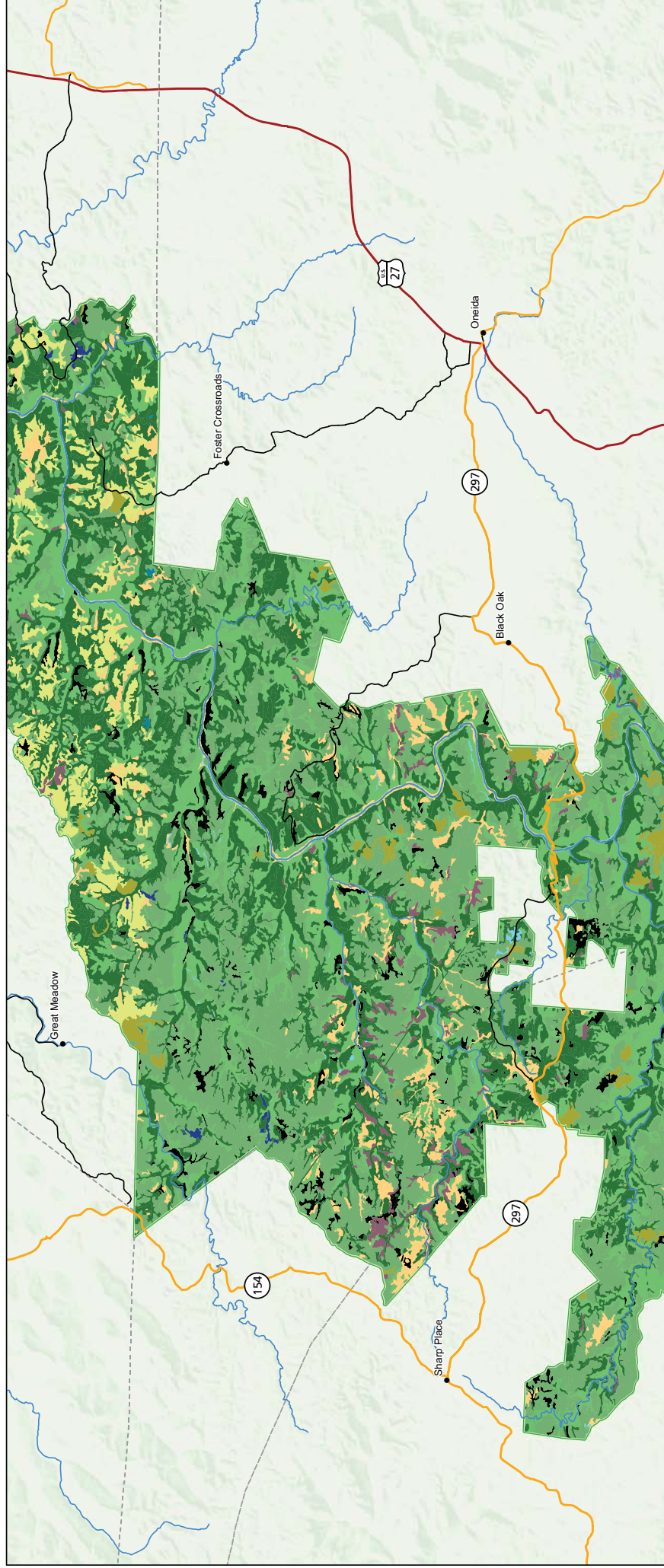
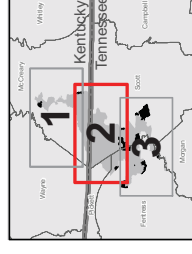
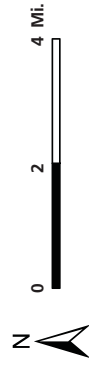
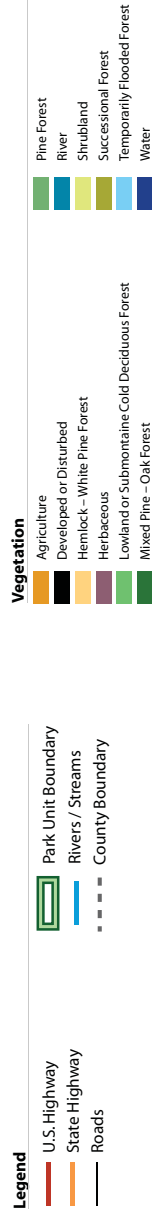


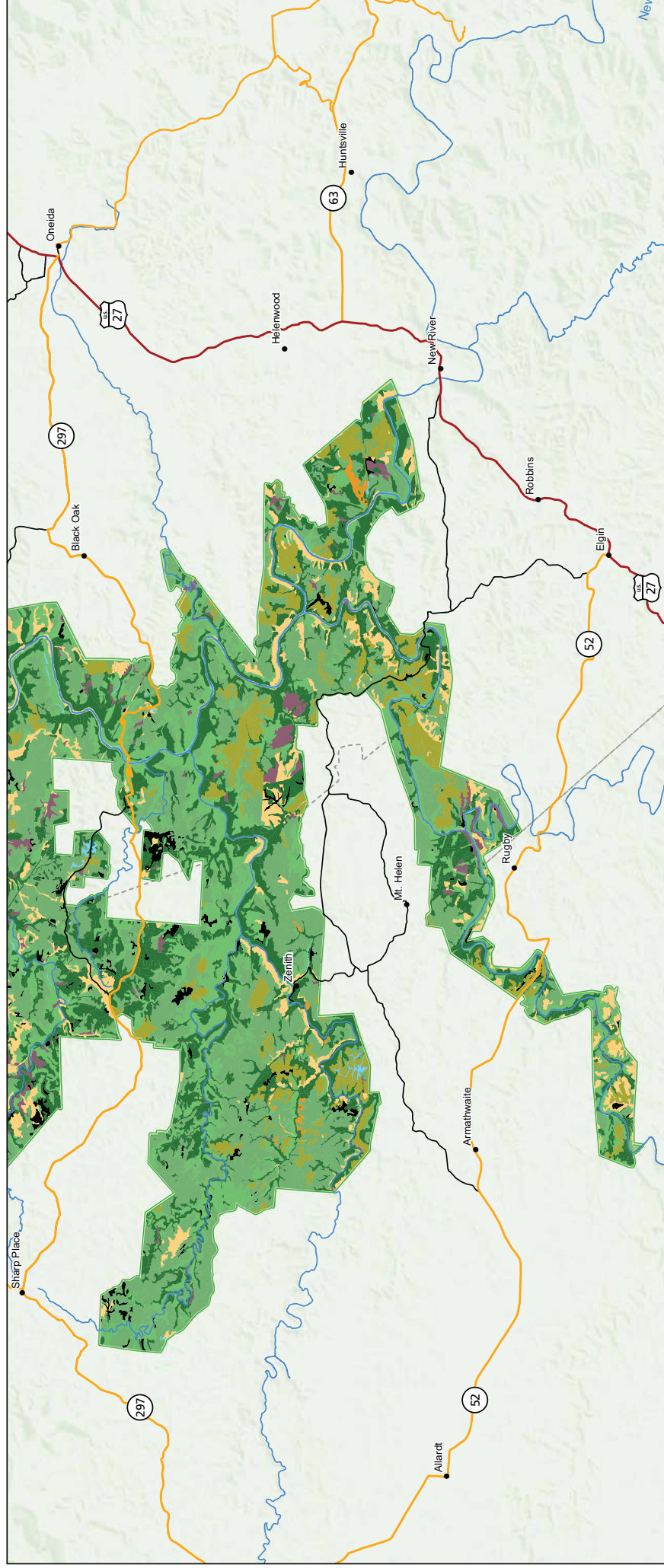
Figure 19. Vegetation of Big South Fork National River and Recreation Area (Map 1)



Legend

Figure 20. Vegetation of Big South Fork National River and Recreation Area (Map 2)





Legend

- U.S. Highway
- State Highway
- Roads
- Park Unit Boundary
- Rivers / Streams
- County Boundary

Vegetation

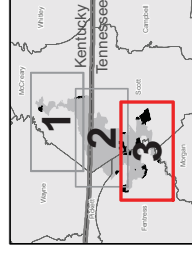
- Agriculture
- Developed or Disturbed
- Hemlock - White Pine Forest
- Herbaceous
- Lowland or Submontane Cold Deciduous Forest
- Mixed Pine - Oak Forest

- Pine Forest
- River
- Shrubland
- Successional Forest
- Temporarily Flooded Forest
- Water

Figure 21. Vegetation of Big South Fork National River and Recreation Area (Map 3)



0 2 4 Mi.



Lowland or Submontane Cold Deciduous Forest

This mapping unit is made up of 10 NVCS types. Descriptions of each of these forests follow:

- **Piedmont Rich Cove / Mesic Slope Forest (Twinleaf–Canada Waterleaf Type)**—This forest association is generally found on mesic lower slopes. The moderate to very dense (40%–90% cover) tree canopy contains a mixture of sugar maple (*Acer saccharum*), American beech, tuliptree, and American basswood (NatureServe 2007).
- **Beech–Maple Unglaciaded Forest**—This dense hardwood forest is typically dominated by American beech and sugar maple. It generally occurs on unglaciaded terraces and mesic slopes of maturely dissected plateaus and submontane regions (NatureServe 2007).
- **Central Interior Beech–White Oak Forest**—This common forest type consists of a moderate to very dense (50%–90% cover) tree canopy dominated by American beech and white oak (*Quercus alba*). It is generally found on mesic mid- to lower slopes in moderately dissected terrain (NatureServe 2007).
- **Southern Ridge and Valley Small Stream Hardwood Forest**—This hardwood forest is generally known to occur along small streams and on small stream terraces. The canopy is generally closed, and at Big South Fork NRR is dominated by white oak, chestnut oak (*Quercus prinus*), black oak (*Quercus velutina*), and tuliptree (NatureServe 2007).
- **Cumberland Plateau Dry–Mesic White Oak Forest**—This common oak forest generally occurs on all slope positions, but is mostly found on middle to high slopes and ridges. The canopy is always dominated by white oak, with chestnut oak usually codominating or occurring as a prominent canopy tree (NatureServe 2007).
- **Mixed Oak / Heath Forest (Piedmont / Central Appalachian Low-elevation Type)**—This mixed oak association generally occurs between 100–2,300-foot elevation on rolling to sublevel sites of uplands, mountain valleys, and lower mountain slope benches. At Big South Fork NRR, it contains moderate to moderately dense (50%–70% cover) and variable tree canopy dominated by combinations of white oak, scarlet oak, chestnut oak, black oak, and red maple (NatureServe 2007).
- **Xeric Ridge Top Chestnut Oak Forest**—This dry oak forest is common in the park and is generally found on north- and west-facing high slopes and ridgetops over soils derived from sandstone. This is a closed-canopy forest dominated by chestnut oak and scarlet oak (NatureServe 2007).
- **Ridge and Valley Dry–Mesic White Oak–Hickory Forest**—This dry–mesic late-successional Appalachian forest occurs on slopes with southerly or westerly aspects and well-drained upland soils. At Big South Fork NRR, the moderate to very dense (60%–90% cover) tree canopy was dominated by white oak, black oak, chestnut oak, and mockernut hickory (*Carya alba*) (NatureServe 2007).
- **Ridge and Valley Limestone Oak–Hickory Forest**—Generally, the few examples of this community exist on south- to east-facing steep slopes underlain by limestone with fairly shallow soils. The sparse to moderate (20%–60% cover) tree canopy at Big South Fork NRR included white oak, chinquapin oak (*Quercus muehlenbergii*), and eastern red cedar (NatureServe 2007).
- **Rich Appalachian Red Oak / Sugar Maple Forest**—This mixed hardwood forest is generally found at 900–2,000-foot elevations. At Big South Fork NRR, the canopy was dense (80% cover) and dominated by northern red oak, sugar maple, and tuliptree (NatureServe 2007).

Mixed Pine–Oak Forest

Three forest associations occur within this mapping unit: Southern Blue Ridge Escarpment Shortleaf Pine–Oak Forest, Appalachian White Pine / Mesic Oak Forest, and Appalachian Shortleaf Pine–Mesic Oak Forest. Southern Blue Ridge Escarpment Shortleaf Pine–Oak Forest generally occurs on crests of low-elevation slopes and ridges. Canopies are codominated by shortleaf pine (*Pinus echinata*) and combinations of dry-site oaks that may include southern red oak (*Quercus falcata*), scarlet oak, chestnut oak, post oak (*Quercus stellata*), and black oak (NatureServe 2007). Appalachian White Pine / Mesic Oak Forest is a mixed pine–oak forest typically found below 2,900-foot elevation, on protected ridges, mid- to upper slopes, and in disturbed bottoms. Canopies are dominated by variable mixtures of eastern white pine, white oak, mockernut hickory, and red maple (NatureServe 2007). Appalachian Shortleaf Pine–Mesic Oak Forest is generally found on low to mid-slope positions, on protected to intermediately exposed sites. The canopy is typically dominated by shortleaf pine and white oak, sometimes with substantial contributions from other oaks (NatureServe 2007).

Temporarily Flooded Forest

The forest associations that occur within Temporarily Flooded Forest mapping unit are: Sycamore–Sweetgum Swamp Forest, River Birch Levee Forest, and Montane Alluvial Forest (Small River Type). Sycamore–Sweetgum Swamp Forest is generally found on small to medium-sized streams and on larger streams where flooding is frequent. This forest is typically dominated by sycamore (*Platanus occidentalis*), sweetgum (*Liquidambar styraciflua*), and sometimes red maple (NatureServe 2007). River Birch Levee Forest is typically found on levees along small rivers and streams. It is generally dominated by river birch (*Betula nigra*) but sycamore may be codominant, or at least prominent (NatureServe 2007). Montane Alluvial Forest (Small River Type) is a dense forested alluvial wetland found on temporarily flooded alluvial flats and ravines. It is dominated by eastern hemlock and and/or eastern white pine (NatureServe 2007).

Successional Forest

There are eight forest associations that were mapped as Successional Forest. Descriptions of each of these forest associations follow:

- **Red Cedar Successional Forest**—Stands of this forest association occur in a variety of disturbed areas such as eroded soils on abandoned agricultural land. It is dominated by eastern red cedar (*Juniperus virginiana* var. *virginiana*), and may include a host of other woody species including hickory (*Carya* spp.), eastern redbud (*Cercis canadensis*), and Virginia pine (NatureServe 2007).
- **Walnut Successional Forest**—This forest often occurs on former homesites along streams and is dominated by black walnut (*Juglans nigra*). Tuliptree, butternut (*Juglans cinerea*), sugarberry (*Celtis laevigata*), and yellow buckeye (*Aesculus flava*) may also be dominant or codominant in some examples (NatureServe 2007).
- **Sweetgum Successional Forest**—This early-successional upland forest dominated by sweetgum results from succession following human activities such as logging and clearing.
- **Successional Tuliptree Forest**—This seminatural or successional forest is typically found on disturbed mesic areas (e.g., abandoned farmland and townsites, old strip mines, old clear-cuts, burned areas, and other areas where the canopy was removed or heavily disturbed in the past). Stands are dominated by tuliptree but also include various other species, such as sweetgum, sugar maple, black locust (*Robinia pseudoacacia*), black walnut, white ash, slippery elm (*Ulmus*

rubra), shingle oak (*Quercus imbricaria*), chinquapin oak, and shagbark hickory (NatureServe 2007).

- **Interior Mid- to Late-successional Tuliptree–Hardwood Upland Forest**—This forest has been documented primarily in areas that were clear-cuts, old fields, or cleared by fire or other natural disturbances. It is also found along mesic stream terraces and is dominated by tuliptree. This forest may also include other species such as red maple, oaks, flowering dogwood (*Cornus florida*), and hickory (NatureServe 2007).
- **Successional Sweetgum Floodplain Forest**—This is a successional forest community that is found in old fields, old pastures, clearcuts, and burned or eroded areas along floodplains of major creeks and other temporarily flooded areas. The tree canopy is generally dominated by sweetgum, and sometimes tuliptree, with lesser amounts of red maple (NatureServe 2007).
- **Virginia Pine Successional Forest**—This community occurs in areas where canopy removal has created open conditions and bare mineral soil. This forest typically has a very dense canopy of Virginia pine, and may also include loblolly pine (*Pinus taeda*), shortleaf pine, as well as successional deciduous trees (e.g., red maple, sweetgum, tuliptree) (NatureServe 2007).
- **Eastern White Pine Successional Forest**—This wide-ranging successional forest is commonly associated with human-caused disturbances such as agricultural lands and old fields that are no longer intensively mowed, plowed, or managed. The tree canopy ranges from woodland to forest closure, with 25%–85% cover. It is often dominated by monotypic and even-aged eastern white pine. Occasional associates include red maple, eastern red cedar, or scattered oaks (NatureServe 2007).

Shrubland

The NVCS associations that occur within the shrubland map unit at Big South Fork NRR include Blackberry–Greenbrier Successional Shrubland Thicket, Cumberland Sandstone Glade Heath Shrubland, and Southeastern Smooth Alder Swamp.

Blackberry–Greenbrier Successional Shrubland Thicket is a successional blackberry (*Rubus* spp.) community found in areas that have been cleared but not recently disturbed. Stands of this association are dominated by greenbrier species (*Smilax* spp.), blackberries, and dewberries (also *Rubus* spp.). A variety of tree saplings and other woody species (e.g., oaks, sweetgum, red maple, and winged sumac (*Rhus copallinum*)) also occur (NatureServe 2007). Cumberland Sandstone Glade Heath Shrubland is found on sandstone bedrock exposures. The tallest shrub is farkleberry (*Vaccinium arboreum*), which is seldom over 6 feet in height. Scrubby trees (less than 10 feet in height) may also be present, and usually include scarlet oak and southern red oak, as well as pitch pine and Virginia pine. Southeastern Smooth Alder Swamp is found on muck overlying mineral soils, at the edges of forested swamps, or in other related seasonally flooded situations (e.g., depressions in floodplains, backwaters of lakes, and beaver ponds). The vegetation is dominated by tall shrubs, and is characterized by some combination of brookside alder (*Alnus serrulata*), *Viburnum* spp., dogwoods (*Cornus* spp.), and willows (*Salix* spp.). In addition, saplings of red maple are typical (NatureServe 2007).

Herbaceous Vegetation

Four associations occur within the herbaceous vegetation mapping unit. They are Little Bluestem–Broomsedge Grassland, Successional Broomsedge Vegetation, Cultivated Meadow, and Cumberland Riverside Scour Prairie. Little Bluestem–Broomsedge Grassland is an essentially native perennial grassland which is (or has been) human-maintained to some extent. It contains a variable mix of grasses, dominated by little bluestem (*Schizachyrium scoparium*) and a variety of other broomsedges (*Andropogon* spp.). This association may occur on annually mowed power line rights-of-way, mowed successional or abandoned agricultural fields, and pastures (NatureServe 2007). Successional Broomsedge Vegetation is a human-modified, but predominantly native, grassland found on old fields and pastures. The dominant species is common broomsedge (*Andropogon virginicus* var. *virginicus*), with lesser amounts of tall purple-top fluffgrass (*Tridens flavus*), bristly foxtail (*Setaria parviflora*), purple lovegrass (*Eragrostis spectabilis*), and beaked panicgrass (*Panicum anceps*) (NatureServe 2007). Cultivated Meadow includes grassland pastures and hayfields, more or less cultural, though sometimes no longer actively maintained. The dominant species in this association are the European “tall or meadow fescues” (NatureServe 2007). These communities are sometimes nearly monospecific but can also be very diverse and contain many native species of grasses, sedges, and forbs. Cumberland Riverside Scour Prairie is generally found on both gravel and bedrock substrates that are scoured by spring floods. A typical cobble bar site, described from the Clear Fork River and the New River of the Big South Fork NRR, is dominated by big bluestem (*Andropogon gerardii*), yellow Indiangrass (*Sorghastrum nutans*), and little bluestem (NatureServe 2007).



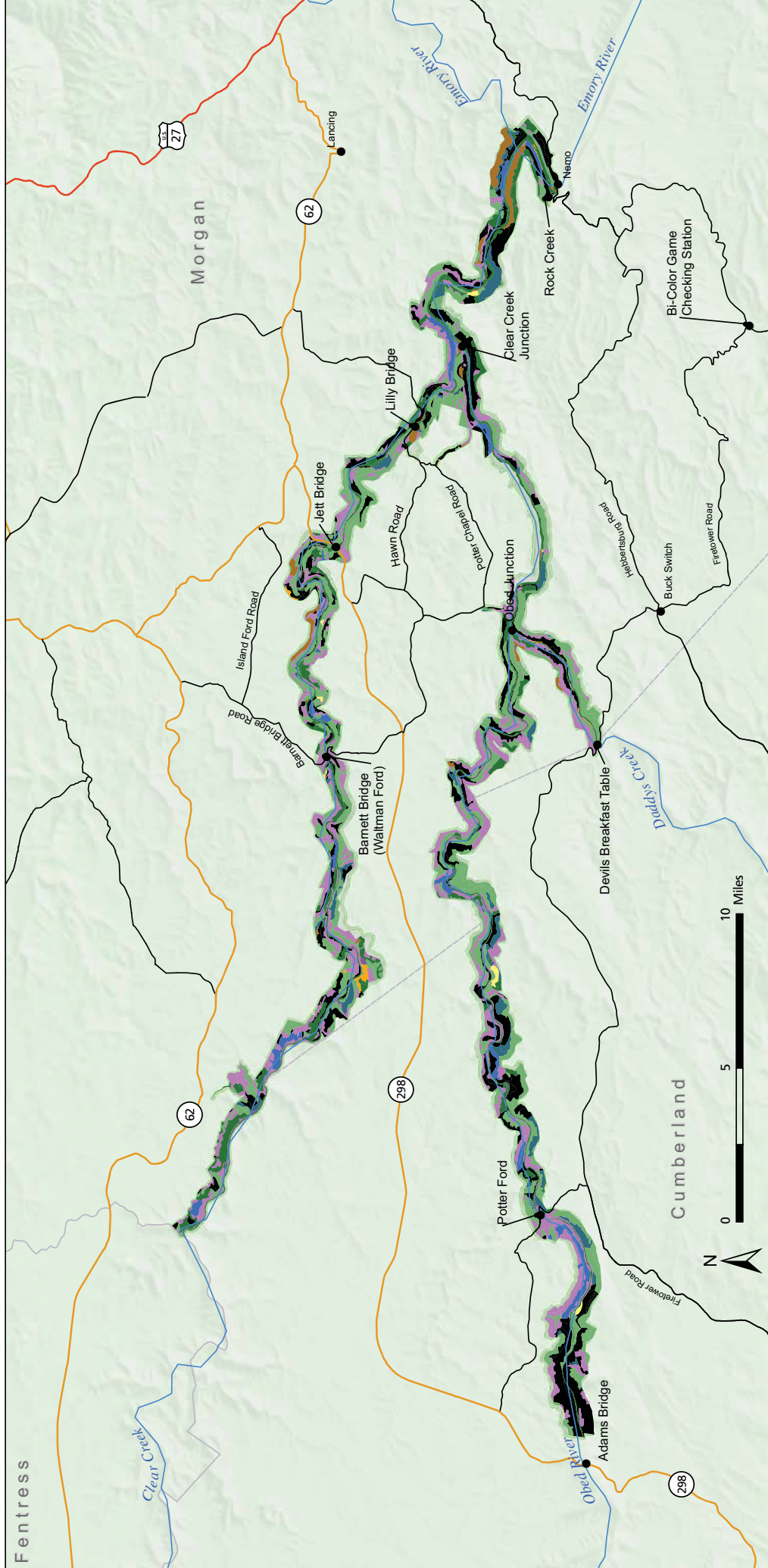
Little bluestem
(*Schizachyrium scoparium*).

Non-native Species

At Big South Fork NRR, forests along rivers and streams are most susceptible to invasion by nonnative plants, the most invasive of which include Japanese spiraea (*Spiraea japonica*), mimosa (*Albizia julibrissin*), tree-of-heaven (*Ailanthus altissima*), multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), Japanese knotweed (*Polygonum cuspidatum*) and Nepalese browntop (*Microstegium vimineum*). Efforts are currently underway to remove these exotic plants in a manner that does not damage the sensitive, native floodplain plant community (NPS 2006f). In addition, many of the remaining fields at Big South Fork NRR are often infested with non-native plants, such as tall fescue (*Lolium arundinaceum*), sericea lespedeza (*Lespedeza cuneata*), multiflora rose, and autumn olive (*Elaeagnus umbellata*). Efforts are currently underway to manage these fields in a way that eliminates exotic species and encourages native grasses, forbs, and shrubs for the benefit of wildlife (NPS 2006f).

OBED WILD SCENIC RIVER

Classification and mapping of vegetation was also recently completed at the Obed WSR by NatureServe and the University of Georgia Center for Remote Sensing and Mapping Science. Based on the draft data, 30 NVCS vegetation associations and nine land use / land cover types were identified in the park (Nordman 2008). For the purposes of this plan/EIS, these vegetation types were grouped into seven broad mapping units, including upland evergreen forest, temporarily flooded evergreen forest, upland deciduous forest, temporarily flooded deciduous forest, upland mixed evergreen/deciduous forest, upland deciduous shrubland, and herbaceous vegetation. The vegetation communities that make up each of these map units are described in the following sections, and distribution is shown in figure 22. The land use / land cover types have also been grouped for this plan/EIS into three mapping units, including agriculture, developed/disturbed areas, and water. Although not described in detail below, these types are graphically depicted in figure 22.



Legend

Vegetation

- U.S. Highway
- State Highway
- Roads
- Park Unit Boundary
- Gorge
- Rivers / Streams
- County Boundary

Vegetation

- Agriculture
- Developed or Disturbed
- Herbaceous
- Temperate Flooded Deciduous
- Temperate Flooded Evergreen
- Upland Deciduous Forest
- Upland Deciduous Shrubland
- Upland Evergreen Forest
- Upland Mixed Evergreen/Deciduous
- Water

Figure 22. Vegetation of Obed Wild and Scenic River Area

For Illustrative Purposes Only

Due to its rugged terrain, the vegetation of the Obed WSR has not been altered as much by humans as the vegetation at Big South Fork NRR. However, the southern pine beetle infestation described previously did affect vegetation at Obed WSR (Nordman 2008).

Upland Evergreen Forest

This mapping unit consists of five NVCS types, including four that were described previously for Big South Fork NRR: Southern Appalachian Eastern Hemlock Forest (White Pine Type), Eastern White Pine Successional Forest, Appalachian Low-elevation Mixed Pine / Hillside Blueberry Forest, Virginia Pine Successional Forest. The fifth association in this mapping unit, the Southern Appalachian Eastern Hemlock Forest (Typic Type), is dominated by eastern hemlock and found on lower or protected slopes, as well as terraces (Nordman 2008).

Temporarily Flooded Evergreen Forest

This mapping unit consists of one NVCS type, the Montane Alluvial Forest (Small River Type), which was described previously for Big South Fork NRR.

Upland Deciduous Forest

Six NVCS types make up this mapping unit, including five that were described previously for Big South Fork NRR: Beech–Maple Unglaciaded Forest, Interior Mid- to Late-successional Tuliptree–Hardwood Upland Forest, Successional Tuliptree Forest, Cumberland Plateau Dry–Mesic White Oak Forest, and Xeric Ridge Top Chestnut Oak Forest. The sixth type, Interior Low Plateau Chestnut Oak–Mixed Oak Forest, is typically found on dry/xeric upper slopes, mid-slopes, and narrow ridgetops. These forests have canopies that are strongly dominated by chestnut oak, with several other oak species (scarlet, black, northern red, white), blackgum (*Nyssa sylvatica*), red maple, and mockernut hickory also present (Nordman 2008).

Temporarily Flooded Deciduous Forest

This mapping unit is made up of one NVCS type, the River Birch Levee Forest, which was described previously for Big South Fork NRR.

Upland Mixed Evergreen/Deciduous Forest

Five NVCS types make up this mapping unit, including the Virginia Pine Successional Forest, Appalachian White Pine / Mesic Oak Forest, and Cumberland/Appalachian Hemlock–Hardwood Cove Forest described for Big South Fork NRR. It also includes the Southern Appalachian Cove Forest, which is generally found in mesic habitats on gentle to steep, lower slopes along creeks in ravines; in coves or gorges; and in depressions on protected slopes with cool aspects and acidic soils. This association encompasses hemlock–hardwood forests and acidic cove forests with eastern hemlock, tuliptree, sweet birch (*Betula lenta*), northern red oak, and red maple (Nordman 2008). The other association is the Appalachian White Pine–Xeric Oak Forest, which typically occurs on exposed upper slopes and ridgetops at elevations below 3,000 feet. This association represents mixed forests with eastern white pine, chestnut oak, and scarlet oak occurring singly or in combination (Nordman 2008).

Upland Deciduous Shrubland

This mapping unit is comprised of three shrubland types, two of which (the Blackberry–Greenbrier Successional Shrubland Thicket and the Cumberland Sandstone Glade Heath Shrubland) were described

for Big South Fork NRR. The third type, the Rocky Bar and Shore (Alder–Yellowroot Type), is found on rocky or gravelly substrates along narrow river margins. Smooth alder (*Alnus serrulata*) and yellowroot (*Xanthorhiza simplicissima*) are common and characteristic but not always dominant, and occur with a variety of other shrubs (Nordman 2008).

Herbaceous Vegetation

This map unit consists of three NVCS types, one of which, the Cumberland Riverside Scour Prairie, was described for Big South Fork NRR. It also includes the Cumberland Plateau Cliff-top Sandstone Barren association, which is generally found on xeric cliff-tops, exposed slopes, and other rocky areas with patches of vegetation in thin soils. The herbaceous layer is dominated by little bluestem, cypress panicgrass (*Dichanthelium dichotomum*), orangegrass (*Hypericum gentianoides*), and Curtiss' milkwort (*Polygala curtissii*). Scattered trees and shrubs, such as Virginia pine, farkleberry, and white fringetree (*Chionanthus virginicus*), may occur on the margins of the community and in patches of deeper soil (Nordman 2008). The other NVCS type in this mapping unit is the Water-willow Rocky Bar and Shore, which is found on the shoals or bars of rocky streams and riverbeds, where they are subject to frequent high-energy floods. American water-willow (*Justicia americana*) is the dominant, and sometimes the only, species, forming lawn-like stands in shallow reaches of rivers. Lizard's tail (*Saururus cernuus*) is often present and may be codominant (Nordman 2008). This mapping unit also includes other grasslands, fields, meadows, pastures, and areas dominated by forbs that were not described by NatureServe.

Invasive Species

Based on the classification effort by NatureServe (Nordman 2008), at least 9% (69 species) of the plant species in the Obed WSR are not native to the region or continent. Most of these species were plantings or are harmless present day components of the flora that found their way into natural areas from plantings or errant seed mixes. However, some of the 69 exotic species found within the park are considered aggressive invasive species that are severe or significant threats and are actively outcompeting and replacing native species in other parts of the Southeast. The Cumberland Riverside Scour Prairie found at Obed WSR can be prone to invasion by exotic plant species. These species are a threat to the overall ecological health of the park, and may become more troublesome in the future (Nordman 2008).

VEGETATION AND ROLE OF CLIMATE CHANGE

Some parks are already seeing changes to vegetation and wildlife habitat and water resources as a result of climate change, and research predicts that many parks will see changes to these resources in upcoming decades (NPS 2009k). The vegetation has been mapped in both parks as part of the inventory program for the Appalachian Highlands Inventory and Monitoring Network. According to the climate change brief for this network (NPS 2010e), a major issue for Big South Fork NRR and Obed WSR is water supply, and droughts as well as upstream water withdrawal are of concern regarding potential effects on vegetation communities and aquatic fauna. The two parks contain the best remaining examples of a globally imperiled river scour prairie grassland community, the Cumberlandian cobble, which is dependent upon scouring floods for survival. Extended droughts or any significant disruption of groundwater flow could exterminate this community and affect other vegetation. Climate monitoring in APHN parks is centered on maintaining data collection from historic weather stations, and future plans call for additional measurements in long-term monitoring plots.

WILDLIFE AND AQUATIC SPECIES

BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

The terrestrial vegetation types described in the “Vegetation” section of this chapter combine with the terrain and aquatic environments at Big South Fork NRA to provide diverse habitats for fish and wildlife.

Many studies of specific habitat types and wildlife groups, such as inventories of mammals, mussels, fish and aquatic life, bats, and vegetation have been performed at the park unit over the past century, with many in the last decade.

Mammals

A total of 48 mammals have been documented as being “present in the park,” with nine other mammals possibly present at Big South Fork NRA including 10 species of bats (Britzke 2007).

The most common native large mammal found at the park unit is the white-tailed deer (*Odocoileus virginianus*). Although nonnative, a stable or increasing population of feral hogs (*Sus scrofa*) is also found at Big South Fork NRA. Outside the park, pigs are hunted year-round and inside the park they can be taken during any big game season when deer are harvested. They were previously monitored through hunting licenses, but the hunting season has been extended, and big game hunters are encouraged to take as many animals as they can. Population estimates can only be estimated based on hunter harvest, but the park is not presently collecting this data.

Black bear (*Ursus americanus*) and elk (*Cervus elaphus*) were released in Tennessee relatively recently (1996/1997 and early 2000s, respectively), and although the programs are considered a success, these species are less common than other large mammals. Although there is a stable bear population, there are no current population estimates available in Big South Fork NRA. There is currently no population of elk within the park unit. This may be attributed to more suitable habitat found surrounding Big South Fork NRA, including farms.



Black bear (*Ursus americanus*).

Predators, including coyote (*Canis latrans*), red fox (*Vulpes vulpes*), river otter (*Lontra canadensis*), and bobcat (*Lynx rufus*), also occur at Big South Fork NRA. Medium sized mammals found at the park unit include beaver (*Castor canadensis*), woodchuck (*Marmota monax*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), mink (*Mustela vison*), muskrat (*Ondatra zibethicus*), gray squirrel (*Sciurus carolinensis*), and skunk (*Mephitis mephitis*). Small mammals are abundant at Big South Fork NRA and include woodrat (*Neotoma magister*), chipmunk (*Tamias striatus*), deer mouse (*Peromyscus maniculatus*), voles (*Microtus* sp.), moles (*Parascalops breweri*), shrews (*Sorex* and *Blarina* sp.), various rats and mice, and bats (Britzke 2007).

Birds

Breeding bird surveys have been conducted annually at Big South Fork NRA from 1994 to 2006 (Stedman n.d.). Approximately 180 species of birds occur within the Big South Fork, and are dominated

by those found in the forest interior. Edge species also find some habitat to suit their needs, but birds of open country are largely excluded from the park, and the degree of exclusion increases each year as park forests mature and their open areas diminish (Stedman 2006).

Besides having general characteristics determined by habitat, the bird communities of Big South Fork NRA are distinct during the various seasons of the year: observers can detect more birds per hour during the spring and early summer than any of the other seasons. As summer proceeds into fall, birdsong decreases and many breeding species begin to migrate south. The detectability and density of birds in the Big South Fork NRA diminish. During the late winter the detectability and density reach their lowest points; however, by late March, an influx of early migrants swells the numbers and the increase continues until peak numbers are once again recorded in May and June. This is because the park unit provides habitat to a large component of neotropical migrants breeding within or migrating through the area. Almost half of breeding species and most transients found at the park unit belong to this group of New World birds that nest mainly in the temperate or boreal zones of the northern hemisphere during summer, and then spend the winter in the tropics of Central and/or South America. Undeveloped places like Big South Fork NRA provide breeding habitat and migration stopover points for many such species and are therefore of considerable importance to their survival.

Based on survey data, the red-eyed vireo (*Vireo olivaceus*) is the most common species reported annually at Big South Fork NRA. Other common species include American crow (*Corvus brachyrhynchos*), ovenbird (*Seiurus aurocapillus*), indigo bunting (*Passerina cyanea*), and hooded warbler (*Wilsonia citrina*) (Stedman n.d.).

Reptiles and Amphibians

A total of 28 reptiles (16 snakes, 6 turtles, and 6 lizards/skinks) and 28 amphibians (16 salamanders, 8 frogs, 2 toads, 1 mudpuppy, and 1 newt) have been documented as present at Big South Fork NRA (Stephens et al. 2008). Reptiles include the racer snake (*Coluber constrictor*), eastern hog-nosed snake (*Heterodon platirhinos*), rough green snake (*Opheodrys aestivus*), common garter snake (*Thamnophis sirtalis sirtalis*), northern copperhead (*Agkistrodon contortrix mokasen*), timber rattlesnake (*Crotalus horridus*), slender glass lizard (*Ophisaurus attenuatus longicaudus*), fence lizard (*Sceloporus undulates*), five-lined skink (*Eumeces fasciatus*), broadhead skink (*Eumeces laticeps*), common map turtle (*Graptemys geographica*), eastern box turtle (*Terrapene carolina carolina*), and red-eared slider (*Trachemys scripta elegans*). Amphibians at the park unit include spotted salamander (*Ambystoma maculatum*), dusky salamander (*Desmognathus fuscus*), Black Mountain salamander (*Desmognathus welteri*), four-toed salamander (*Hemidactylium scutatum*), northern red salamander (*Pseudotriton ruber ruber*), bullfrog (*Rana catesbeiana*), green frog (*Rana clamitans melanota*), wood frog (*Rana sylvatica*), American toad (*Bufo americanus americanus*), Fowler's toad (*Bufo fowleri*), mudpuppy (*Necturus maculosus*), and red-spotted newt (*Notophthalmus viridescens viridescens*) (Stephens et al. 2008).



Eastern hog-nosed snake (*Heterodon platirhinos*).

Fish

One of the world's richest assemblages of temperate freshwater fish once inhabited the Cumberland River into which the Big South Fork River flows. However, impoundment and coal-mining related impacts have made the Cumberland River one of the nation's most severely altered river systems.

The Big South Fork NRRRA encompasses over 138 miles of fishing streams and is home to 79 species of fish considered present in the park, 15 of which are classified as game fish (Scott 2007; NPS 2006g). All together, the fish population contains a total of twelve different families, including lampreys (*Ichthyomyzon* spp.), darters (*Etheostoma* spp., *Percina* spp.), shiners (*Cyprinella* spp., *Notropis* spp.), minnows (*Pimephales* spp.), suckers (*Catostomus* spp., *Hypentelium* spp., *Moxostoma* spp.), and bass (*Micropterus* spp.) (NPS 2006g; Scott 2007).

Mussels

Mussel species are the most jeopardized and rapidly declining faunal group in the United States: 12 of the nation's 300 species are now extinct, and over 67% are listed as endangered, threatened, or special concern, or are being considered for listing (NPS 2006h). Of the nearly 300 recorded species of freshwater mussels in the United States, approximately 130 are or were known to occur within the political boundaries of Tennessee. The Big South Fork currently has 26 documented species, 10 of which are federally listed as endangered and discussed in the "Federally Listed Threatened and Endangered Species" section of this chapter. In the Southeast, only the Duck, Clinch, and Green rivers contain this level of diversity, and only two other NPS units in the country have greater diversity (NPS 2006h).

Big South Fork NRRRA staff are working with the USFWS, USGS, Tennessee Wildlife Resources Agency, and two mussel hatcheries (Virginia Tech Mussel Facility and Kentucky Center for Mollusk Conservation), to propagate freshwater mussels and reintroduce them into the wild. This is the first such effort in a national park (O'Connell 2004).

Crayfish

The Big South Fork Crayfish is one of nine crayfish species listed endangered by the Tennessee Wildlife Resources Commission. This species inhabits freshwater creeks of moderate gradient. This species is restricted to a single stream system, with approximately 10 occurrences in an occupied area of less than 100 square kilometers. First identified in the Perkins Creek tributary of the Big South Fork of the Cumberland River, this species is now known to be endemic to the Roaring Paunch Creek System in Scott County Tennessee, and McCreary County, Kentucky. Originating just north-east of Oneida Tennessee, Roaring Paunch Creek flows north along the Cumberland Plateau roughly 23 miles into McCreary County Kentucky before it empties into the Big South Fork Cumberland River. The Big South Fork Crayfish is considered extremely vulnerable to extirpation due primarily to a limited distribution. Individuals are found among vegetation in heavily silted pools and among boulders as well as being found in streams with no vegetation or boulders. Threats to habitat quality exist from urbanization and acid mine runoff (NatureServe 2009; Williams, Bivens, and Carter 2002).

OBED WILD AND SCENIC RIVER

The woodlands that surround the river and the river itself provide important habitats for numerous wildlife and aquatic species.

Mammals

A total of 33 mammal species are considered present at Obed WSR (Schapansky, pers. comm., 2008a) including 9 bat species. White-tailed deer are the only large mammals known to occur in this park unit. Predators are also found and include gray fox (*Urocyon cinereoargenteus*) and bobcat. Medium-sized mammals include beaver, raccoon, opossum, mink, muskrat, and gray squirrel. Small mammals are abundant and include woodrat, chipmunk, mole, and shrews (Schapansky, pers. comm., 2008a).

Birds

A certified list of birds by the NPS documents 159 bird species as present at Obed WSR (Schapansky, pers. comm., 2008b). Common birds include the black-throated green warbler (*Dendroica virens*), downy woodpecker (*Picoides pubescens*), green heron (*Butorides virescens*), red-eyed vireo, white-eyed vireo, yellow-throated vireo, blue-headed vireo (Stedman 2006), American crow, and broad-winged hawk (*Buteo platypterus*). It is speculated that the seasonal changes in bird populations at Obed WSR would be similar to those described for Big South Fork NRRRA given that they are relatively close to one another geographically.

Reptiles and Amphibians

A total of 15 reptiles (9 snakes, 1 lizard, 2 skinks, and 3 turtles) and 23 amphibians (7 frogs, 13 salamanders, 2 toads, and 1 newt) are considered present in Obed WSR (Schapansky, pers. comm., 2008b; NPS 2007b). Reptiles include northern black racer (*Coluber constrictor constrictor*), northern ringneck snake (*Diadophis punctatus*), corn snake (*Elaphe guttata guttata*), rough green snake, common carter snake, northern copperhead, timber rattlesnake, common snapping turtle (*Chelydra serpentina serpentina*), common map turtle (*Graptemys geographica*), eastern box turtle, eastern fence lizard (*Sceloporus undulatus*), and five-lined skink (Schapansky, pers. comm., 2008b). Amphibians present include northern red salamander, spotted salamander, green salamander (*Aneides aeneus*), eastern hellbender (*Cryptobranchus alleganiensis alleganiensis*), dusky salamander, eastern American toad (*Bufo americanus americanus*), Fowler's toad, Northern spring peeper (*Pseudacris crucifer crucifer*), Cope's gray treefrog (*Hyla chrysoscelis*), bullfrog, green frog, wood frog, and red-spotted newt (NPS 2007b).

Fish

Fish habitat in Obed WSR is somewhat less diverse than that in Big South Fork NRRRA, primarily due to the size of the park. Still, over 45 miles of fishable stream are present in Obed WSR in the Obed River, Clear Creek, and Daddys Creek. A total of 50 species of fish are considered present in the park unit, and 13 of these species are considered game fish. The fish population contains a total of 12 different families, including lampreys, darters, shiners, minnows, suckers, and bass (NPS 2007b).

Mussels

A total of ten mussel species, including 585 individual specimens, were found in 2001 at the access points at the upper Emory River, Daddys Creek, Clear Creek, and White's Creek (Ahlstedt et al. 2001). Species collected on the Obed River included the Tennessee pigtoe (*Fusconaia barnesiana*), Cumberland moccasin shell (*Medionidus conradicus*), spike mussel (*Elliptio dilatata*), wavyrayed lampmussel (*Lampsilis fasciola*), rainbow mussel (*Villosa iris*), plain pocketbook (*Lampsilis cardium*), pink heelsplitter (*Potamilus alatus*), Tennessee clubshell (*Pleurobema oviforme*), and the federally endangered purple bean mussel (*Villosa perpurpurea*). The diversity of mussels appears to be lower in Obed WSR when compared to Big South Fork NRRRA. This may be due to the boulder and bedrock substrate and

higher gradient of the Obed River and its tributaries, which limit the availability of optimal mussel habitat.

Crayfish

There are over 70 species of crayfish in Tennessee (TDEC 2009). Within the Obed WSR, 16 crayfish species are reported (Schapansky, pers. comm., 2008c).

FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES

Under the *Endangered Species Act* (ESA) of 1973, the NPS has the responsibility to address impacts to federally listed threatened, endangered, and species proposed for listing. The terms “threatened” and “endangered” describe the official federal status of certain species in the park as defined by the ESA. Under the Act, so-called “candidate” species receive no statutory protection under the ESA, but the USFWS encourages cooperative conservation efforts for these species because they are, by definition, species that may warrant future protection under the ESA. The term “candidate” is used officially by the USFWS when describing those species for which it has on file sufficient information on biological vulnerability and threats to support issuance of a “proposed rule to list,” but for which issuance of the proposed rule is precluded due to other higher priority listings. The term “proposed” describes species for which a “proposed rule to list” has been published in the *Federal Register*; however, a finalized rule has not yet been issued.

The ESA also requires the designation of “critical habitat” for listed species when “prudent and determinable.” Critical habitat includes geographic areas that contain the physical or biological features that are essential to the conservation of the species and may need special management or protection, even if the area is not occupied by the species at the time of listing. Critical habitat designations affect only federal agency actions or federally funded or permitted activities. The ESA requires that such actions avoid “destruction” or “adverse modification” of designated critical habitat (USFWS 2009a).

Section 4.4.2.3 of the NPS *Management Policies 2006* (Management of Threatened or Endangered Plants and Animals), moreover, directs the agency to consider federally listed threatened, endangered, and candidate species proposed for listing, as well as state-listed species, to the extent practical in its decision making.

BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

The Big South Fork watershed is a national focus for major conservation efforts because of its aquatic and terrestrial features. The Big South Fork River is particularly significant in that it harbors over 20 species of mussels. As many as 10 federally listed or candidate mussel species occur in the river. Three fish, two river-dependent plants, and two upland plants are also federally listed. A single specimen of both the Indiana bat (*Myotis sodalis*) and the gray bat (*Myotis grisecans*) have been found during migration periods.

The species are presented in table 21 and described in detail below. Although the NPS has records of other federally listed species at Big South Fork NRRA—including eastern cougar (*Puma concolor cougar*), red-cockaded woodpecker (*Picoides borealis*), cracking pearlymussel (*Hemistena lata*), catspaw mussel (*Epioblasma obliquata obliquata*), clubshell mussel (*Pleurobema clava*), orangefooted pimpleback mussel (*Plethobasus cooperianus*), and American chaffseed mussel (*Schwalbea americana*)—these species are not known to occur there today and are therefore not considered further in this plan/EIS (Blount, pers. comm., 2009a).

TABLE 21. FEDERALLY LISTED SPECIES OF BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

Common Name	Scientific Name	Status	USFWS List	NPS List	Comments
Mussels					
Cumberland elktoe	<i>Alasmodonta atropurpurea</i>	Endangered	X	X	
Cumberlandian combshell	<i>Epioblasma brevidens</i>	Endangered	X	X	
Cumberland bean	<i>Villosa trabalis</i>	Endangered	X	X	
Little-wing pearl mussel	<i>Pegias fabula</i>	Endangered	X	X	
Tan riffleshell	<i>Epioblasma florentina walkeri</i>	Endangered	X	X	
Dromedary pearl mussel	<i>Dromus dromas</i>	Endangered		X	Reintroduced in 2008
Oyster mussel	<i>Epioblasma capsaeformis</i>	Endangered		X	Augmented in 2008
Spectaclecase	<i>Cumberlandia monodonta</i>	Candidate		X	Reintroduced in 2008
Clubshell	<i>Pleurobema clava</i>	Endangered		X	
Fluted kidneyshell	<i>Ptychobranthus subtentum</i>	Candidate		X	Augmented in 2008
Fish					
Duskytail darter	<i>Etheostoma percnurum</i>	Endangered	X	X	Recently re-described as the tuxedo darter (<i>Etheostoma lemniscatum</i>)
Blackside dace	<i>Phoxinus cumberlandensis</i>	Threatened		X	
Palezone shiner	<i>Notropis albizonatus</i>	Endangered		X	Found in 2008
Plants					
Cumberland sandwort	<i>Minuartia cumberlandensis</i>	Endangered	X	X	
Virginia spiraea	<i>Spiraea virginiana</i>	Endangered	X	X	
Cumberland rosemary	<i>Conradina verticillata</i>	Threatened	X	X	
White fringeless orchid	<i>Platanthera integrilabia</i>	Candidate		X	

Source: Widlak, pers. comm., 2009; Blount, pers. comm., 2009a

The river's terrace, floodplain, and boulder-cobble bars host rare plant species including the federally listed Cumberland rosemary and Virginia spiraea. Several of these species are unique to the Cumberland

Plateau. The federally listed Cumberland rosemary is narrowly restricted to the Cumberland River and Tennessee River systems, with a particularly high concentration occurring within Big South Fork.

Federally Listed Mussels

Cumberland bean (*Villosa trabilis*)—This species is a medium-size freshwater mussel or bivalve mollusk with a dingy olive-green shell with numerous faint wavy green lines. It is found in sand, gravel, and cobble substrates in waters with moderate to swift currents and depths less than 3 feet. Mussels are most often observed in clean, fast-flowing water in substrate that contains relatively firm rubble, gravel, and sand swept free from siltation, and are usually buried in shallow riffle and shoal areas (NatureServe 2009).

Freshwater mussels such as the Cumberland bean reproduce when males release sperm into the water column, which are taken in by the females through their siphons during feeding and respiration. The fertilized eggs are retained in the females' gills until the larvae fully develop. The larvae are released into the water where they attach and encyst on the gills or fins of a fish host. When metamorphosis is complete, they drop to the streambed as juvenile mussels (USFWS 1990).

This species was historically known from numerous river systems in the Cumberland region, including the Big South Fork River and Tennessee River basins and is currently reproducing in the Big South Fork River. Although none of the known fish hosts (fantail darter, barcheek darter, striped darter, and Tennessee snubnose darter) are known to occur in the main stem, these fish are known from Big South Fork River tributaries (NPS 2009j). A reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts of silt from poor land management.

Cumberland elktote (*Alasmidonta atropurpurea*)—This species is a freshwater mussel with a somewhat shiny and black shell with greenish rays. Habitat ranges from small creeks to medium-sized rivers. The mussel is most common in smaller stream habitats. Preferred habitat appears to be shallow flats or pools with slow current and sand substrate with scattered cobble/boulder material, although it will occur in mud or rocky substrates and faster currents. Native host fish include whitetail shiner (*Cyprinella galactura*), northern hog sucker (*Hypentelium nigricans*), rock bass (*Ambloplites rupestris*), longear sunfish (*Lepomis megalotis*), and rainbow darter (*Etheostoma caeruleum*) (NatureServe 2009).



Cumberland elktote (*Alasmidonta atropurpurea*).

The Cumberland elktote, endemic to the upper Cumberland River system, continues to survive throughout the Big South Fork River system. This is the only threatened or endangered mussel in the Clear Fork River, New River, North White Oak Creek and the main river. The Cumberland elktote is distributed throughout the Big South Fork NRR in these streams. A reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts from poor land use management (NPS 2009j).

Cumberlandian combshell (*Epioblasma brevidens*)—This species is a freshwater mussel that has a yellow to tawny brown shell with narrow green, broken rays. The habitat ranges from large creeks to large rivers, in substrates ranging from coarse sand to mixtures of gravel, cobble, and boulder-sized particles. Cumberlandian combshell is primarily associated with stream sections exhibiting high-energy flows, high water quality, and rocky substrates. The mussel tends to occur at depths of less than approximately 3 feet, although the relict (and presumably nonreproducing) populations now occur in considerably deeper water (NatureServe 2009). This species spawns in late summer and has been observed to release larvae late the following spring (late May and early June). Based on laboratory studies, larval hosts include greenside darter, spotted darter (*Etheostoma maculatum*), redline darter, wounded darter (*Etheostoma vulneratum*), snubnose darter, logperch (*Percina caprodes*), black sculpin (*Cottus baileyi*), mottled sculpin (*Cottus bairdi*), and banded sculpin (NatureServe 2009).

It was historically distributed throughout much of the Cumberland region of the Tennessee and Cumberland River drainages in Alabama, Kentucky, Mississippi, Tennessee, and Virginia. A reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts of silt from poor land management. Other than the Clinch River, the Big South Fork River has the best surviving population. Known fish hosts that occur in the Big South Fork River include the greenside darter (NPS 2009j).

Little-wing pearlymussel (*Pegias fabula*)—This species is a small freshwater mussel or bivalve mollusk that attains an average adult size less than one inch in length. The outer shell is usually eroded away in mature individuals. A few dark rays are apparent along the base of the shell in young individuals. This species is most common at the head of riffles, but is also found in and below riffles on sand and gravel substrates with scattered cobbles. It also inhabits sand pockets between rocks, cobbles, and boulders, and underneath large rocks. It is restricted to small, cool streams. It is usually found lying on top or partially buried in sand and fine gravel between cobbles in only 6 to 10 inches of water. Larval fish hosts include banded sculpin (*Cottus carolinae*), redline darter, emerald darter (*Etheostoma baileyi*), and greenside darter (NatureServe 2009).

The little-wing pearlymussel was historically known from the Cumberland and Tennessee River systems. Currently, it is known from only four rivers in the Tennessee River system and three rivers in the Cumberland River system. Big South Fork harbors the only known reproducing population. The reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts of silt from poor land use management. The Big South Fork River has the best remaining population of this species. Known fish hosts that occur in the Big South Fork River include greenside darter and emerald darter (NPS 2009j).

Tan riffleshell (*Epioblasma florentina walkeri*)—A medium-sized (approximately 3-inch) freshwater mussel with a brown to yellow colored shell with numerous green rays found in headwaters, riffles, and shoals in sand and gravel substrates. Suitable larval hosts include sculpin (*Cottus* spp.), greenside darter (*Etheostoma blennioides*), fantail darter (*Etheostoma flabellare*), redline darter (*Etheostoma rufilineatum*), and snubnose darter (*Etheostoma simoterum*) (NatureServe 2009).

The tan riffleshell was historically known from the Cumberland and Tennessee River systems. A reduction in range can be attributed to impoundments, channelization, loss



Tan riffleshell (*Epioblasma florentina walkeri*).

of riparian habitat, pollution, and the impacts of silt from poor land management. The species historically occurs in the Big South Fork River and still occurs there. DNA results have documented this species as a valid taxon (NPS 2009j).

Dromedary pearl mussel (*Dromus dromas*)—This mussel is a riffle-dwelling species that occurs at shoals with sand and gravel and moderate current velocities. It is also found in deeper, slower moving water in Tennessee and is most often observed in clean, fast-flowing water in stable, clean substrates that contain relatively firm rubble and gravel. Females have larvae from October through May, which are released from late March to late April (NatureServe 2009).

This species historically occurred in the Cumberland including the Big South Fork and Tennessee River systems (Bogan and Parmalee 1983) and has been re-introduced. Known fish hosts that occur in the Big South Fork include greenside darter and logperch (Comiskey and Etnier 1972; Jones and Neves 2000; NPS 2009j).

Oyster mussel (*Epioblasma capsaeformis*)—This species is associated with riffle areas exhibiting high-energy flows, high water quality, and rocky substrates. It lives in moderate to swift currents in small to large creeks and rivers, with substrates ranging from coarse sand and gravel to boulder-sized particles, rarely mud. Within the Big South Fork river system, this species is not found in mud, but rather under large slab rocks and underwater ledges formed by large rocks. It may be associated with beds of water willow (*Justicia americana*) bordering the main channel of the riffle, and can be found in pockets of gravel between bedrock ledges in areas of swift current. Spawning probably occurs during late summer, and larvae are released during the late spring and early summer of the following year (NatureServe 2009).

The species was historically distributed throughout much of the Cumberland Region of the Tennessee and Cumberland River drainages. A reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts of silt from poor land management.

Oyster mussels historically occurred in the Big South Fork River and have been reintroduced. Gravid females have been observed from the Big South Fork and are probably reproducing. Known fish hosts for the oyster mussel include bluebreast darter and dusky darter, which occur in the Big South Fork River (NPS 2009j).

Spectaclecase (*Cumberlandia monodonta*)—The spectaclecase, reintroduced to Big South Fork NRR, occurs in large rivers in substrates ranging from mud and sand to gravel, cobble, and boulders, in relatively shallow riffles and shoals with slow to swift current. It is usually found in firm mud between large rocks in quiet water very near the interface with swift currents. Specimens have also been reported in tree stumps, root masses, and in beds of rooted vegetation. The species appears to spawn twice a year during relatively short periods in the autumn (October and November) and spring (April and May). Little else is known about spectaclecase reproduction, including—despite extensive laboratory testing—the larval host fish (NatureServe 2009).

The spectaclecase, a candidate for federal protection, is a rare, widespread species in the Tennessee River system, but it is possibly extirpated from the Cumberland River. It was known historically from the Big South Fork and has been reintroduced. Fish hosts are unknown (NPS 2009j).

Fluted kidneyshell (*Ptychobranchus subtentum*)—This species inhabits small to medium rivers in areas with swift current or riffles, although a few populations have been recorded from larger rivers in shoal areas. The fluted kidneyshell requires flowing, well-oxygenated waters, and it is often found embedded in sand, gravel, and cobble substrates. Spawning is thought to occur in late summer or early fall, and larvae

are released the following spring or early summer. Host fishes include barcheek darter, redline darter, fantail darter, and banded sculpin (NatureServe 2009).

The fluted kidneyshell, a candidate for federal protection, is a rare species endemic to the Tennessee and Cumberland River system. It was known historically and recently collected from the Big South Fork River and has been augmented by adding adults to the population. The reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts of silt from poor land use management (NPS 2009j).

Clubshell (*Pleurobema clava*)—This is a small (up to two inches), thick, freshwater mussel with a tan-colored shell with green rays. It is generally found in clean coarse sand and gravel in runs, often just downstream of a riffle, and cannot tolerate mud or slackwater conditions. Virtually nothing is known about its diet or reproductive habits, although laboratory studies identified the striped shiner, blackside darter, central stoneroller, and logperch as potential fish hosts (NatureServe 2009).

The clubshell historically occurred throughout the Ohio River (including the Big South Fork River) and Lake Erie basins, but it now survives in only a few small, isolated populations in both basins. The current distribution represents a range reduction greater than 95 percent. The reduction in range can be attributed to impoundments, channelization, loss of riparian habitat, pollution, and the impacts of silt from poor land use management. Three live specimens tentatively identified as *P. clava* were found in 1999 in the Big South Fork River. Fish hosts are unknown (NPS 2009j).

Federally Listed Fish

Duskytail darter (*Etheostoma percnurum*)—This darter inhabits pools and riffles of large creeks and small to medium rivers that are approximately 30 to 260 feet wide, of moderate gradient, warm, and usually clear. Young and adults typically are in silt-free rocky pools and slow runs, under or near cover, often among considerable detritus, or among cobbles and small boulders (NatureServe 2009). These fishes occur over heterogeneous mixtures of rock sizes from pea gravel to rubble/cobble, slab-rock, and boulders. They rarely occur in heavily silted areas. Spawning occurs from late April through June. Diet of young mainly consists of microcrustaceans, chironomid larvae, and heptageniid nymphs; larger individuals eat chironomid larvae, mayfly nymphs, microcrustaceans, caddisfly larvae, and sometimes fish eggs (NatureServe 2009).



Duskytail darter (*Etheostoma percnurum*).

The Big South Fork population of the duskytail darter is one of three extant populations described in the Recovery Plan for duskytail darter. The three original populations are all geographically isolated and relatively restricted in size, and all except the Big South Fork population are located in the Tennessee River drainage. Because it differs morphologically from the Tennessee River populations, researchers have determined that the Big South Fork population is a distinct species (Shute et al. 1997). Because of the water quality issues influencing the Big South Fork system, the Big South Fork Duskytail survives under threat of being wiped out by a single pollution event, which would eliminate the only known population. Until relatively recently, duskytail darters had been collected at only one site on the Big South

Fork, at the mouth of Station Camp Creek, and the extent of the population there was unknown. Conservation Fisheries, Inc. was contracted to survey streams within the Big South Fork River NRRA and within the Big South Fork watershed for the presence of duskytail darters. Dr. Brooks Burr (Southern Illinois University, Carbondale) was also contracted by the Kentucky Division of Fish & Game to determine if duskytail darters might occur within Kentucky's portion of the Big South Fork system. During the surveys (Shute et al. 1997), the known range of the duskytail darter was extended into Kentucky approximately as far downstream as the confluence with Bear Creek. Duskytailed darters were subsequently collected as far downstream as Blue Heron (NPS 2009j).

Blackside dace (*Phoxinus cumberlandensis*)—The blackside dace is found in about 30 streams in the upper Cumberland River system, primarily above Cumberland Falls, in southeastern Kentucky and northeastern Tennessee. The species inhabits short stream reaches totaling about 14 stream miles in the following counties: Pulaski, Laurel, McCreary, Whitley, Knox, Bell, Harlan, and Letcher, Kentucky; and Scott, Campbell, and Claiborne, Tennessee. No estimate of total population numbers is available. All but three populations are found in stream reaches less than a mile in length, and some are limited to only a few hundred yards. This fish is found in the Big South Fork NRRA in a small tributary near Yamacraw in Kentucky, but not in the main river.

This fish was not recognized as a distinct species until 1975, and relatively few historic fish collection records exist for the Upper Cumberland River Basin. The blackside dace inhabits small (7 to 15 feet wide) upland streams with moderate flows. The species is generally associated with undercut banks and large rocks and is usually found within relatively stable, well-vegetated watersheds with good riparian vegetation. Stable watersheds help maintain cool temperatures and minimize silt to the benefit of the species. O'Bara (1985) also found that the fish's presence was apparently closely correlated with healthy riparian vegetation where canopy cover exceeded 70 percent and with streamflows of the riffles. The fish was found neither in low gradient silty streams nor in high-gradient mountain tributaries. The status of this species is due primarily to the impacts of siltation, and the effects of acid mine drainage. Based on a survey by O'Bara (1985), the most frequently cited threats were related to coal mining, followed in order of threat by logging, road construction, agriculture, human development, and natural low flows. Controlling siltation, particularly in relation to surface mining, would be necessary to assure that the species suffers no further population losses or potential loss of genetic variation (NPS 2009j).

Palezone shiner (*Notropis albizonatus*)—The palezone shiner inhabits clean, clear waters of flowing pools and runs found over bottoms with fractured bedrock, cobble, and gravel mixed with clear sand. The palezone shiner reaches a maximum length of less than 6 cm. Highly restricted in distribution, the palezone shiner is found only in the Tennessee River drainage in Alabama and Tennessee and disjunctly to the north in the Cumberland River drainage in Kentucky. It is uncommon and localized throughout its range. In Kentucky, for example, it occurs only in the Little South Fork of the Cumberland and also in the Rock Creek system in McCreary County, Kentucky.

This rare species, when found, usually occurs in moderately large, high-gradient, clear streams flowing over bedrock, cobble, or gravel mixed with clean sand; it prefers pools and pool runs below riffles. It is thought that spawning occurs from early June through July in Alabama, but Etnier and Starnes (1993) report that tuberculate individuals have been collected in May and June in Tennessee. Warren et al. (1994) indicate spawning from mid-May to early July, peaking in June, with individuals living between three and four years. Little else is known about the biology of this species (NPS 2009j).

Federally Listed Plants

Cumberland sandwort (*Arenaria cumberlandensis*)—Cumberland sandwort is a perennial herbaceous plant that grows in cool, humid, rockshelters formed through differential weathering of sandstone strata.

This species grows on sandy floors of these rockhouses and in similar situations such as beneath sandstone ledges. The few species that share this habitat with Cumberland sandwort include Lucy Braun's white snakeroot (*Eupatorium luciae-brauniae*) and featherbells (*Stenanthium gramineum*). Cumberland sandwort is narrowly endemic to the Cumberland Plateau of northcentral Tennessee and adjacent Kentucky. There are currently more than 30 occurrences known, but most of them concentrated within a small portion of the overall range, in the Big South Fork watershed. Most of the National Area's populations are located in rockshelters or lower ledges of the sandstone cliffline that rims the Big South Fork River gorge. Additional unmapped populations are likely in the Big South Fork NRRA, particularly west of the Big South Fork River in Scott, Fentress, and Pickett County (NPS 2009j).

Cumberland rosemary (*Conradina verticillata*)—Cumberland rosemary is a low (less than 20 inches), aromatic, perennial evergreen shrub, forming clumps or mats of sprawling branches that root at the nodes. Cumberland rosemary is endemic to the upper Cumberland Plateau in north-central Tennessee and adjacent southeastern Kentucky and restricted there to floodplain habitats. Suitable habitats are full to moderate sunlit gravel bars in floodplains of the Big South Fork and its major tributaries. Substrate can vary from dense deep sands to cobble boulders that are well drained. Populations occur on boulder bars, boulder-cobble-sand bars, sand gravel bars, sand terraces adjacent to the river, and islands with gently sloping sand banks. High quality populations are annually scoured by spring flooding to preserve and restore open conditions. Annual floods also act as a disperser through the transport of viable plant fragments downstream. Common associates include green-headed coneflower (*Rudbeckia laciniata*), along with globally rare plants such as large-flowered Barbara's-buttons (*Marshallia grandiflora*) and Virginia spiraea (*Spiraea virginiana*) (NatureServe 2009).



Cumberland rosemary
(*Conradina verticillata*).

As of 1996, 91 occurrences were believed to be extant across the range. Most occurrences are very small and isolated from others. Fewer than 4,000 total individuals were estimated at the known locations. This species' abundance and distribution has probably been reduced by dam construction and by water pollution from nearby coal mining. Habitat destruction due to intensive recreational use also poses a threat (NPS 2009j).

Virginia spirea (*Spiraea virginiana*)—Virginia spiraea is a clonal shrub that grows up to approximately 4 feet high. This species occurs along creek edges with margins of exposed rock and piled detritus, bars of gravel, rubble and/or boulders, and including dolomitic limestone. It occurs in alluvial silt collected within cracks in the bedrock. These sites experience a regime of periodic flooding. Elevations range from 850–1,420 feet (NatureServe 2009).

Virginia spiraea occurs along creek edges with margins of exposed rock and piled detritus, bars of gravel, rubble and/or boulders. It occurs in alluvial silt collected within cracks in the bedrock. These sites experience a regime of periodic flooding. Associated species include *Acer pensylvanicum*, *Alnus*, *Arisaema dracontium*, *Arundinaria gigantea*, *Conradina verticillata*, *Dica palustris*, *Ilex verticillata*, *Juniperus virginiana*, *Liriodendron tulipifera*, *Orontium aquaticum*, *Osmunda regalis*, *O. cinnamomea*, *Phlox smoenae*, *Sailx*, *Senecia aureus*, *Silen virginica*, *Spiraea japonica*, *Toxicodendron radicans*, *Trautvetteria*, *Tsuga*, *Ulmus*, and *Viburnum dentatum*.

Virginia spiraea is intrinsically threatened by its limited range and small number of populations, making it especially vulnerable to land-use conversion and habitat fragmentation. Populations are isolated, consisting of sterile clones, and damming of rivers has increased this isolation. Many sites are threatened by changes in hydrology by impoundment and by impact from recreation use (fishing and boating).

Roadside maintenance, beaver damage, deer browse, all-terrain vehicle users (ATVs), and upslope timbering are noted as potential threats. Exotic species (*Rosa multiflora*, *Elaeagnus umbellata*, *Ailanthus altissima*, *Spiraea japonica*, *Alliaria petiolata*, *Albizia julibrissin*, and *Polygonum cuspidatum*) are also a threat.

White fringeless orchid (*Platanthera integrilabia*)—White fringeless orchid is generally found in wet, flat, boggy areas at the head of streams or seepage slopes. The species is often found in association with *Sphagnum* species and *Osmunda cinnamomea*, *Woodwardia areolata*, and *Thelypteris novaboracensis*, in acidic muck or sand, and in partially shaded, but not fully shaded, areas. Populations of this species are associated with sandstones of the Appalachian Plateaus of Kentucky, Tennessee, and Alabama; the Coastal Plain of Alabama and Mississippi; the Blue Ridge Province of Georgia, North Carolina, and Tennessee; the Ridge and Valley Physiographic Province in Alabama; and the Piedmont of Georgia and South Carolina. White fringeless orchid is currently known from about 50 irregularly scattered occurrences in the southeastern U.S., primarily on the Cumberland Plateau of Tennessee and Kentucky. Many occurrences consist of fewer than 100 plants.



White fringeless orchid
(*Platanthera integrilabia*).

Most surviving populations are not vigorous and exhibit very poor seed set and reproduction (reproduction is nearly exclusively sexual). The habitat where this species grows has often been drained or turned into farm ponds or hog lots or has experienced residential and commercial construction. Active management may be required to inhibit woody succession and prevent canopy closure at sites where the species is found; timber harvest must be carried out carefully to protect the species from damage. Development, canopy closure, improper timber harvest techniques, and invasive exotic plants remain threats (NPS 2009j).

Critical Habitat—Critical habitat rules were finalized in the Federal Register, August 31, 2004, 50 CFR 17. New River, Clear Fork and North White Oak, along with other tributaries and the main stem Big South Fork in the National Area are listed as designated Critical Habitat and should be afforded the protection under the new ruling, as applied by the USFWS. Within Big South Fork NRRRA, critical habitat is designated for three federally listed mussels including the Cumberland elktoe mussel, oyster mussel, and the Cumberland combshell mussel. The primary constituent elements of critical habitat for all mussel species discussed herein consist of:

1. Permanent, flowing stream reaches with a flow regime (i.e., the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of the five mussels and their host fish;
2. Geomorphically stable stream and river channels and banks (structurally stable stream cross section);
3. Stable substrates, consisting of mud, sand, gravel, and/or cobble/boulder, with low amounts of fine sediments or attached filamentous algae;
4. Water quality (including temperature, turbidity, oxygen content, and other characteristics) necessary for the normal, behavior, growth, and survival of all life stages of the mussels and their host fish; and
5. Fish hosts with adequate living, foraging, and spawning areas for them.

All areas designated as critical habitat for the mussels are within the species' historic ranges and contain one or more of the physical or biological features (primary constituent elements) identified as essential for the conservation of these species (NPS 2009j).

OBED WILD AND SCENIC RIVER

The USFWS reports five federally listed species currently within the Obed WSR area: spotfin chub (*Erimonax monachus*), purple bean (*Villosa perpurpurea*), Cumberland bean, Cumberland rosemary, and Virginia spiraea (Widlak, pers. comm., 2009). In addition, the NPS lists the gray bat for Obed WSR (Blount, pers. comm., 2009a).

It is important to note that the Cumberland bean was not documented in a 2001 mussel survey (see "Wildlife and Wildlife Habitat" section for more details), and the NPS considers records of this species at Obed WSR questionable because they can only be separated from purple bean based on the color of the inside of the shell (Ahlstedt et al. 2001). Externally, both species look identical but internally, the Cumberland bean pearlymussel is white and the purple bean is purple. In addition, the Cumberland bean pearlymussel has never been documented in the Emory River drainage. Although Parmalee and Bogan (1998) report these species in the Obed WSR, recent conversations with Dr. Parmalee indicated that only the purple bean exists in the Obed WSR. In addition, although both species are federally listed, there is some question as to whether or not they are both valid species, or if they represent a single species (Ahlstedt et al. 2001).

Regardless, all of these species are considered in detail in this plan-EIS. Please see the Big South Fork NRR "Special Status Species" for detailed descriptions of the Cumberland bean, gray bat, Cumberland rosemary, and Virginia spiraea. The other species found at Obed WSR are described below.

Fish

Spotfin Chub. This small chub's habitat includes cool and warm, typically clear, large creeks or medium-sized rivers of moderate gradient, in upland and mountain areas, generally in or near moderate and swift currents, over gravel to bedrock, and rarely over sand or silt (NatureServe 2009). Eggs are laid in stone cracks, crevices, or in the narrow interface of two touching rocks. Breeding sites can occur in moderate current of shallow portions of runs, in areas strewn with unsilted rubble and boulders (NatureServe 2009).

Mussels

Purple Bean. A freshwater mussel with a dark brown to black shell with numerous closely spaced fine green rays. Its habitat is creeks to medium-sized rivers and occasionally headwaters. The mussel is generally associated with riffles, but may be out of direct current and in pools or flats in streams with seasonal flows in riffles. It is not found in backwaters. Substrates range from silty-sand to boulder-sized rocks. Currents vary from fast to slight, and water depths are typically shallow (less than 2 feet) (NatureServe 2009).

Critical Habitat

The whole length of Obed WSR has been designated as critical habitat for spotfin chub (USFWS 2009c) and the purple bean is the only mussel species for which critical habitat has been designated in the park. The area in the park designated as critical habitat for the purple bean mussel is a stretch of the Obed River from the Emory River confluence to Adams Bridge (USFWS 2009d).

Primary constituent elements for the spotfin chub have not been identified, and those for the purple bean are the same as described for Big South Fork NRRA.

SPECIES OF SPECIAL CONCERN

NPS policy requires that state-listed species, and others identified as species of management concern by the park, are to be managed in parks in a manner similar to those that are federally listed. NPS is cooperating in the protection and enhancement of species of concern listed by the states (NPS 2005a).

BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA AND OBED WILD AND SCENIC RIVER

The Tennessee Division of Natural Areas and Kentucky State Nature Preserves Commission maintain county lists of rare species (Tennessee Division of Natural Areas 2007; Kentucky State Nature Preserves Commission 2009). The lists for the counties that encompass the park units were compared with species lists from the NPS (Stedman 2006; Scott 2007; Stephens et al. 2008; Britzke 2007; Schapansky, pers. comm., 2008a, 2008b, 2008c; NPS 2007b) to identify those that are known to occur in Big South Fork NRRA and Obed WSR (listed as “present in the park” on NPS lists). Based on this comparison, 68 state-listed species have been identified for consideration in this plan/EIS. In addition, some state sensitive species known to occur in the park units but not appearing on the county lists are also considered. Table 22 provides a summary of information regarding these species, including the park unit where they are known to occur, and a brief description of their habitat.

TABLE 22. STATE-LISTED SPECIES PRESENT IN BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA AND OBED WILD AND SCENIC RIVER

Species	Status ¹	Park Unit	Habitat description
Mammals			
Eastern Big-eared Bat <i>Corynorhinus rafinesquii</i>	TN – D KY - S	Both	Found in southeastern U.S. Roosts in caves, mines, buildings (TDEC 2009).
Gray Bat <i>Myotis grisescens</i>	TN – E KY – T Federal - E	Both	Found in southeastern U.S. Relies on a small number of caves to roost (<8) (TDEC 2009).
Eastern Small-footed Bat <i>Myotis leibii</i>	TN – D KY – T	Big South Fork NRRA	Found in eastern U.S. Opportunistic roosting in summer (under loose bark, buildings, hollow trees, crevices, etc.). Winters in caves (TDEC 2009).
Woodland Jumping Mouse <i>Napaeozapus insignis</i>	TN - D	Big South Fork NRRA	Prefers boreal spruce–fir and hemlock hardwood forests with thick underbrush. Large range with limited suitable habitat (TDEC 2009).
Eastern Woodrat <i>Neotoma magister</i>	TN - D	Both	Has a large habitat ranging from low wetlands and swamps to higher forested areas. Feeds primarily on plant material (TDEC 2009).
Smokey Shrew <i>Sorex fumeus</i>	TN - D	Both	Is a northern and mountain species with range that moves south into Appalachia (TDEC 2009).
American Black Bear <i>Ursus americanus</i>	KY - S	Big South Fork NRRA	Prefers mixed deciduous–coniferous forests with a thick understory (NatureServe 2009).

TABLE 22. STATE-LISTED SPECIES PRESENT IN BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA AND OBED WILD AND SCENIC RIVER

Species	Status ¹	Park Unit	Habitat description
Evening Bat <i>Nycticeius humeralis</i>	KY - S	Big South Fork NRR	Prefers deciduous and mixed forest interspersed with cultivated areas. Commonly found along waterways (NatureServe 2009).
Birds			
Peregrine Falcon <i>Falco peregrinus</i>	TN - E	Obed WSR	Prefers to nest in cliffs. Large range covering much of western Canada and U.S. down through Central America to South America (TDEC 2009).
Bald Eagle <i>Haliaeetus leucocephalus</i>	TN-T	Both	Can live in numerous habitats. Prefers large rivers, lakes, and forests of mixed to uniquely conifer or hardwood (TDEC 2009).
Cerulean Warbler <i>Dendroica cerulea</i>	TN - D	Both	Inhabits deciduous forests throughout eastern U.S. Migrates through southern U.S. to South America. Breeding grounds are in north and central part of country (TDEC 2009).
Swainson's Warbler <i>Limnithlypis swainsonii</i>	TN - D	Both	Breeds in forests of southeastern U.S. Migratory bird that inhabits understory, hunts in leaf litter, and migrates to Central America and Caribbean (TDEC 2009).
American Coot <i>Fulica americana</i>	KY - E	Big South Fork NRR	Inhabits freshwater lakes, ponds, marshes, and larger rivers; wintering is also on brackish estuaries and bays. Also on land bordering these habitats. Calm open water with plenty of algae and other aquatic vegetation (NatureServe 2009).
Dark-eyed Junco <i>Junco hyemalis</i>	KY - S	Big South Fork NRR	Inhabits coniferous and deciduous forest, forest edge, clearings, bogs, open woodland, brushy areas adjacent to forest, and burned-over lands; in migration and winter, utilizes a variety of open woodland, brushy, and grassy habitats (NatureServe 2009).
Golden-winged Warbler <i>Vermivora chrysoptera</i>	KY - T	Big South Fork NRR	Inhabits deciduous woodland, usually in dry uplands or areas of thick undergrowth in swampy areas; woodland edge with low cover; hillside scrub; overgrown pastures; abandoned farmland; power line right-of-ways; recently logged sites; bogs; forest openings; and in territories usually having patches of herbs and shrubs, sparse tree cover, and a wooded perimeter (NatureServe 2009).
Great Blue Heron <i>Ardea herodias</i>	KY - S	Big South Fork NRR	In freshwater and brackish marshes, along lakes, rivers, bays, lagoons, ocean beaches, mangroves, fields, and meadows. Nests commonly high in trees in swamps and forested areas, less commonly in bushes, or on ground, rock ledges, and coastal cliffs. Often nests with other herons (NatureServe 2009).
Savannah Sparrow <i>Passerculus sandwichensis</i>	KY - S	Big South Fork NRR	Prefers habitat with short to intermediate vegetation height, intermediate vegetation density, and a well developed litter layer. These preferred habitats cover a wide range of vegetation types, including alpine and arctic tundra, coastal salt marshes, sedge bogs, grassy meadows, and native prairie (NatureServe 2009).
Sharp-shinned Hawk <i>Accipiter striatus</i>	KY - S TN - D	Both	Found in forest and open woodland, coniferous, mixed, or deciduous, primarily in coniferous in more northern and mountainous portion of range (NatureServe 2009).

TABLE 22. STATE-LISTED SPECIES PRESENT IN BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA AND OBED WILD AND SCENIC RIVER

Species	Status ¹	Park Unit	Habitat description
Reptiles			
Southeastern Five-lined Skink <i>Eumeces inexpectatus</i>	KY - S	Big South Fork NRA	These skinks often are under or in ground litter, logs, piles of wood, or stumps, which appear to be important elements of the habitat (NatureServe 2009).
Amphibians			
Green Salamander <i>Aneides aeneus</i>	TN - D	Both	Found in damp (but not wet) crevices in shaded rock outcrops and ledges. Also found beneath loose bark and in cracks of standing or fallen trees (e.g., in cove hardwoods), and sometimes in or under logs on the ground (NatureServe 2009).
Black Mountain Dusky Salamander <i>Desmognathus welteri</i>	TN - D	Both	Is highly aquatic; found in streams and springs in wooded parts of range (TDEC 2009).
Invertebrates			
Cumberland Bean Pearly Mussel <i>Villosa trabalis</i>	Federal –E TN-E KY-E	Big South Fork NRA	Has a limited range in Virginia, Kentucky, N. Carolina, Alabama, Georgia, and Tennessee. Found in water less than 3 ft in swift moving currents and sandy/gravel substrate (TDEC 2009).
Tan Riffleshell <i>Epioblasma florentina walkeri</i>	Federal-E, h TN-E KY-E	Big South Fork NRA	Occurs in a substrate of coarse gravel sand, gravel, and some silt in current, and in less than 3 feet of water (Parmalee and Bogan 1998).
Little-winged Pearly Mussel <i>Pegias fabula</i>	Federal-E TN-E KY-E	Big South Fork NRA	Prefers cool, clear tributary streams with high gradients and swift currents. Inhabits the Cumberland Plateau and is thought to exist in only a handful of stream reaches (TDEC 2009).
Cumberlandian Combshell <i>Epioblasma brevidens</i>	Federal-E TN-E KY-E	Big South Fork NRA	Occurs in Virginia, Mississippi, Kentucky, Tennessee, and Alabama, in streams with coarse gravel or gravel substrate (TDEC 2009).
Clubshell <i>Pleurobema clava</i>	Federal-E, h TN-E KY-E	Big South Fork NRA	Occurs in medium-sized and large rivers at depths of 15 to 18 feet on a firm substrate of sand and gravel (Parmalee and Bogan 1998).
Cumberland Elktoe <i>Alasmodonta atropurpurea</i>	Federal-E TN-E KY-E	Big South Fork NRA	Occurs only in Kentucky and Tennessee. Prefers fine substrates and more slow moving current, usually in smaller streams (TDEC 2009).
Dromedary Pearly mussel <i>Dromus dromas</i>	Federal-E, h TN-E KY-X	Big South Fork NRA	An inhabitant of shoals and riffles, it has been collected in a gravel and sand substrate in about 3 feet of water (Parmalee and Bogan 1998).
Oyster Mussel <i>Epioblasma capsaeformis</i>	Federal-E, h TN-E KY-E	Big South Fork NRA	Usually found in shallow riffles in fast water less than 3 feet in depth in a gravel and sand substrate (Parmalee and Bogan 1998).
Fluted Kidneyshell <i>Ptychobranchus subtentum</i>	Federal-C KY-S	Big South Fork NRA	Primarily a stream and small river species, inhabiting a sand or sand and gravel substrate in riffles with fast current, usually at depths of 2 feet or less (Parmalee and Bogan 1998).

TABLE 22. STATE-LISTED SPECIES PRESENT IN BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA AND OBED WILD AND SCENIC RIVER

Species	Status ¹	Park Unit	Habitat description
Spectaclecase <i>Cumberlandia monodonta</i>	Federal-C TN-E KY-E	Big South Fork NRRRA	Found in medium to large rivers, in substrates from mud and sand to gravel, cobble, and boulders (TDEC 2009).
Fish			
Olive Darter <i>Percina squamata</i>	TN – D KY – E	Both	Occurs in upland rivers in Blue Mountain and Cumberland Plateau regions of Tennessee, and Cumberland River drainage. Occupies streams with steep gradients and fast moving water over boulders and bedrock (Etnier and Starnes 1993).
Ashy Darter <i>Etheostoma cinereum</i>	TN – T KY - S	Both	Has a fragmented range of silt-free streams and slow pool edges around rubble and boulders in the Cumberland, Duck, and Tennessee river basins (Etnier and Starnes 1993).
Emerald Darter <i>Etheostoma baileyi</i>	TN - D	Big South Fork NRRRA	Found in rocky pools and sometimes riffles of Upper Kentucky and Cumberland river drainages (Etnier and Starnes 1993).
Spotfin Chub <i>Erimonax monachus</i>	Federal-T h TN-T	Obed WSR	Occurs within the four river systems in Tennessee River. Inhabits clear water over gravel in mid-sized rivers with moderate current (Etnier and Starnes 1993).
Arrow Darter <i>Etheostoma sagitta</i>	TN - D	Big South Fork NRRRA	Prefers shallow, cool pools and slow to moderate current runs in intermittent streams (Etnier and Starnes 1993).
Tippecanoe Darter <i>Etheostoma tippecanoe</i>	TN - D	Big South Fork NRRRA	Found in warm, clear larger rivers with gravel substrate (Etnier and Starnes 1993).
Blackside Dace <i>Phoxinus cumberlandensis</i>	TN - T KY - T	Big South Fork NRRRA	Inhabits small, clear, cool woodland streams over sandstone, shale, or sand substrates in Upper Cumberland River drainage in Kentucky and Tennessee (Etnier and Starnes 1993).
Duskytail Darter <i>Etheostoma percnurum</i>	KY - E	Big South Fork NRRRA	Inhabits large streams to moderately large rivers. Occurs in gently flowing pools, generally in the vicinity of riffles, with substrate of large rocks strewn over bedrock or sand and gravel (Etnier and Starnes 1993).
Mountain Brook Lamprey <i>Ichthyomyzon greeleyi</i>	KY - T	Big South Fork NRRRA	Inhabits small upland rivers and creeks with gravel substrate (Etnier and Starnes 1993).
Plants			
Climbing Fumitory <i>Adlumia fungosa</i>	TN - T	Obed WSR	Found in moist coves, rocky woods, ledges, alluvial slopes, and thickets (Flora of North America n.d.).
Roundleaf Shadbush <i>Amelanchier sanguinea</i>	TN - T	Both	Found in upland shrub of hillsides, upland woods, and rocky slopes (Native Plant Information Network n.d.).
Lucy Braun's White Snakeroot <i>Ageratina luciae-brauniae</i>	TN - T	Big South Fork NRRRA	Occurs in sandy floors of sandstone rockhouses of the Cumberland Plateau, particularly where water seeps or drips (NatureServe 2009).
Spreading False-foxglove <i>Aureolaria patula</i>	TN - T	Big South Fork NRRRA	Found on steep limestone bluffs in the shade of rather open stands of mixed hardwoods (root parasitic on oaks) (NatureServe 2009).

TABLE 22. STATE-LISTED SPECIES PRESENT IN BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA AND OBED WILD AND SCENIC RIVER

Species	Status ¹	Park Unit	Habitat description
American Barberry <i>Berberis canadensis</i>	TN - S	Both	Occurs in open woods, on bluffs and cliffs, and along river banks in the eastern and central United States. Formerly an inhabitant of savannas and open woodlands, fire suppression has significantly restricted its habitat to sites with shallow soil (such as glades and cliffs) or areas with mowing or other canopy-clearing activities (such as power line corridors, railroad/road right-of-ways, and riverbanks) (NatureServe 2009).
Cumberland Sandgrass <i>Calamovilfa arcuata</i>	TN - E	Both	Occurs in open areas along rocky stream banks or stream beds, intermittent rocky drainage areas among large rocks, and areas showing evidence of natural disturbance due to water flow (Center for Plant Conservation 2007).
Round Leaf Watercress <i>Cardamine rotundifolia</i>	TN - S	Big South Fork NRRRA	Found along springs, brooks, and wet forested spots (Natural History of North America 2009).
American chestnut <i>Castanea dentata</i>	TN - S	Big South Fork NRRRA	Occurs in Mesic to Dry Forest and flowers from June to July (TDEC 2008b).
Green and Gold <i>Chrysogonum virginianum</i>	TN - T	Big South Fork NRRRA	Performs best in moist, well-drained soil, under partial or full shade. This plant is tolerant to a wide range of well-drained soils, and may develop successfully in richly organic soils. It is also tolerant to lighting conditions, although partial or full shade is vital in southern regions (Cornell University 2009).
Sweet Fern <i>Comptonia peregrina</i>	TN - E	Big South Fork NRRRA	Grows in dry, sterile, sandy to rocky soils in pinelands or pine barrens, clearings, or edges of woodlots (Flora of North America n.d.).
Cumberland Rosemary <i>Conradina verticillata</i>	Federal-T TN – T	Both	Restricted to boulder/cobble/gravel-bars, sand bars and islands, sandy river banks, floodplains in river gorges, and similar sunny riparian areas where seasonal flooding minimizes competition (by keeping out less well-adapted competitors) and creates new gravel-bar habitats for colonization (NatureServe 2009).
Plukenet's Flatsedge <i>Cyperus plukenetii</i>	TN - S	Big South Fork NRRRA	Occurs in Sandy Barrens and flowers from July through October (TDEC 2008b).
Pink Lady's Slipper <i>Cypripedium acaule</i>	TN - E	Both	Occurs in dry to wet forests, bogs, brushy barrens, heath, and roadsides on highly acidic soil (Flora of North America n.d.).
Southern Lady's Slipper <i>Cypripedium kentuckiense</i>	TN - E	Big South Fork NRRRA	Found in mesic, shaded areas in mature floodplain forests, near streams and creeks and in ravines. Also associated with woodland acid spring seeps and with forested limestone seeps adjacent to bayheads (NatureServe 2009).
Needleleaf Rosette Grass <i>Dichanthelium aciculare</i>	TN - E	Big South Fork NRRRA	Occurs in Sandy Pinewoods and Barrens and flowers from May to October (TDEC 2008b).
Spinulose Shield-fern <i>Dryopteris carthusiana</i>	TN - T	Big South Fork NRRRA	Found in bogs. Sporulation occurs from June to September (TDEC 2008b).

TABLE 22. STATE-LISTED SPECIES PRESENT IN BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA AND OBED WILD AND SCENIC RIVER

Species	Status ¹	Park Unit	Habitat description
Tawny Cotton-grass <i>Eriophorum virginicum</i>	TN - E	Both	Found in bogs and meadows (Flora of North America n.d.).
Rockcastle Aster <i>Eurybia saxicastellii</i>	TN - E	Both	Found in sandstone boulder-cobble river bars that are spring-flooded and summer-dry (NatureServe 2009).
Mountain Witch Alder <i>Fothergilla major</i>	TN - T	Both	Found in dry ridgetop forests of middle elevation ridges in the mountains, especially along the Blue Ridge Escarpment, summits, and upper slopes of Piedmont monadnocks, and north-facing bluffs in the lower Piedmont (NatureServe 2009).
Lesser Rattlesnake Plantain <i>Goodyera repens</i>	TN - S	Big South Fork NRA	Found in moist conifer/rhodododendron woods. Flowers from June to August (TDEC 2008b).
Rough Hawkweed <i>Hieracium scabrum</i>	TN - T	Both	Occurs in sandy soils, open, disturbed sites (fields, stream sides), and wooded sites (Flora of North America n.d.).
Goldenseal <i>Hydrastis canadensis</i>	TN - S	Both	Grows best in rich, mesic hardwood forest, especially those underlain by limestone or alkaline soils (NatureServe 2009).
American marshpennywort <i>Hydrocotyle americana</i>	TN - E	Big South Fork NRA	Occurs in wet soils and pools. Flowers in June and July (TDEC 2008b).
Butternut <i>Juglans cinerea</i>	TN - T	Both	Grows in rich mesophytic forests, lower slopes, ravines, and various types of bottomland, including banks and terraces of creeks and streams, and floodplain forests (NatureServe 2009).
Marsh Peavine <i>Lathyrus palustris</i>	TN - S	Big South Fork NRA	Occurs in wet woods and Marshes. Flowers May through June (TDEC 2008b).
Whorled Yellow Loosestrife <i>Lysimachia quadrifolia</i>	TN - S	Big South Fork NRA	Occurs in Spring runs and fens. Flowers June through August (TDEC 2008b).
Large-flowered Barbara's-buttons <i>Marshallia grandiflora</i>	TN - E	Both	Grows in rocky lake shores, creek banks, bluffs, and floodplains. It tends to occur in moist to wet sandy soil, in sandy/cobbly alluvium, or in bedrock crevices along rivers (NatureServe 2009).
Cumberland stitchwort <i>Minuartia cumberlandensis</i>	Federal-T TN - E	Big South Fork NRA	Occurs in rockhouses. Flowers July through September (TDEC 2008b).
Sweet Pinesap <i>Monotropsis odorata</i>	TN - T	Big South Fork NRA	Grows in pine woodlands of the southeastern U.S., mostly in the Appalachian Mountains (Botanical Society of America 2009).
American Ginseng <i>Panax quinquefolius</i>	TN - S	Both	Primarily occurs in rich, cool, moist, but not extremely wet woods, under a closed canopy (NatureServe 2009).
Long Beechfern <i>Phegopteris connectilis</i>	TN - S	Big South Fork NRA	Occurs in mountain bogs and rocky seeps. Sporulation in June and August (TDEC 2008b).

TABLE 22. STATE-LISTED SPECIES PRESENT IN BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA AND OBED WILD AND SCENIC RIVER

Species	Status ¹	Park Unit	Habitat description
White Fringeless Orchid <i>Platanthera integrilabia</i>	Federal-C TN – E	Big South Fork NRR	Generally found in wet, flat, boggy areas at the head of streams or seepage slopes (NatureServe 2009).
Palegreen Orchid <i>Platanthera flava</i> var. <i>herbiola</i>	TN - T	Big South Fork NRR	Occurs in swamps and floodplains. Flowers May through June (TDEC 2008b).
Tennessee Pondweed <i>Potamogeton tennesseensis</i>	TN – T	Both	Found in streams, ponds, and shallows of rivers (NatureServe 2009).
Virginia Spiraea <i>Spiraea virginiana</i>	Federal-T TN – E	Both	This species occurs along creek edges with margins of exposed rock and piled detritus, bars of gravel, rubble, and/or boulders, and including dolomitic limestone. It occurs in alluvial silt collected within cracks in the bedrock. These sites experience a regime of periodic flooding. Elevations range from 850 to 1,420 feet (NatureServe 2009).
Pinelands Dropseed <i>Sporobolus junceus</i>	TN - S	Obed WSR	Found in openings in pine and hardwood forests, usually in sandy to loamy soils (Utah State University Herbarium n.d.).
Wofford's featherbells <i>Stenanthium diffusum</i>	TN – E	Big South Fork NRR	Occurs in rockhouses. Flowers September and October (TDEC 2008b).
American Yew <i>Taxus canadensis</i>	TN - E	Big South Fork NRR	Found in understory shrub in rich forests (deciduous, mixed, or coniferous), bogs, swamps, gorges, ravine slopes, and rocky banks (Flora of North America n.d.).
Roundleaf Fameflower <i>Talinum teretifolium</i>	TN - T	Big South Fork NRR	Found on rock outcrops (NatureServe 2009).
Menges' Fameflower <i>Talinum mengesii</i>	TN - T	Obed WSR	Found in woods, glades, barrens, cliffs, outcrops, rocky banks, sandstone, granite, gneiss, and rarely on limestone at 100-1,000 meters elevation. Flowering occurs from April to October (Flora of North America n.d.).
Northern White Cedar <i>Thuja occidentalis</i>	TN - S	Big South Fork NRR	Occurs mostly on calcareous substrates, neutral to basic swamps, shores of lakes and rivers, uplands, cliffs, and talus (Flora of North America n.d.).
Bristle-fern <i>Trichomanes boschianum</i>	TN - T	Big South Fork NRR	Found in deeply sheltered grottoes on noncalcareous rocks (Flora of North America n.d.).
Zig-zag Bladderwort <i>Utricularia subulata</i>	TN - T	Obed WSR	Inhabits acidic wet sand and bogs (Penskar and Higman 1999).
Sand Grape, Rock Grape <i>Vitis rupestris</i>	TN - E	Big South Fork NRR	Occurs in sandy rocky riverbanks. Flowers May through June (TDEC 2008b).

¹Status: E, Endangered; T, Threatened; S, Special Concern; h, Historic; D, Deemed in need of management; X, Extirpated. Note that where "T" occurs with "h," this indicates that the species is still threatened throughout their range, and that they have historically been identified within the park but are not known to occur there today.

SOUNDSCAPES

According to NPS, a soundscape is defined to be the “total acoustic environment of an area,” which includes both natural and human sounds (NPS 2009b). According to section 4.9 of NPS *Management Policies 2006*, the natural soundscape of a park refers to the combination of all of the natural sounds occurring within the park, absent the human-induced sounds, as well as the physical capacity for transmitting those natural sounds (NPS 2006c). Natural sounds may range from bird calls, insect chirps, and bats to sounds produced by physical processes like wind rushing through leaves on trees, thunder, and rushing and falling water through rivers, creeks, and streams within a park. In a survey conducted in 1998 in which people were asked to define the most important reasons for having national parks, 72% indicated that parks provide opportunities to experience natural peace and the sounds of nature. Further, visitor preference studies identified birds, animals, wind, and water as very pleasing sounds (NPS 2009b).

Unnatural and unwanted sounds in a national park setting, hereafter referred to as “noise,” are intrusive, human-made sounds, whose degree of disturbance is highly dependent upon the particular situation and location. Individuals tend to judge the annoyance of noise relative to the natural sounds (i.e., without the intruding noise source) and to the activities occurring where the noise is heard. For example, if regions of the park are dedicated to enjoying the tranquility and serenity of the natural environment, sounds from motor boating and hunting would be distracting to the visitor experience. However, if these activities are consistent with the purpose of a particular zone of the park, these sounds would be considered appropriate. Therefore, noise is a subjective term, and it is important to characterize the activities essential to the park’s purpose (NPS 2000).

In addition to its effect on humans, noise can adversely affect wildlife communities within parks by interrupting important communication networks for survival and reproduction between insects, birds, and mammals. For example, certain wildlife communications may signify mating calls, danger from predators, and territorial claims (NPS 2009b).

The magnitude of noise is usually described by its sound pressure. Since the range of sound pressure varies greatly, a logarithmic scale is used to relate sound pressures to some common reference level, usually the decibel. Sound pressures described in decibels are called sound pressure levels and are often defined in terms of frequency-weighted scales (A, B, C, or D).

The A-weighted decibel scale is commonly used to describe noise levels because it reflects the frequency range to which the human ear is most sensitive (1,000–6,000 Hertz). Sound levels measured using an A-weighted decibel scale are generally expressed as dBA. Throughout this section, all noise levels are expressed in dBA. Several examples of sound pressure levels in the dBA scale are listed in table 23, while table 24 presents examples of sound pressure levels measured in national parks.

TABLE 23. EXAMPLES OF COMMON SOUNDS: A-WEIGHTED SOUND LEVEL IN DECIBELS (dBA)

A-weighted	Overall Level	Noise Environment
120	Uncomfortably loud (32 times as loud as 70 dBA)	Military jet airplane takeoff at 50 feet.
100	Very loud (8 times as loud as 70 dBA)	Jet flyover at 1,000 feet. Locomotive pass-by at 100 feet.
80	Loud (2 times as loud as 70 dBA)	Propeller plane flyover at 1,000 feet. Diesel truck 40 mph at 50 feet.
70	Moderately loud	Freeway at 50 feet from pavement edge at 10 AM. Vacuum cleaner (indoor).
60	Relatively quiet (1/2 times as loud as 70 dBA)	Air condition unit at 100 feet. Dishwasher at 10 feet (indoor).
50	Quiet (1/4 times as loud as 70 dBA)	Large transformers. Small private office (indoor).
40	Very quiet (1/8 times as loud as 70 dBA)	Birds calls. Lowest limit of urban ambient sound.
10	Extremely quiet (1/64 times as loud as 70 dBA)	Just audible.
0		Threshold of hearing.

Source: Federal Interagency Committee on Noise 1992 (Modified by The Louis Berger Group, Inc., 2009).

TABLE 24. SOUND PRESSURE LEVELS MEASURED IN NATIONAL PARKS

Sound	dBA ^a
Threshold of human hearing	0
Haleakala NP: Volcano crater	10
Canyonlands NP: Leaves rustling	20
Zion NP: Crickets (less than 20 feet)	40
Whitman Mission: Conversational speech (less than 20 feet)	60
Yellowstone NP: Snowcoach (approximately 100 feet)	80
Arches NP: Thunder	100
Yukon-Charley Rivers NP: Military jet (approximately 330 feet above ground level)	120

Source: NPS 2003c.

^adBA = A-weighted sound level in decibels.

SOUNDSCAPES AND SOURCES OF NOISE AT THE PARKS

Big South Fork National River and Recreation Area

Sources of noise that affect the existing soundscape at Big South Fork NRRA include vehicular traffic, including off-highway vehicle use; construction and maintenance of park roads; oil and gas operations

within and adjacent to park; visitor uses such as hunting; logging and timber harvesting; industrial activities such as manufacturing, sawmills, and coal mining; and agricultural activities in the area around the park (NPS 2006c). Vehicular access within the gorge section of the park is limited to 11 river accesses to keep noise pollution and other environmental impacts at a minimum. No off-highway vehicle use or mineral extraction is allowed in these areas. Nonetheless, the soundscape in the gorge is impacted by activities in adjacent areas. For example, tourist activities and oil and gas extraction near Honey Creek on the plateau affect the soundscapes of the gorge below (Blount, pers. comm., 2007).

Obed Wild and Scenic River

The narrow land base of Obed WSR allows for the sounds of civilization to intrude in many places. The close proximity to county roadways makes traffic flow one of the sources of noise at this park unit. Although oil and gas operations occur around the Obed WSR, the noise is masked by that associated with traffic flow. Equipment used at active oil wells is barely audible until one is within sight of the wellpad; however, the majority of tourists do not visit these areas. Further, rushing water in the gorge area is the primary source of sound, making it one of the more peaceful places in the park unit (Schapansky, pers. comm., 2009).

Existing Sound Levels

The natural soundscapes of Big South Fork NRR and the Obed WSR have not been studied and characterized by sound level measurements in the past. Since there are currently no available data for these park units, determining similarities between them and a park with a similar geologic setting where noise measurements have been conducted allows for drawing conclusions about the existing soundscapes of Big South Fork NRR and the Obed WSR.

In order to formulate a comparison between park units, it is important to understand the many factors that influence the acoustic condition of a park. Some of these factors include the vegetation type, topography, climatic conditions, and biotic factors (i.e., biological sounds from unique bird populations, insect noise, etc.). Although all of these factors are relevant, the two most significant factors that may be used to determine the acoustic similarity between two park units, when no other data is available, are the dominant vegetation type and topography.

Data was recently collected (winter 2005 and summer 2006) at Great Smoky Mountains National Park. Great Smoky Mountains National Park is located approximately 125 miles from Big South Fork NRR and the Obed WSR, also in the southern Appalachians. Based on a discussion with park staff at Big South Fork NRR and the Obed WSR, as well as the NPS Natural Sounds Program, the vegetation types and the vastly changing rugged terrain that characterize the Great Smoky Mountains National Park are relatively similar to the vegetation and topography of Big South Fork NRR and the Obed WSR. For example, sound level measurements within the Great Smoky Mountains National Park were conducted in vegetation zones including mixed forest type, open field grass/pasture, cove hardwood, hardwood/deciduous, hardwood, northern hardwood and spruce evergreen. Measurements were conducted at varying elevations as well. Similarly, Big South Fork NRR contains hardwood deciduous and mixed deciduous but also contains hardwood mixed with pine, which differs from the Great Smoky Mountains National Park vegetation zones. Also, Big South Fork NRR does not contain any spruce forest types, and it must be noted that the density of the trees in Big South Fork NRR may be less than that of the Great Smoky Mountains National Park due to early to mid-20th century logging. However, the density issue is mainly confined to the understory and should not substantially affect the comparison to the Great Smoky Mountains National Park data. The vegetation in the Obed WSR includes hemlock ravines near the rivers and white and Virginia pines. In terms of topography, both Big South Fork NRR and the

Obed WSR contain vast rugged terrain and scenic bluffs due to the gorge area cut by the rivers that flow through the park units.

Although the vegetation types and topographical features of Big South Fork NRR and the Obed WSR are relatively similar to the Great Smoky Mountains National Park, it is important to note that differences in vegetation and topography between the park units can affect the sound propagation differently. In general, vegetative cover affects the transmission of sound by reflecting and absorbing energy. Tree trunks, branches, and foliage partially scatter acoustic energy, and the frequencies that are scattered or absorbed are dependent upon the size of the tree trunks as well as the leaf area and cross-section (Bucur 2006). Thus, vegetation type is also relevant. Additionally, the density of trees and shrubs can affect sound transmission. It has been noted that a dense stand of trees and shrubs at least 16 feet wide is necessary to alter sound transmission (Anderson et al. 1984). Less dense regions of vegetation may allow for lesser amounts of attenuation. Along with vegetative effects on sound propagation, topographical features such as hills and valleys, as well as surface materials, may influence sound propagation. For example, acoustic energy may become diffracted (or “bent”) at obstacles such as hills, thus changing the propagation of the sound wave. Further, soft forest soils or soft ground in open fields are good absorbers of acoustic energy, whereas water and rocky surfaces reflect acoustic energy.

Since the Great Smoky Mountains National Park data is the best available, and the vegetation types and topography are similar enough to make comparisons to Big South Fork NRR and the Obed WSR, it has been used in this analysis to characterize the soundscapes of these park units. The Great Smoky Mountains National Park data was collected during the winter of 2005 and the summer of 2006 for a daytime (7:00 AM to 7:00 PM) and nighttime (7:00 PM to 7:00 AM) period. Several noise metrics were measured that facilitate the characterization of the soundscape; however, impact assessment is based on comparisons against the natural ambient levels since the NPS is required to protect the natural experience. Natural ambient levels represent the natural environment absent human sounds, and may be well estimated based on the L90 metric. The L90 metric represents the level exceeded 90% of the time.

During the winter of 2005, the daytime L90 levels in the Great Smoky Mountains National Park ranged between 26.3 and 32.2 dBA in the mixed forest, open field grass/pasture, various hardwood, and spruce/evergreen vegetation zones for varying elevations. Nighttime L90 levels ranged between 24.4 and 32.9 dBA (NPS 2009c). Similarly, during the summer of 2006, the daytime L90 ranged between 24.9 and 39.0 dBA, while the nighttime L90 ranged between 21.6 and 42.6 dBA. It is expected that the natural ambient noise levels in Big South Fork NRR and the Obed WSR would cover similar wintertime and summertime ranges (NPS 2009d).

CULTURAL RESOURCES

In order to understand the archeological resources, historic structures, cultural landscapes, and ethnographic resources at both Big South Fork NRR and Obed WSR, the prehistoric context and historic cultural context of the Cumberland Plateau is described below.

PREHISTORIC CULTURAL CONTEXT OF THE CUMBERLAND PLATEAU

The prehistory of the Cumberland Plateau is divided into the PaleoIndian period, Archaic period, Woodland period, and the late prehistoric or Mississippian period. Site types for these prehistoric occupants of the Cumberland Plateau range from lithic (stone flake) scatters to prehistorically occupied rockshelters. Table 25 summarizes the time frames and characteristics of each period.

TABLE 25. PREHISTORIC CULTURAL TIMELINE OF CUMBERLAND PLATEAU

Cultural Period	Sub-period	Dates	Characteristics
PaleoIndian		10,000–8000 BC	Exemplified by the use of large distinct projectile (spear) point types used to hunt herding animals and megafauna; nomadic hunters and gatherers migrating through the area subsisting on the abundant game and plant life of the region.
Archaic	Early	8000–6000 BC	Diversified subsistence strategy based on maximizing local resources set the prehistoric seasonal life cycle for the next 9000 years; including hunting smaller game, gathering plant food, and fishing; inhabited rockshelters as well as riverine base camps.
	Middle	6000–4000 BC	Widespread introduction of groundstone tools, adzes (axe-like tool), axes, bannerstones, and pendants; projectile points were probably used in conjunction with spears & darts and a throwing stick known as the atlatl; variety of bone tools; increased group size and/or longer periods of seasonal occupation.
	Late	4000–1000 BC	Emergence of cultivated plants, suggesting the development of early plant domestication; seasonal patterns of hunting, fishing, and plant food processing practices; increase in population, and possibly extended habitation.
Woodland	Early	1000–200 BC	Use of smaller projectile points suggest invention & use of Bow & Arrow. Invention of and early pottery styles reveal that occupation of rockshelter sites increase in the Big South Fork area at this time.
	Middle	200 BC–AD 600	Continuation of hunting and gathering with the use of cord-marked or fabric-marked pottery and plain and check-stamped–limestone-tempered pottery. Primary occupation is still in the rockshelters
	Late	AD 600–1000	Horticulture and village settlement have not been identified in the region of Big South Fork NRR and Obed WSR.
Late Prehistoric		AD 900–1600	Mississippian cultural groups characterized by shell-tempered ceramics, platform mounds, sustainable agriculture, densely populated settings, and complex political hierarchies exist in the large river bottoms but not in the Big South Fork. Pottery from this period provides evidence for seasonal forays onto the Cumberland Plateau to supplement corn, bean, squash agriculture.

Sources: Chapman 1975; Cohen 1977; Dragoo 1976; Jennings 1989; Kerr 1998; McNutt and Lumb 1987; Willey 1966; Wilson and Finch 1980; Des Jean 1994.

HISTORIC CULTURAL CONTEXT OF THE CUMBERLAND PLATEAU

Historic Period

The late 1700s and 1800s saw the introduction of European people to the area. Hunting and agriculture drew small settlements to the area. The rugged landscape and nature of the region kept it from becoming heavily populated. The first Euro-American fur trappers or “long hunters” arrived in the region in the late 1700s, and camps were established at “Station Camp Creek” near the modern Charit Creek Lodge. By 1780, the Big South Fork and its tributaries were being actively hunted and explored. By 1800, there were several permanent homesteads in the area. The early settlements were limited to the river and streams where small sections of fertile land could be found. Small farms and communities sprang up along the Upper Cumberland Plateau and the river bottom areas of the Big South Fork of the Cumberland River (NPS 2008b).

During the early 1800s pioneers began developing sodium chloride salt production in the region. One of the early salt production areas, the Beatty Saltworks, was established near “Salt Town” sometime after 1813. The saltworks operated until approximately 1840. In 1818, under a lease from Martin Beatty, Marcus Huling and Andrew Zimmerman were drilling to obtain brine water for salt production. Instead of salt water, the well began producing 100 barrels of oil per day. This quantity of oil was sufficient to ruin the well as a source of salt water. Huling and Zimmerman began collecting this viscous oil into casks that they carried out and sold to local merchants and even sent as much as 2,000 gallons to European markets. This well and the site became the country’s first commercial oil well (Jillison 1952; Fiege 1988; Commonwealth of Kentucky House Resolution #78, 1970; Argus of Western America 1818; Shepard 1988).

Saltpeter, potassium nitrate, was also being produced in the rockshelters of the area during the early through mid-19th century. This essential ingredient of gunpowder was found here and exploited by cottage industries. After the Civil War, however, cheaper sources and a drop in demand effectively ended this industry. Rebuilding and expansion after the war created a need for timber and coal and exploitation of those resources intensified (NPS 2008b; Des Jean 1997).

Coal mines such as the Blue Heron, or Mine 18, owned by the Stearns Coal and Lumber Company operated from 1937 through 1962. When the Stearns Coal and Lumber Company abandoned Blue Heron in 1962, the town was abandoned and the buildings were raised and relocated or collapsed due to neglect and decay (NPS 2008b).

The post-World War II era experienced a departure of young men as they returned from the war and were lured away by the promise of a better, more productive life elsewhere (NPS 2008b).

ARCHEOLOGICAL RESOURCES

Archeological resources consist of “any material or physical evidence of past human life or activities which are of archeological interest, including the record of the effects of human activities on the environment. They are capable of revealing scientific or humanistic information through archeological research” (NPS 2006c).

Big South Fork National River and Recreation Area

The Big South Fork NRRA is located in the Cumberland Plateau along the Kentucky–Tennessee border. The Cumberland Plateau has been occupied by humans for approximately 12,000 years and contains a rich and diversified cultural context.

The Big South Fork NRRRA is considered by some to be the most important archeological location in the Southeast Region of the NPS. The Big South Fork NRRRA contains approximately 1,350 documented archeological sites, which may possibly represent only 40% of the estimated total for the park unit. Between 1996 and 2001, 249 new culturally associated rockshelters were recorded by Middle Tennessee State University (Smith and Des Jean 2008). These rockshelter occupations date from PaleoIndian through to the Mississippian periods (10,000 BC - AD 1400) to the modern Historic Period (AD 1900-1974).

Archeological resources at the Big South NRRRA consist of locations chosen by prehistoric hunter-gatherers and include limited use and seasonal hunting camps, rockshelters, semi-sedentary open campsites, and small hunting camps. Archeological sites created by historic occupations include 19th century farms and communities, moonshine-still operation sites, niter mined rockshelter sites, salt manufacturing locations, and coal mines and “coal camps,” timber production sites, and contemporary farms (NPS 2009e).

Obed Wild and Scenic River

Obed WSR is located approximately 20 miles south of the Big South Fork NRRRA in Tennessee (refer to figure 1 in chapter 1). The Obed WSR area contains a diverse and long cultural history dating back to the PaleoIndian period 12,000 years ago. Native Americans continuously occupied the Obed WSR region, hunting and gathering food along its banks. More than 200 rockshelters have been recorded within the Obed WSR boundaries, and 10 of these have been assessed as significant archeological sites possibly eligible for inclusion into the National Register of Historic Places (national register).

According to Thompson (1979), numerous archeological resources exist in the vicinity of the Obed WSR. These resources exist mostly in the form of rockshelters, prehistoric open camps, historic hunting camps, gristmills, moonshine still sites, subsistence farms, timber production sites, coal mines, and segments of historic railroad grade (NPS 2004b).

Artifacts within the Obed WSR consist of projectile (dart and arrow) points, lithic (stone) scrapers, faunal remains plain or cord-marked ceramics, lithic flakes, and ruins of structures (Thompson 1979). Based on physiographic features and archeological investigations conducted at nearby Big South Fork NRRRA, an estimated 340 rockshelters may exist within the congressionally approved boundary of Obed WSR (NPS 2004b).

HISTORIC STRUCTURES AND RESOURCES

The NPS defines historic structures as “a constructed work, usually immovable by nature or design, consciously created to serve some human activity.” Examples are buildings of various kinds, monuments, dams, roads, railroad tracks, canals, millraces, bridges, tunnels, locomotives, nautical vessels, stockades, forts and associated earthworks, ruins, fences, and outdoor sculpture. In the national register context of Big South Fork NRRRA and Obed WSR, a historic structure is any structure constructed by or utilized by humans during the post-contact era.



Historic moonshine-still operation site.



Historic structure at Big South Fork NRRRA.

Big South Fork National River and Recreation Area

Early settlers, Cumberland farmsteads, and a brief boom of the Industrial Revolution left a variety of historic structures at the Big South Fork NRRA. These buildings and engineering structures have survived relatively intact and are important examples of the historic human use of this area through time.

Currently, there are 13 “Cumberland” style farm structures that have been assessed as eligible for inclusion in the national register (NRHP 2009; Des Jean, pers. comm. 2010). Additionally, three abandoned railroad bridges, a vehicular low-water timber bridge, and a large steel coal mine tipple have also been identified as eligible for inclusion into the national register (NPS 1996).



Historic farmstead structure.

Table 26 contains the 18 historic structures that are listed on the NPS List of Classified Structures (LCS) and are available for visitation by guests of the Big South Fork NRRA. In order for a building to be considered for the LCS, the structure must meet one of the following criteria: either the structure is listed individually or is eligible for the national register, or the structure is a contributing element of an historic site or district that is listed or is eligible for the national register. In addition, the LCS includes other structures, such as those that have been moved or reconstructed; commemorative structures; and structures that have achieved significance within the last 50 years that are managed as cultural resources.

Obed Wild and Scenic River

Currently, there are no structures within the Obed WSR listed on the NPS LCS. However, small coal mines located in the vicinity of the Obed WSR had been in use since 1847, and the number increased with the construction of the railroads. Iron furnaces around Rockwood have created a need for coal since 1868. Numerous small and larger mines developed after the 1880s, and later strip mining became important after World War II. The structures and features within the Obed WSR associated with coal mining and extraction sites include a 1880s railroad tunnel and mining camp remnants (NPS 2004b). Other developments of the historic period include gristmills, oil and gas development sites and sandstone quarries used for producing building stones. Although there are numerous oil and gas wells within the Obed WSR watershed, little historical information is available on the extent or locations of abandoned operations within the Obed WSR boundaries (Des Jean, pers. comm., 2009). The remains of the historic gristmill at Lilly Bluff sit at that location and are being managed for preservation. There are no sites listed in the national register at Obed WSR (NRHP 2009).

TABLE 26. LIST OF CLASSIFIED STRUCTURES IN THE BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

Resource	Type	Date Constructed	LCS Number	Eligibility Status	Description
Litton/Slaven Barn	Structure	1900	92182	Eligible, 1981	The barn is listed as a contributing building and currently serves as a museum that houses the exhibits within the proposed Big South Fork Rural Historic District.
Litton/Slaven House and Cabin	Structure	1900	92183	Eligible, 1981	The Litton/Slaven House and Cabin is listed as a contributing building, and is currently serving as a wayside exhibit within the proposed Big South Fork Rural Historic District.
Litton/Slaven Earthen Dam	Super-structure	1900	232905	Eligible, 1981	Currently the dam forms part of a hiking trail that runs above the farmstead.
Blevins, Oscar. House	Structure	1879	92185	Eligible, 1981	House is listed as a contributing building and is currently serving as an exhibit in the proposed Big South Fork Rural Historic District.
Blevins, Oscar. Corn Crib	Structure	1879	504439	Eligible, 1981	The corn crib exhibits the vernacular design and construction techniques of the former residents of an isolated Cumberland Plateau community.
Blevins, Oscar. Outbuilding	Structure	1870s–1880s	511850	Eligible, 1981	The outbuilding exhibits the vernacular design and construction techniques of the former residents of an isolated Cumberland Plateau community.
Blevins, John. Barn	Structure	1925	92186	Eligible, 1981	The John Blevins Simpson Barn was constructed in 1925 and assessed as eligible for inclusion into the national register under criteria A and C due to its association with the historic subsistence farming culture of the Cumberland Plateau. The barn is an exemplary example of the vernacular folk architecture of Southern Appalachia. The barn currently serves as a warehouse for general supply storage.
Blevins, John. House	Structure	1824	92187	Eligible, 1981	The John Blevins House is listed as a contributing building within the proposed Big South Fork Rural Historic District and currently serves as a dormitory.
Blevins, John. Corn Crib	Structure	1920	92188	Eligible, 1981	The corn crib currently is being utilized as general storage facility.
Blevins, John. Smithy	Structure	1920	92189	Eligible, 1981	The John Blevins Smithy, built in 1920, originally served as a mill. Currently, the structure is being utilized as a general storage facility.
Litton, John. Cabin Ruins at Parched Corn Creek	Structure	1881	100405	Eligible, 1981	The cabin was assessed as eligible for inclusion into the national register due to its representation of an exemplary example of log barn construction on the Cumberland Plateau. Unfortunately this cabin burned to the ground in 1997 leaving only the standing, cut-stone chimney.

TABLE 26. LIST OF CLASSIFIED STRUCTURES IN THE BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

Resource	Type	Date Constructed	LCS Number	Eligibility Status	Description
Privy at Parched Corn Creek	Structure	1960s–1970s	100406	Not Eligible, 1981	The privy has been dated to approximately the late 1960s / early 1970s based on oral history. The privy originally served as a latrine, but is not in use or maintained. The structure was assessed as not eligible for inclusion into the national register despite its close proximity to the old Armpie Blevins farmstead. The structure is determined to be a noncontributing component of the Big South Fork Rural Historic District.
Blevins, Lora. Corn Crib	Structure	1929	92178	Eligible, 1981	The Lora Blevins Corn Crib is listed as a contributing structure within the proposed Big South Fork Rural Historic District and currently serves as an exhibit.
Blevins, Lora. House	Structure	1929	92179	Eligible, 1981	The Lora Blevins house was built in 1929, is listed as a contributing building in the Big South Fork Rural Historic District, and was recently determined a contributing feature of a Component Landscape as documented in a 1998 NPS Cultural Landscape Inventory, Level 1. The house currently serves as an exhibit.
Blevins, Lora. Pole Barn	Structure	1929	92177	Eligible, 1981	The Lora Blevins Pole Barn was built in 1929 and is listed as a contributing building in the proposed Big South Fork Rural Historic District. The barn currently serves as an exhibit.
Ranson Boyatt Farmstead Ruins	Structure	Unknown	416703	Eligible, 1981	The farmstead typifies the confined but picturesque setting that many of the first farming settlers of the Upper Cumberland adapted to in the mid- to late nineteenth century. The Ranson-Boyatt Farmstead Site has integrity of location and setting, exhibiting extant cultural artifacts and landscape features from the original Boyatt farmstead.
Low Water Bridge	Structure	Unknown	579462	Eligible, 1981	The LCS contains only limited information pertaining to the status of the bridge and its description.
Coal Tipple at Blue Heron	Structure	1939	578708	Eligible, 1981	The Blue Heron Tipple was mechanized in the 1930s. It separated the various sizes of coal coming from the mine in coal cars. The tipple is currently part of Blue Heron, or Mine 18, Mining Community.

Source: NPS 2009f.

CULTURAL LANDSCAPES

Cultural landscapes are defined as “a geographic area (including both cultural and natural resources and the wildlife or domestic animals therein) associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values” (NPS 2006c). Figures 8, 9, and 10 in chapter 2 show the cultural landscapes at Big South Fork NRRA and Obed WSR.

Big South Fork National River and Recreation Area

Beginning in 1997, the cultural landscape team from the NPS Southeast Regional Office in Atlanta, GA, began documenting the many cultural landscape features of the Big South Fork for a level I cultural landscape inventory. Features at the park include cemeteries that are both actively tended and others long abandoned. Industrial remnants at the park include the Blue Heron Tipple and Tram, the Yamacraw and Roaring Paunch Railroad bridges, the mine and town ruins at Worley, and the K and T Railroad bed and the site of the Beatty Oil Well. Transportation features, such as a stone-lined footbridge at No Business Creek, remain in place as do several other cut-stone culverts and the evidence of farming in the form of remnant fields, farmhouse ruins, and fences (Brown et al. 2001).

Some features are very remote and are the only remaining part of a formerly intact cultural landscape. However, several farmsteads were found to retain enough integrity to warrant listing on the national register. More attention was focused on these farmsteads, such as the Oscar Blevins, Lora Blevins, Litton-Slaven, and Parched Corn Creek sites, which are now regarded as component landscapes within an overall Big South Fork “Rural Historic District” (Des Jean, pers. comm., 2009). In addition, when Congress created the NRRA, the Charit Creek Farmstead was to be maintained in its historic appearance. Therefore, it is treated as an “administrative landscape” (Des Jean, pers. comm., 2009).



Historic farmstead structures.

One townsite that is being reviewed is No Business. No Business is a small, linear, abandoned town site in the Big South Fork NRRA that was permanently vacated in the early 1960s after 164 years of continuous settlement. The site was once one of the largest communities in the area with approximately 300 inhabitants, including many now prominent families. Many of the landscape features around the No Business drainage carry these surnames.

Additional properties under review as cultural landscapes consist of the Ranse Boyatt Farmstead, Salt Town, and the Newtie King home site. These properties are currently designated and managed by the Big South Fork NRRA as administrative landscapes pending further review (Des Jean, pers. comm., 2009).

Obed Wild and Scenic River

The Obed WSR contains some possible cultural landscapes. Below is a summary of the prominent landscape features that are worthy of protection and management consideration, but are not currently managed as cultural landscapes.

The Tub Mill at Lilly Bluff contained a horizontal water wheel in the channel of the spillway and is currently pending further review for consideration as a cultural landscape; however, no maintenance of the property is being conducted at the site (Des Jean, pers. comm., 2009).

Another important landscape landmark within the Obed WSR is Lilly Arch, which rises nearly 50 feet from base to apex, and is considered one of the most impressive and prominent natural features at the park unit. The natural arch is carved out of Pennsylvanian sandstone, and is the only one of its kind in the park unit. Located near the end of the Point Trail, the Lilly Arch represents a natural link to the past. Like many boulders and cliffs at the park, the arch was used by Native Americans and the early pioneers as a place of shelter. Today you can walk through the arch and peer down into the rushing waters of the Obed River (NPS 2008c). Although archeological resources have been recorded within the vicinity of the arch, the arch is currently not considered, nor under review as a cultural landscape (Des Jean, pers. comm., 2009).

An additional property of interest that is adjacent to the Obed WSR boundary, but is under the management of other governmental agencies, is the old girder and truss bridge at Nemo. The bridge was erected in 1930–1931 and was the first iron structure to join the two banks of the river. Located just above the Obed–Emory confluence, the old bridge is now closed to motor traffic and is used as a footbridge by hikers as a part of the 300-mile-long Tennessee State Cumberland Trail. Automobile traffic crossing the river at Nemo bridge was moved to a new concrete bridge in 1999 (NPS 2008c).

ETHNOGRAPHIC RESOURCES

Ethnographic resources are defined as “cultural and natural features of a park that are of traditional significance to traditionally associated peoples. These peoples are the contemporary park neighbors and ethnic or occupational communities that have been associated with a park for two or more generations (40 years), and whose interests in the park’s resources began before the park’s establishment” (NPS 2006c).

The Shawnee and Cherokee tribes have been historically associated with the Big South Fork area. Under a series of treaties and agreements, including the 1785 Treaty of Hopewell, the 1790 Butler and Walton Treaty of Tellico, and the 1805 Treaty of Tellico, Cherokee tribal rights and land ownership was ceded to the U.S. government (NPS 2007a). The Shawnee claim association with the area; however, there are no identified sites attributed to the Shawnee. Both tribes most likely used the upland areas for supplementary subsistence hunting and gathering (Des Jean, pers. comm., 2009).

Although there were Scots-Irish and German immigrants to the area in historic times, there are no distinct ethnographic groups of European descent associated with either Big South Fork NRR or Obed WSR (Des Jean, pers. comm., 2009).

December 29, 2006, the NPS sent letters to three Cherokee bands, three Shawnee groups, and the Chickasaw Nation to notify them of the plan/EIS in order to initiate compliance with Section 106 of the National Historic Preservation Act. Two responses were received. The United Keetowah Band of Cherokee Indians in Oklahoma merely requested continued consultation on the project. The Eastern Band

of Cherokee Indians responded that the project area may have cultural, archeological, or religious significance to the Eastern Band of Cherokee.

VISITOR USE AND EXPERIENCE

BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

Visitor Use

Annual Visitor Statistics—Table 27 displays visitation numbers at Big South Fork NRRA, which are based largely on counts taken at the Bandy Creek Visitor Center. While these counts may underestimate the actual number of annual visitors to the park, they record a general trend in visitation, which is illustrated in figure 23. The total number of visitors to Big South Fork NRRA during the period from 1990 to 2009 was approximately 15 million. An average of 783,090 visitors come to the park each year. Visitation peaked in 2001 and has generally declined from 2002 to the present, increasing slightly from 2004 to 2005 and then again, more recently, from 2007 to 2009.

Seasonal Visitor Statistics—Seasonal visitor use patterns at Big South Fork NRRA are generally predictable throughout the year. Visitation at Big South Fork NRRA increases throughout the summer (figure 24) with peak visitation occurring in October. Spring visitor use is moderate to high, with visitor numbers increasing during the summer months. Winter season use is relatively light, with January and February accounting for the lowest percentage of park visitors over the 17-year period (NPS 2009i).

TABLE 27. ANNUAL VISITATION AT BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

Year	Annual Visitation	% Change
2009	686,747	1.6%
2008	675,928	7.8%
2007	626,751	0.6%
2006	622,807	-10.9%
2005	699,230	0.4%
2004	696,114	-7.4%
2003	752,140	-11.8%
2002	852,873	-6.9%
2001	916,548	6.1%
2000	864,200	0.5%
1999	860,224	0.4%
1998	856,480	-0.2%
1997	858,388	0.3%
1996	855,882	-4.1%
1995	892,328	11.5%
1994	800,460	8.5%
1993	737,947	-1.9%
1992	752,203	-12.5%
1991	860,017	8.2%
1990	794,539	

Source: NPS 2009i

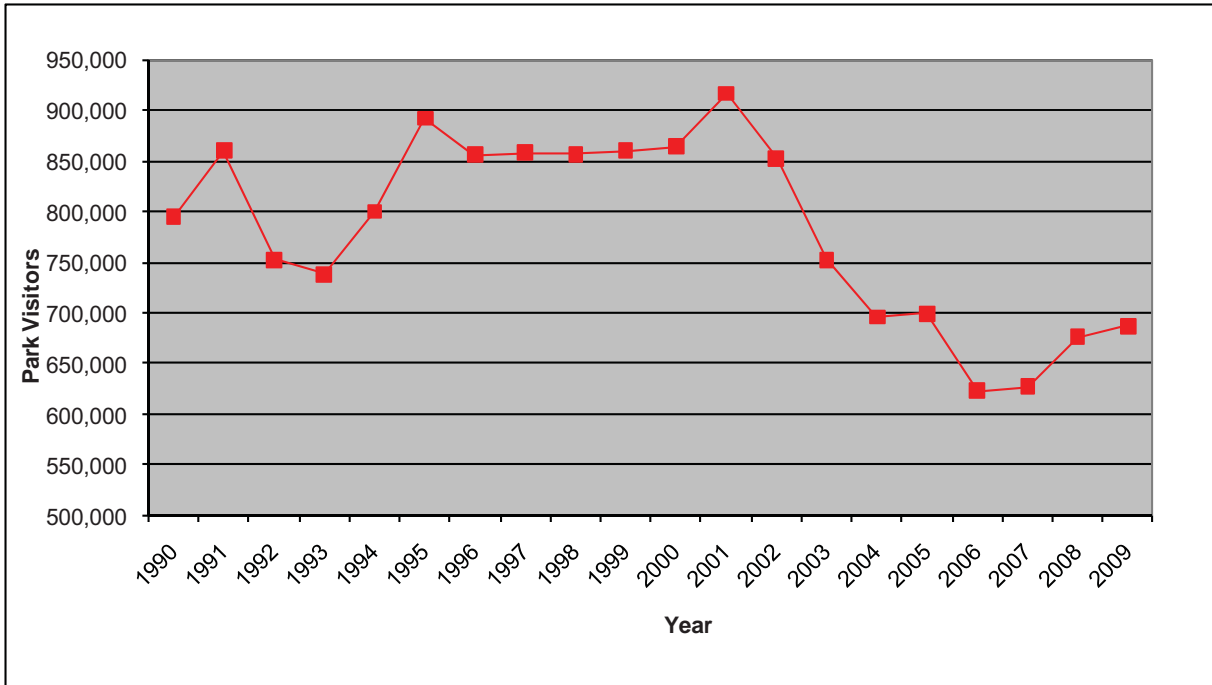


FIGURE 23. TREND IN ANNUAL VISITATION AT BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

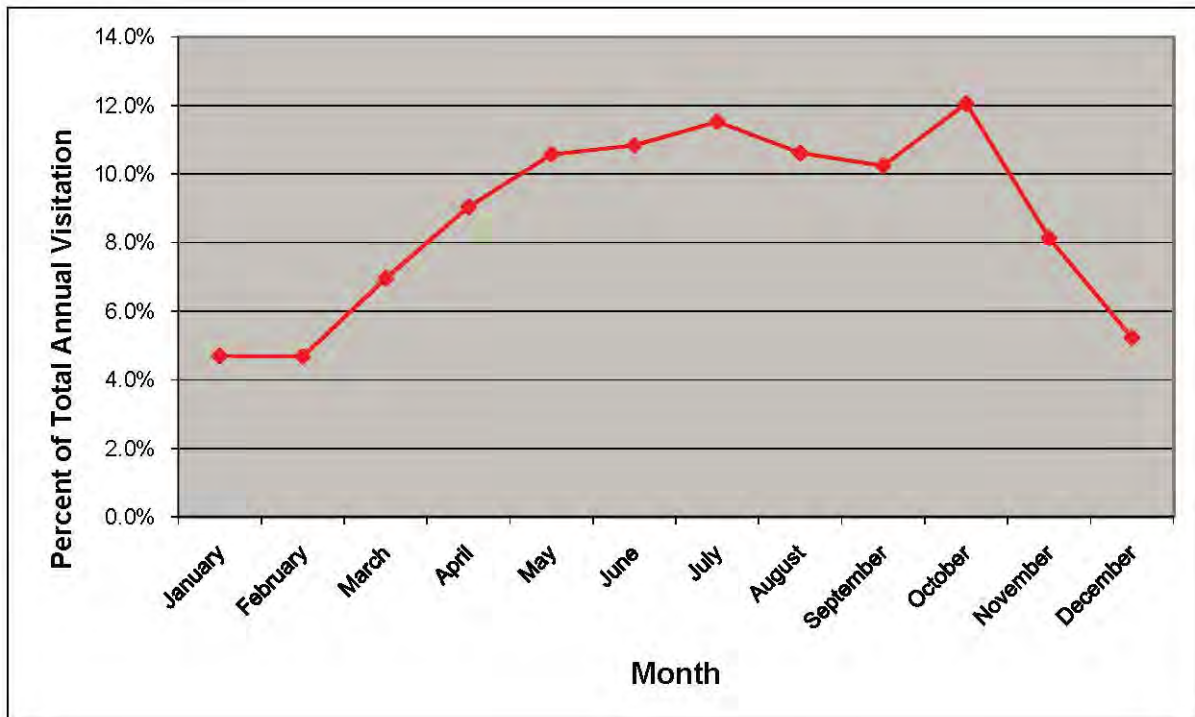


FIGURE 24. PERCENT OF TOTAL ANNUAL VISITATION, BY MONTH, FOR BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA (1990–2008)

Visitor Activities

The NPS or its licensed concessionaires operate the facilities within the Big South Fork NRRA and Obed WSR. The Big South Fork NRRA contains two developed campgrounds, one lodge, a horse stable, two visitor centers, 11 river accesses, and numerous recreational opportunities. Figures 8 through 10 in chapter 2 show the locations of visitor use areas. The NPS owns 9 acres of land in Stearns, KY, outside the recreation area boundaries. The Stearns Visitor Services Division office and a maintenance building are operated at this site. The Kentucky visitor center is located in the Stearns train depot operated by the Big South Fork Scenic Railroad. The NPS also owns 20 acres of land located between the recreation area headquarters and Oneida, TN. This land was acquired for potential use as a visitor center and is currently undeveloped (NPS 1997). The following discussion includes a brief description of each of these opportunities.

Hiking—There are over 300 miles of hiking trails located throughout the park, which exist both in the gorge and on the plateau, providing ample scenic opportunities to park visitors. Trail lengths range from short, paved trails leading to scenic vistas to longer, loop trails used for day-hiking and long-distance backpacking trails traversing much of the park area. Leatherwood Ford Trailhead offers a short trail up to the Bandy Creek Rapids, which is designed to be accessible to individuals with disabilities. Hiking is pursued year-round, but peaks during traditional high-use periods including spring break (NPS 2005a).

Mountain Biking—Biking is permitted on three biking-dedicated trails, some horse trails, marked multiple-use trails, and on all roads in the area. Many of the roads and trails open to bike use are not ideal because of the gravel and sand surfaces or heavy use for other activities. The dedicated trails are maintained by organized bike groups that use the trails. As with most other activities, spring and fall are the most popular seasons for bike use (NPS 2005a).

All-terrain Vehicles—ATV use is presently only allowed for the purpose of transporting big game during hunting seasons. Federal regulations require all off-road vehicles, including ATVs, to be restricted to designated routes on all federal lands. ATVs can legally be used on multiple-use trails during deer and hog hunting seasons if the operator is actively involved in hunting. Although recreational ATV riding has been identified in the General Management Plan, actual designations for off-road vehicle use are still in the planning stages.

Camping—Bandy Creek and Blue Heron campgrounds both offer campsites and restroom/shower facilities accessible to individuals with disabilities. There are 190 improved campsites at Bandy Creek, which is the largest visitor development area and includes a large campground with swimming pool and play structures, electric and water hookups, and restroom/shower houses. Group campgrounds are also provided, as are stables for horse boarding and rentals, picnicking, a large variety of trails, and a small visitor information station. The Blue Heron campground contains 45 developed campsites. A smaller, more primitive campground at Alum Ford adjoins Lake Cumberland and contains 7 campsites and a boat ramp. The Sheltopee Trace trail transects this site. Camping is also allowed along some of the back roads and in the backcountry, and there are horse campgrounds at Station Camp and Bear Creek that have special facilities for equestrians (NPS 2005a).



Mountain biking at Big South Fork NRRA.

Limited camping occurs within the gorge near trail heads and is most popular along the streams. There is a general trend towards an increase in recreational vehicle camping and a decrease in tent camping, although backcountry camping is increasing, especially during the popular summer season. May and October are the most popular times for weekend camping, and hunters use the camping facilities during the fall hunting season. Camping outside designated areas does occur and has caused minor resource damage (NPS 2005a).

Horse Riding—Big South Fork NRA has a reputation for being a premier riding area and is frequented by locals and visitors alike. Many people bring their own horses and camp at special campgrounds. Concessionaire-operated activities are available through Bandy Creek Stables, and horses can be rented from licensed businesses outside of the park. Members of equestrian organizations visit the area often and can hold competitive events with a special use permit. As this is one of the most popular recreational activities in the park, it occurs regularly in all but the coldest months. Fifteen- to 25-mile loops comprise approximately two-thirds of the park unit horse trails and are primarily located between White Oak Creek and the Tennessee state line. Marked routes are also available for use by wagons drawn by livestock (e.g. horses and mules). Maintenance of horse trails is a major work item for NPS staff, and riding groups also often assist in this task. Proper planning and maintenance are critical for both resource protection and rider safety (NPS 2005a).



Horseback riding at Big South Fork NRA.

Canoeing, Kayaking, and Rafting—There are 11 access points to the Big South Fork River or its major tributaries within the recreation area. Access points are located at Blue Heron, Yamacraw (East), Yamacraw (West), Alum Ford, Worley, Burnt Mill Bridge, North White Oak, Peter's Bridge, Brewster Bridge, Zenith, Leatherwood Ford, Station Camp, and outside the park at New River Bridge

Part of the reason the Big South Fork NRA was established was to protect the free-flowing Big South Fork and its tributaries. As a result, this river system offers some of the highest quality rafting in the eastern United States. Whitewater rafting and kayaking generally occur upstream from Leatherwood Ford, while canoeing occurs mostly downstream from Leatherwood Ford. The river flow must be a minimum of 800 cfs for rafting through the main gorge, and 10,000 cfs is the recommended maximum for safe rafting.



Kayaking at Big South Fork NRA.

Whitewater recreation occurs mostly in the spring and is popular with visitors from outside the local area. Commercially provided trips are available and very popular (NPS 2005a).

Climbing—Rock climbing and rappelling is gaining popularity at Big South Fork NRR. The natural terrain, which includes an extensive network of sandstone cliffs, provides attractive opportunities for recreational climbing (NPS 2005a). Climbing is limited based on the park compendium.

Hunting and Trapping—Hunting is allowed at Big South Fork NRR, with squirrel, raccoon, and deer being the most popular game. The hunting seasons are determined by applicable Kentucky and Tennessee hunting regulations. In Tennessee in 2008, small game hunting seasons occur throughout the year, with the timing of open seasons dependent upon specific species. Big game hunting season for deer and wild hog extend from late September through mid-January. A special park season for wild hog extends from January 21st through the last day of February to help control the population of the nonnative species. Wild turkey seasons occurred in the fall from mid-November to mid-December and in the spring from late March to mid-May. In Kentucky, elk season extended from October to January; deer were hunted in McCreary County from mid-October to mid-December; fall turkey season extended from early September to mid-January; and small game open seasons were dependent upon specific species (NPS 2005a; TWRA 2008; KDFWR 2008).

Within the park, safety zones have been established for the protection of visitors. Vehicular restrictions have limited some traditional hunting access in both the plateaus and gorge areas (NPS 2005a).

Fishing—Fishing is seasonal and managed according to state regulations. Fishing by locals and visitors occurs in the small and large streams and in the headwaters of Lake Cumberland. Creek fishing is more popular with locals. Many of the fishing spots are in the gorge, but require hiking due to the legislative restrictions on vehicular use. Within the watersheds surrounding the park, there are a total of 79 species of fish, including 15 that are classified as game fish. Altogether, the fish population contains a total of 12 different families, including lampreys, darters, shiners, minnows, suckers, and bass (Scott 2007).

Big South Fork Scenic Railway—The non-profit McCreary County Heritage Foundation owns and operates a sightseeing train (Big South Fork Scenic Railroad) that runs from historic downtown Stearns through Barthell, which is adjacent to the national area boundary, and to the Blue Heron Mine. This scenic route takes visitors through the gorge and is seasonally popular. The first phase of an expansion of the route from Barthell north to Worley was completed in the summer of 2006 (BSFSR 2009). McCreary County Heritage Foundation also has plans to extend the route from Worley to Yamacraw.



Fishing at Big South Fork NRR.

Visitor Centers—The Bandy Creek Visitor Center serves as the primary contact point for park visitors and is open seven days per week, year-round, except on Christmas. Center staff are available to provide visitors with information and supply backcountry permits. A small book store, brochures, limited exhibits, restrooms, and nearby Oscar Blevin trailhead are found at this location. The Stearns Depot Visitor Center in Kentucky is open daily from May through October from 9:00 AM to 5:30 PM. Staff are available to provide visitors with general information, and the departure point for the scenic railway is located nearby (NPS 2009g).

Aesthetic Resources

Although the presence of humans is evident in the park units and surrounding region, the dominant visual elements are water and vegetation on a predominantly hilly landscape. While man-made developments are apparent, the relatively dense vegetation reduces these influences within a short distance.

The general absence of light pollution provides for night sky-watching at Big South Fork NRR. On clear nights, around 2,000 stars are visible to the naked eye (NPS 2008d). The University of Tennessee works in cooperation with Big South Fork in presenting astronomy programs throughout the year.

As it becomes increasingly difficult to find places free of air pollution and light interference, places with dark, clear night skies become that much more valuable. Sources of nearby artificial light that may obscure views of the night sky are the nearby towns of Oneida and Huntsville, vehicle lights from nighttime traffic along Tennessee State Highway 52 and Interstate Highway 27, as well as the more distant Interstates 75 and 40.

Health and Safety

Big South Fork NRR experiences an average of 10 emergency medical cases per year. This covers the most serious injuries that require some type of EMS treatment other than basic first aid. The majority of these are related to recreational activities within the National Area. Approximately five of these cases are basic life support cases involving broken bones, sprains and soft tissue injuries that most often require emergency room treatment. The other are advanced life support cases that often involve back or head related injuries requiring overnight medical treatment. The primary cause of these injuries is horseback riding accidents usually caused by falling from a horse. Other types of injuries occur during river activities such as rafting or kayaking, backpacking, and day hiking. Approximately one injury per year is caused by a snake bite. This is often in one of the developed campgrounds. Motor vehicle accident injuries are limited within the National Area, most likely due to the low speed roads.

Big South Fork NRR experiences, on average, one fatality per year. These incidents are almost exclusively from water related activities such as swimming, wading, or boating. These accidents usually occur at the National Area's River access points.

While reviewing the case files over the last five years, there were three oil related accidents within the park. One involved a trash truck blowing out a hydraulic line and releasing approximately 5 gallons of hydraulic fluid. The other two were oil transportation related incidents with one being an overturned oil tanker truck near the New River outside of the National Area and the other being a broken pipeline crossing the New River within the boundary of the National Area. There were no injuries caused by any of these incidents.

OBED WILD AND SCENIC RIVER

Visitor Use

Annual Visitor Statistics—Table 28 displays visitation statistics for Obed WSR. While these counts may underestimate the actual number of annual visitors to the park, they record a general trend in visitation, which is illustrated in figure 25. The total number of visitors to Obed WSR during the period from 1990 to 2009 was approximately 4.1 million. An average of 207,613 visitors come to the Obed WSR each year. Visitation peaked in 1997, and has generally fluctuated year-to-year since 2001. Table 28 displays visitation numbers, while the general trend in visitation is illustrated in figure 25 (NPS 2009i).

TABLE 28. ANNUAL VISITATION AT OBED WILD AND SCENIC RIVER

Year	Annual Visitation	Percent Change
2009	212,933	10.8%
2008	192,154	5.3%
2007	182,504	-1.4%
2006	185,176	5.3%
2005	175,800	-27.6%
2004	242,682	17.6%
2003	206,337	-11.4%
2002	232,768	20.5%
2001	193,105	-19.6%
2000	240,194	-2.3%
1999	245,899	-1.5%
1998	249,518	-16.4%
1997	298,642	37.8%
1996	216,699	-6.7%
1995	232,228	-4.0%
1994	241,947	7.0%
1993	226,077	21.4%
1992	186,272	115.6%
1991	86,414	-17.6%
1990	104,902	

Source: NPS 2009i

Seasonal Visitor Statistics—Seasonal visitor use patterns at Obed WSR are generally predictable throughout the year. Visitation at Obed WSR increases during the spring season, peaks in early summer, and declines in early fall. Overall, most visitation from 1990 to 2009 occurred during the summer and fall months with peak visitation occurring in June. Spring visitor use is moderate to high, with visitor numbers increasing during the summer months. Winter season use is relatively light, with the months of January and February accounting for the lowest percentage of visitors to the park over the 17 year period (see figure 26, NPS 2009i).

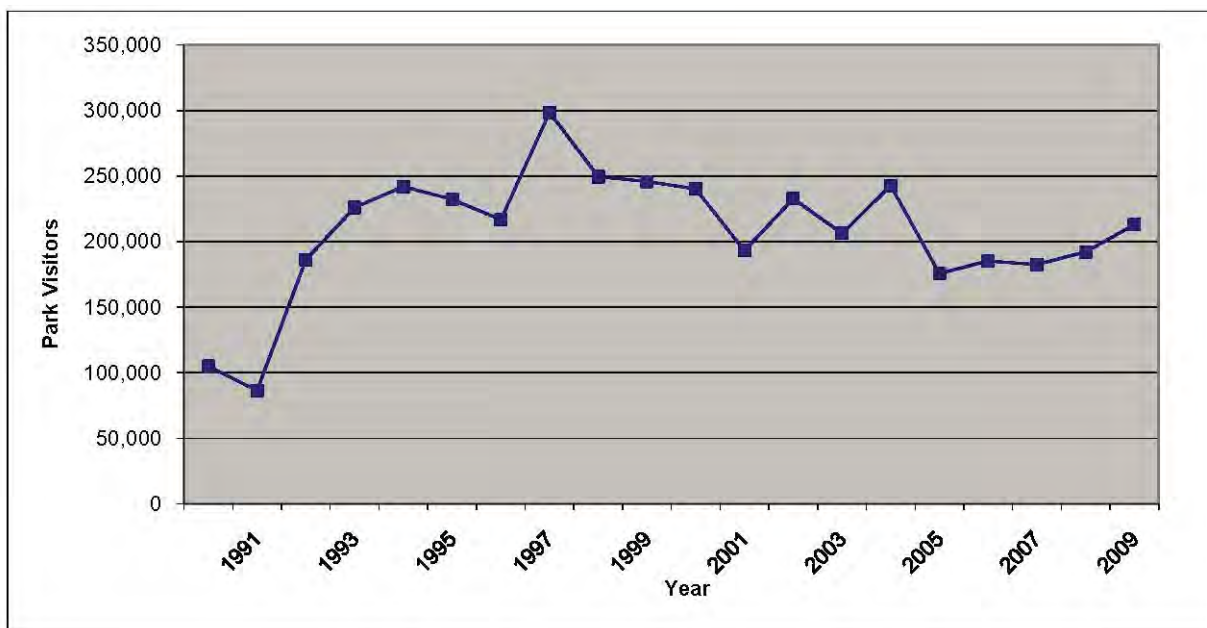


FIGURE 25. TREND IN ANNUAL VISITATION AT OBED WILD AND SCENIC RIVER

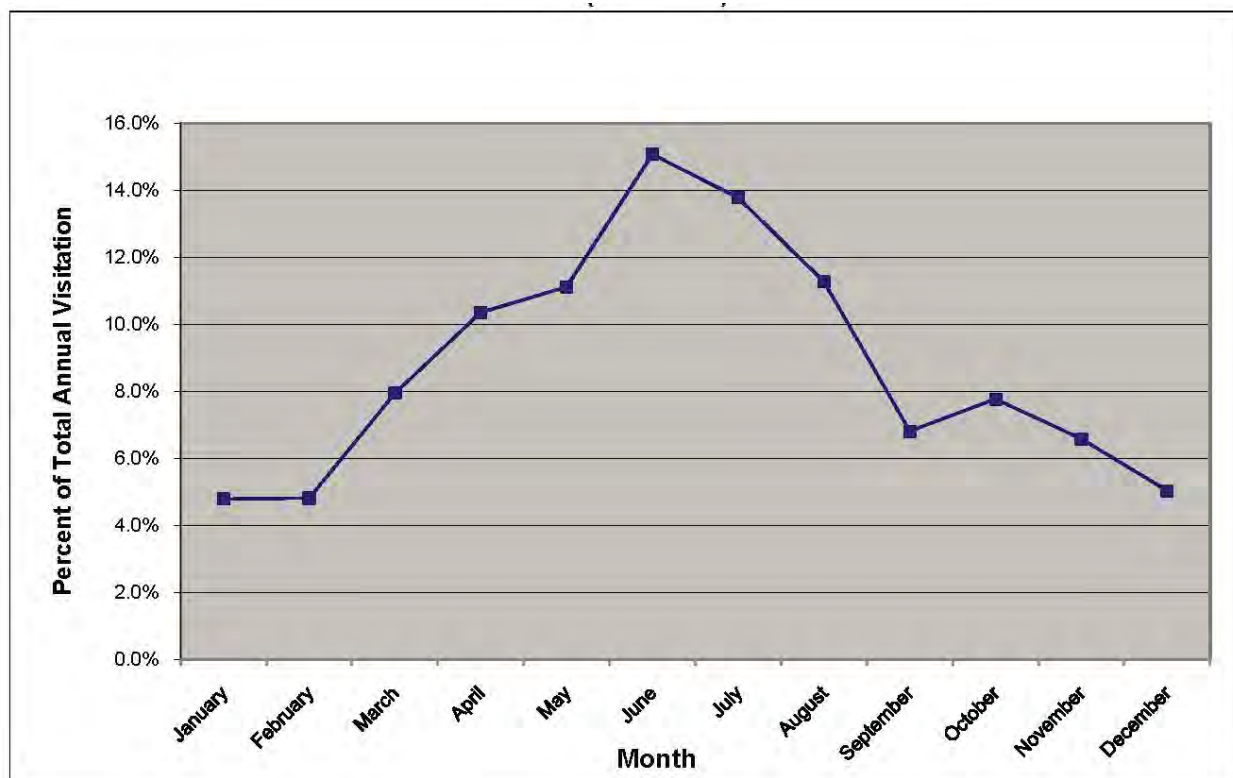


FIGURE 26. PERCENT OF TOTAL ANNUAL VISITATION, BY MONTH, FOR OBED WILD AND SCENIC RIVER (1990-2008)

Visitor Activities

The NPS or its licensed concessionaires operate the facilities within Obed WSR, which include two camping areas and numerous recreational opportunities for hiking, paddling, rock climbing, and fishing. Five bridges span rivers and creeks within the park, allowing visitors access to the water and serving as focal points for recreation. Figure 18 illustrates the location of these areas within the park. The following discussion includes a brief description of each of these opportunities.

Hiking—Hiking the trails along the Obed WSR is one of the most enjoyable activities for visitors. Several different trails with different lengths and scenery are available, including the Point Trail (3.8 miles roundtrip), the Lilly Bluff Overlook Trail (200 yards), the Lilly Bridge Trail (0.8 mile roundtrip), the Lilly Boulder Trail (1 mile roundtrip), the Emory River Nature Trail (0.7 mile roundtrip), and a portion of the Cumberland Trail, a scenic trail that travels through 11 Tennessee counties following a line of ridges and gorges along the eastern escarpment of the Cumberland Plateau in Tennessee (NPS 2009h).

Camping—There is one developed campground, Rock Creek Campground, located at the north side of the Nemo Bridge access which contains 12 primitive camping sites on the south shore of the Emory River. The Barnett Bridge access to Clear Creek also includes two to three primitive camping sites (NPS 2009h).

Canoeing, Kayaking and Rafting—Canoeing, kayaking, and rafting bring many people to the Obed WSR. The river includes difficulty classifications ranging from II to IV, making it one of the best whitewater rivers in the eastern United States. Spring and winter are usually the best times to paddle on the river, as increased water levels during those seasons are common. Favorite spots for paddlers to embark include: Potters Ford, Devils Breakfast Table, Barnett Bridge, Jett Bridge, Lilly Bridge, and Nemo. No outfitters are available near the river, so paddlers must have experience and equipment to take advantage of the Obed WSR rapids (NPS 2009h).

Climbing—The Obed WSR sandstone rock faces provide a challenging opportunity for experienced climbers, with several hundred climbing routes spanning through much of the park. Obed WSR has a long history of rock climbing dating back to the 1970s. Through the 1990s, the number of climbers increased annually, although in recent years those numbers have stabilized. Boulder climbing is also available along the Obed River and is an important activity for visiting climbers. Along the Boulder Trail over a dozen boulders are available to climbers and over 100 are located within the park unit's boundaries (NPS 2009h).

Due to its popularity, Obed WSR has been featured in climbing magazines that popularized places like Lilly Boulders, which provides bouldering “problems” or routes for all skill levels. Due to the impacts of this sport on the vegetation and wildlife that inhabit the rock faces and bouldering areas, Obed WSR completed a *Climbing Management Plan* in 2002 that prescribed a resource inventory of important ecological communities along the cliffline in order to allow the park to develop appropriate management prescriptions regarding sport climbing routes (NPS 2002a).

Hunting and Trapping—Hunting is permitted in certain locations at the Obed WSR during the state and federal hunting seasons. As in Big South Fork NRR, squirrel, raccoon, and deer are the popular game. In 2008, small game hunting lasted year-round, with the timing of open seasons dependent upon specific species. Big game hunting season for deer, feral hog, wild hog, and bear extended from late November through mid-January. Wild turkey seasons occurred in the fall from mid-November to mid-December and in the spring from late March to mid-May (NPS 1995a; TWRA 2008).

Fishing—Fishing opportunities are plentiful at the Obed WSR. An assortment of smallmouth bass, bluegills, catfish, and muskie are but a few of the various fish that swim the river (NPS 2009h).

Visitor Center—The Obed WSR Visitor Center is located in downtown Wartburg and serves as the primary contact point for all visitors. It is open 7 days per week, year-round, except for Thanksgiving and Christmas. The visitor center houses a small bookstore, brochures, and exhibits on the river, its inhabitants, the cultural history of the area, and the recreational opportunities that the park provides (NPS 2009h).

Aesthetic Resources

Like the neighboring Big South Fork NRR, dominant visual elements at Obed WSR are water and vegetation on a predominantly hilly landscape. While man-made developments are apparent, the relatively dense vegetation mitigates these influences within a short distance. While there is no specific information related to night sky-watching at Obed WSR, the general absence of light pollution at nearby Big South Fork NRR enables around 2,000 stars to be visible to the naked eye on clear nights (NPS 2008d).

As it becomes increasingly difficult to find places free of air pollution and light interference, places with dark, clear night skies become that much more valuable. Sources of nearby artificial light that may obscure views of the night sky are the nearby towns of Wartburg and Crossville and vehicle lights from nighttime traffic along Tennessee State Highways 27 and 298.

Human Health and Safety

The NPS policy regarding public health and safety (contained in the *NPS Management Policies 2006*, section 8.2.5) is that the saving of human life will take precedence over all other management actions. The NPS and its concessionaires, contractors, and cooperators will seek to provide a safe and healthful environment for visitors and employees. The NPS works cooperatively with other federal, state, and local agencies, organizations, and individuals to carry out this responsibility. However, park visitors assume a substantial degree of risk and responsibility for their own safety when visiting areas that are managed and maintained as natural, cultural, or recreational environments (NPS 2006c).

During the period between January 2005 and December 2009, park staff responded to two incidents requiring medical care within the park. In the first incident, on June 8, 2007, a man fell while hiking on a designated trail at night. Visitors located him the following day and he was taken by ambulance to a nearby hospital and treated for broken bones and a punctured lung. In the second incident, on November 14, 2007, a park visitor was walking along the streambed below Lilly Bridge when he slipped and injured his knee. He was quickly treated by park staff; the knee was immobilized and he was carried to an ambulance. Within the same reporting period (2005 to 2009) there were two incident reports relating to oil and gas development. In the first, on October 10, 2005 a visitor reported that a gas line attached to Lilly Bridge was dripping oil. Investigation revealed significant amounts of petroleum sheen on the surface of Clear Creek and on rocks along the shore. The company which owned the gas line stated that they had pressurized the gas line to test for leaks and that when the line failed to maintain its pressure, they found two leaking gaskets—one on either side of Lilly Bridge. Other government agencies were notified (the National Response Center, the USFWS and the Tennessee Division of Water Pollution Control), a boom was stretched across Clear Creek and absorbent pads were used to clean some of the sheen from the surface of the water and from the surrounding rocks. In a second incident involving the same pipe under Lilly Bridge, on February 1, 2006, park personnel observed a petroleum-smelling liquid seeping out of this line and hardware attached to it onto the ground. The owner of the line was contacted and corrected the problem (Hudson, pers. comm., 2009).

PARK MANAGEMENT AND OPERATIONS

BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

Park management and operations refer to the adequacy of staffing levels and the quality and effectiveness of park infrastructure in protecting and preserving vital resources and providing for an effective visitor experience. Park infrastructure facilities include roads that provide access to and within the park (for administrative, visitor, and emergency use), housing for staff required to work and live in the park, visitor orientation facilities (visitor centers, developed and interpreted sites, and other interpretive features), visitor amenities (including lodging and food service), administrative buildings (park staff offices and workspace), management-support facilities (garages, shops, storage buildings and yards used to house and store equipment, tools, and materials), and utilities (phones, sewer, water, and electricity).

Currently, the Big South Fork NRRRA has approximately 50 full-time employees and the number of seasonal employees varies from year to year based on available funds (table 29). There are five divisions: park management, administration, resource management, visitor services, and facility management (Blount, pers. comm., 2009b).

TABLE 29. PARK MANAGEMENT AND OPERATIONS IN THE BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA

Division	Responsibilities	Number of Employees
Management	All management functions of the park and external relations; also supervises the Obed Unit Manager and Obed Operations.	2
Administrative	Parkwide administrative, managerial, and support functions; safety and planning; coordination with external institutions.	6 (full-time)
Resource Management	Ecosystem monitoring, research, restoration efforts; species-specific management initiatives; prescribed fire management; environmental compliance (NEPA); resource protection; Cultural Resource Management program related to American Indian and European-American heritage and archeology in the park.	9 (full-time)
Visitor Services (Interpretation and Law Enforcement Sections)	Public and media communications; facilitation of interpretive programs for park visitors; management of park exhibits, visitor center displays, site bulletins and booklets, park newspaper, information rack, and park website. Safety and security enforcement for park visitors and staff; emergency medical services; search and rescue; law enforcement; archeological site patrols; resource damage detection; wildland fire; criminal investigation and prosecution.	15 full-time and career seasonals (subject to furlough)
Facility Management	Maintenance of paved and unpaved surfaces, road shoulders, and bridges; maintenance of buildings; maintenance, repair, and rehabilitation of the trails.	18 full-time and career seasonals (subject to furlough)

Source: Blount, pers. comm., 2009b.

Management

The annual budget of the park was \$4,458,000 as of 2009. Big South Fork NRRRA is managed by the park superintendent and there is one administrative support position. The Superintendent's office is responsible for all management functions of the park including program accountability, budget, reporting, coordination with the Southeast Regional and Washington offices, lands, supervision of division chiefs,

and external relations. The Big South Fork Superintendent also supervises the Obed Unit Manager and Obed Operations.

Administrative

This division oversees all of the administrative procedures that must take place within the Big South Fork NRRRA. The budget, payroll, personnel actions, purchasing, funding requests, GIS, and anything that pertains to monetary or administrative activities is overseen by this division. This division has 6 full-time employees (Blount, pers. comm., 2009b).

Resource Management

This division is responsible for all cultural and natural resources with regard to the National Environmental Policy Act (NEPA) compliance, compliance with section 102 and 106 of the National Historic Preservation Act, and other cultural and natural resource compliance. Additionally, they conduct on-site compliance reviews for NEPA documents; this may include archeological, historic structure, botanical, or landscape analyses. The division is also responsible for managing research permits and interacting with other outside agencies on resource issues such as fish and wildlife, oil, gas and mining. Other responsibilities include the provision of scientific information to ecological researchers from external institutions, and the management of land records, archives, historic photographs, historic documents, museum objects and artifacts, and historic objects associated with the park (Blount, pers. comm., 2009b).

The resource management division has the following positions filled by full-time employees: Chief of Resource Management, community planner - NEPA coordinator, archeologist, wildlife biologist, botanist, geologist, oil and gas technician, biological technician, geologist, and museum management technician.

Big South Fork NRRRA had requested a permanent increase to base funding to address the workload associated with existing oil and gas sites and future operations. A single biological science technician was coordinating the oil and gas program prior to 2009. The park received a partial funding increase in 2008 and the full funding increase in 2009. The funding increase provides for salaries and supporting costs for 3 full-time positions. A geologist and biological science technician were hired in 2009 and one permanent position is presently vacant. Duties for the oil and gas staff include: inspecting existing oil and gas operations; coordinating with state environmental programs to ensure operations are in compliance with state regulations; coordinating plugging and reclamation of orphaned wells.; monitoring park resources in the vicinity of oil and gas sites; coordinating with NPS technical staff to insure wells meet 9B regulations; and coordinating with operators for development of plans of operations. The present estimated cost of running this program, which can vary year to year, is approximately \$287,000 per year, which includes the salaries of the three full-time employees noted above; contributions from other staff (e.g., wildlife biologist, archeologist, community planner, botanist, and chief of resource management); and other miscellaneous costs (Blount, pers. comm., 2009b).

Visitor Services

The visitor services division includes law enforcement and interpretation.

Law enforcement is responsible for enforcing all of the laws in the Big South Fork NRRRA. Their other responsibilities include managing special use permits, firefighting, managing campgrounds, managing the fee program and enforcing fee compliance, and providing services to visitor centers.

Interpretation is responsible for public outreach, education, and visitor center management. This includes activities such as campfire talks, outreach to schools, and interpretive programs for visitors and staff members. Additionally, the interpretive section of this division staffs the visitor contact stations, including the main visitor center of the park. They also publish all outreach materials, including the newsletter and all brochures. There are 15 full-time employees between both sections (Blount, pers. comm., 2009b).

Facilities Management

This division is responsible for the care and maintenance of all Big South Fork NRRRA roads, trails, grounds, and buildings. This includes provision of specialized maintenance services, routine maintenance, construction, and rehabilitation. All of the Big South Fork NRRRA facilities are serviced by this division (Blount, pers. comm., 2009b).

OBED WILD AND SCENIC RIVER

The Obed WSR has six divisions, staffed by seven full-time, permanent employees (table 30). Every year, the park hires approximately five seasonal employees who work during the summer months. The divisions are: maintenance, resource management, interpretive, resource and visitor protection, administration, and management (Campbell, pers. comm., 2009).

TABLE 30. PARK OPERATIONS AND MANAGEMENT IN THE OBED WILD AND SCENIC RIVER

Division	Responsibilities	Number of Employees
Maintenance	Care of physical plant, construction, signs, fences	1 full-time, 1–3 seasonal
Resource Management	Resource protection issues, including applying for research funding, overseeing NEPA compliance, overseeing cultural compliance	1 full-time, 1 seasonal (occasionally)
Interpretive	Public interpretation programs, public communication and education, visitor programs, staffing of visitor center	1 full-time, 1 seasonal
Resource and Visitor Protection	Law enforcement, fee compliance and collection, public safety, safety education, search and rescue operations	2 full-time
Administration	Human resource issues, payroll, procurement, assistance of management division with budget	1 full-time
Management	Supervision of all activities, evaluations, budget management, oversight of reports to be submitted to NPS, coordination with state agencies of relevance	1 full-time

Source: Campbell, pers. comm., 2009.

The Obed WSR is a relatively small unit, and its annual budget is approximately \$625,000. Approximately 90% of that budget is appropriated to staff salaries (Campbell, pers. comm., 2009).

Maintenance

The maintenance division is responsible for taking care of the physical plant, constructing various structures in the Obed WSR per the area's needs, installing signs, and installing fences. This division has

one full-time employee, and hires one to three seasonal workers for every summer (Campbell, pers. comm., 2009).

Resource Management

This division is responsible for guiding the resource protection issues that are deemed important for the Obed WSR. This involves applying for research funding, overseeing NEPA compliance, overseeing cultural compliance issues associated with the Obed WSR museum, and other issues pertaining to resource management. This division has one full-time employee, and occasionally hires a seasonal employee during the summer (Campbell, pers. comm., 2009). Support for oil and gas management at Obed WSR comes from the staff at Big South Fork NRR.

Interpretive

The interpretive division deals with the interpretive responsibilities of the Obed WSR, according to the usual interpretive aspects of NPS units. This includes staffing the visitor center, scheduling visitor programs, and maintaining public communication and education. Particular programs might include the Obed WSR “Owl Prowl” or other wildlife-watching programs for the public. This division is staffed by one employee, who acquires a seasonal staff in the summer months. The seasonal staff is typically a college student (Campbell, pers. comm., 2009).

Resource and Visitor Protection

This division deals with law enforcement in the park and the provision of safety measures for visitors and staff. This involves patrolling and policing the campground, collecting fees and ensuring fee compliance by visitors, conducting search and rescue operations, and communication with the public regarding climbing and watercraft safety (kayak, canoe, raft, etc.). There are two full-time staff members; due to the extensive training necessary to fulfill this division’s responsibilities, no seasonal staff are ever hired (Campbell, pers. comm., 2009).

Administration

The administration division deals with all human resources issues, including procurement, payroll, and a large number of miscellaneous tasks pertaining to the administrative needs of the Obed WSR. The division also assists the management division with the overall budget management. There is one full-time employee in this division (Campbell, pers. comm., 2009).

Management

The management division is staffed by one full-time employee. This individual’s responsibility is to supervise all activities, conduct evaluations, manage the Obed WSR overall budget, and compose and/or oversee any reports that must be submitted. Such reports may include annual reports or statements of goals and objectives. The management division must develop plans and see that they are carried out. This division is also responsible for facilitating cooperation with various state agencies that interact with the Obed WSR (Campbell, pers. comm., 2009).

