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MAR-23

A BIOLOGICAL SURVEY OF THE NEW RIVER GORGE NATIONAL RIVER

Volume 2
A Survey of Habitats and Wildlife

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NEW RIVER GORGE NATIONAL RIVER

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A Survey of Habitats and Wildlife

by

Virginia Cooperative Fish and Wildlife Research Unit

and the

Department of Fisheries and Wildlife Sciences

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THE EFFECTS OF FLOODING ON RIPARIAN HABITATS

A REVIEW

Floodplains are productive and diverse ecosystems, capable of supporting a variety of plant and animal populations, as well as some of the most productive agricultural systems. Riparian habitats may be considered ecotones between the aquatic habitat of a river and the surrounding terrestrial habitats. They include flora and fauna from both, as well as some unique organisms of their own (Johnson 1978). Riparian habitats, by definition are lands which are periodically flooded, although they do not retain standing bodies of water.

Floodplains have historically been heavily utilized and impacted by man. Because of transportation and recently, recreation, these areas have been favored as sites for human settlements (Teskey and Hinckley 1977). Maddock (1976) estimated that approximately 9.5% of all cultivated land and 16.5% of all urban land within the United States occurred within floodplains.

With these human demands on floodplains, it is not surprising that attempts have been made to restrict the flooding, which naturally occurs on these lands. However, floodplains and river systems are intricately tied together and alteration of flow regime will impact the floodplain ecosystem. All too often, dams, channelization projects, and irrigation systems have been designed with little or no consideration given to the native habitats and wildlife affected by such actions.

Floodplain vegetation is adapted to natural flooding conditions. Those species found on floodplains are there because they are better adapted to the conditions than nearby upland species. A plant's tolerance to flooding is determined in part, by the growth of adventitious roots and new secondary roots under low oxygen conditions (Teskey and Hinckley 1977). Adventitious roots usually develop at or near the water surface where oxygen supply is the greatest. These flood-time root systems develop a more porous structure to facilitate gas exchange.

Even the main roots of floodplain species become dormant or die back immediately after flooding, and the trees which exhibit the greatest amount of adventitious root development also have the highest growth rates and greatest tolerance to flooded conditions (Hosner and Boyce 1962). Harris (1975) observed a higher mortality in red oak and black locust than willow, green ash, and boxelder in a newly impounded flood control lake. Exposure to air causes adventitious roots to die, thus rapid daily flow flucuations are probably determental.

According to Teskey and Hinckley (1977), five factors are critical in determining a plant's response to changes in water level.

1). The time of year during which flooding occurs will affect growth and survival of floodplain species. Gill (1970) found that growth rates were reduced when flooding occurred in the growing season, while Hall and Smith (1955) found no harmful effects associated with flooding in the dormant season. During the latter period tree roots have a low requirement for oxygen (Yelenosky 1964). Associated with time of year is water temperature. Cool water *is* less damaging than warm water because the oxygen holding capacity of cool water is greater (Broadfoot and Willison 1973).

2). Flood duration is critical in species survival. Even with adventitious roots, most bottomland species cannot survive two years of continuous flooding (Broadfoot and Williston 1973). The locations of specific species are situated within boundaries formed by flood duration patterns. Teskey and Hinckley (1978) found that the survival of boxelder, silver maple, river birch, green ash, and sycamore was much greater than oaks, hickories, and other upland species. However, even they died after being exposed to total root submersion for the entire growing season. Teskey and Hinckley (1978) further stated that seedlings were more susceptible to flood duration, and were less likely to survive than mature trees.

Seedling tolerance to flooding is varied. Teskey and Hinckley (1978) found that sycamore and boxelder seedlings experienced 100% mortality after being exposed to 30 continuous days of root submersion during the growing season. River birch seedlings survived this same experiment, but their growth was stunted. Silver maple seedlings were not used in this experiment, but were noted to display good adventitious root development. Black willow seedlings displayed 100% survival to the 30 day flooding, and it was noted that black willow seeds germinate in water.

3). Survival of herbaceous plants has been related to water depth at time of flooding. If flood waters are greater than a few centimeters above the soil surface, gas exchange through lenticels will be blocked (Armstrong 1968). In tree seedlings, those which have not leaved out will remain dormant until the waters recede. Leaves on seedling; which have already leaved out become chlorotic and drop off. Duration of the flood

will then decide survival (Hosner 1958). Harris (1975) recorded high mortality from flooding stress in most seedlings.

4). Siltation resulting from flood waters may have positive and negative imacts on the riparian community. Deposits of clay, silt, and sand impact seedling and herbaceous plant survival. Organic sediments have a high oxygen demand, thereby reducing floodwater oxygen content and putting stress on tree roots. However, flood discharges can rearrange sedimentary deposits (Petts 1984) and provide influx of nutrients which maintain the high primary productivity of riparian communities. New successional sites are often formed by the deposition of sediment in receding flood stages (Petts 1984).

5). Flood frequency has been found to influence the composition and diversity of herbaceous species. Bell (1974) found that as flood frequency decreased, herbaceous species diversity increased.

Severe frequent flooding during the growing season may decrease the growth of mature trees and decrease seedling survival. Depending on flood frequency, the duration and water temperature may also result in floodplain forest mortality. The lack of adaptability of upland species such as red oak, black locust, black cherry, beech, and hickories keeps them form becoming established in floodplain habitats.

A delicate balance exists between the flora and fauna of riparian habitats and the annual flood regime. Unusually high summer flows may scour beds of aquatic vegetation reducing cover for young of the year fish, turtles, and invertebrates. Summer destruction of these plant beds may affect waterfowl food supply and survival the following winter. Ill-timed artifical flows may destroy larvae of amphibians by flushing

them from pools and backwaters (Petts 1984). Eggs of reptiles buried on sandbars and islands may be inundated and drown. Ground nesting birds in riparian habitats may also experience high mortality of nests and nestlings.

EFFECTS OF REDUCED FLOWS ON RIPARIAN COMMUNITIES

Just as altering the flood timing and duration may impact riparian ecosystems, so also will reducing the magnitude of flooding. Petts (1984) states that flood-control facilities (such as Bluestone Dam) reduce normally higher winter flows and increase normally low summer flows. Over the course of a one year cycle, these dams 'smooth out' the variation which naturally occurs in a flood and drought cycle. Elimination or reduction in frequency of flooding limits opportunities for exchanges between the river and its former floodplain, so that processes which cause channel migration and construction of new wetlands is inhibited (Frith 1977).

Reduced flows can result in loss of sediment deposition, which are key factors in retaining riparian habitats. Reduced flows can adversely affect the reproduction of floodplain species, such as black willow whose seeds germinate in water. Schneider and Sharitz (1986) stated that seed dispersal, seed viability, seedling establishment, and seedling survivorship were all dependent on the timing and degree of riverine flooding, although several decades may pass before changes in riparian

community structure are noticed. Schneider (pers. comm.) recommended comparing the forest canopy species with the understory seedlings in an effort to assess changes in the structure of the vegetation.

Flow regulation may reduce habitat for wildlife, such as muskrat (Ondatra zibethica) and beaver (Castor canadensis), because of changes in food supply and cover. Kellerhals and Gill (1973) found that ducks needed the continuous production of successional vegetation, and that lush shoot growth ceased when flows were stabilized Overall, reduced soil moisture results in reduced vegetation density (Gill 1971). Reduced flooding of riparian habitats may also allow upland type species including oaks, black cherry, beech, and hickories to become established. In the aquatic habitat, reduced flows often result in reduced turbidity, allow-ing for increased algal and macrophyte growth.

Reduced flows can produce a vegetative community where none existed before. In the lower Colorado River, a confined river, pre-dam conditions included high floods which raced through a steep narrow gorge, limiting the formation of a riparian plant community. Since dam completion, a riparian community has formed along the river although it is a community not designed to be flooded. With this plant community has come changes in the wildlife composition (Petts 1984). Kellerhals and Gill (1973) noted that in the absence of continued initiation of primary succession, biological productivity would eventually decrease.

In the southern section of the New River Gorge National River, a floodplain exists, while in the northern section the river channel is confined. From this review we can anticipate the types of changes likely to occur from artifical flows. Quantity, timing, and quality of flow

discharges can produce a diverse range of responses in terms of vegetational structure and composition. These changes will likely be noticeable only through the initiation of long-term studies of the vege-tation and wildlife populations. Riparian habitats have evolved in a cycle of flood and drought, but it is a system in which there is a natural repeating cycle of events. Artifical manipulation of the flow regime without an understanding of the effects can destroy the valuable riparian ecosystem, as well its inseparable riverine habitat.

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PURPOSE AND JUSTIFICATION

In 1983 the National Park Service contracted with the Virginia Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife Sciences, VPI&SU, to conduct a biological survey of the New River Gorge National River. The purpose of the survey was to provide the NFS with biological information about the National River 'in order to formulate management plans and make decisions concerning future uses of the NRGNR. The study was divided into three components; 1) Riparian habitats and wildlife; 2) Fisheries; and 3) Mussels. This report comprises information about riparian habitats and wildlife in the NRGNR.

The specific objectives of this study were:

1). To identify and describe the riparian habitats of the New River Gorge National River.

2). To survey these habitats for birds, mammals, reptiles, and amphibians occurring there.

3). To provide density indices, where possible, for wild vertebrate species.

HABITATS AND VEGETATION

STUDY METHODS

During June-September 1984, we periodicly floated through the NRGNR using an inflatable rubber raft. We used the following criteria to characterize the major riparian habitats:

1). Dominant overstory tree species
2). Habitat width and slope
3). Ground cover (soil type and rocks)

Upland habitat types were described using the following criteria:

1). Dominant overstory tree species
2). slope aspect (direction)
3). Elevation

We visited all habitats at least three times (spring, summer, and fall) to identify plant species and to determine developmental chronology (Tables 2-17). We also mapped habitats along the NRGNR (Maps 1-10).

OVERVIEW OF HABITATS

Riparian sites in the southern section of the Gorge, Hinton to Meadow Creek, consist primarily of small floodplain forests with sycamore, river birch, black willow, and silver maple (Acer saccharinum) as dominant species (Tables 1,3,4,5). Much of the floodplain forest has been cleared or altered for farmland, industry, townsites, and homesites.

A few unusual riparian habitat types occur in the southern section of the Gorge including a site dominated by Virginia pine (Pinus virginiana) and quaking aspen, (Populus tremuloides) (RVP)(Table 6) and a talus slope near the 164 bridge, dominated by eastern hemlock (Tsuga canadensis) and upland hardwoods (HRR) (Table 7). An unusual floral community with several rare plant species occurs on an underlying sandstone ledge on the property of Union Carbide's Brooks Camp. (Table 9)(G. Rouse, pers. comm.).

Between Hinton and Meadow Creek, Mississippian age shales, siltstone, and impure limestone make up the underlying rock structure (Fuerst 1981). These geologic formations are relatively softer than those in the northern section of the Gorge and, through erosion, have developed into riparian floodplains.

Downstream from Meadow Creek, the river channel begins to narrow, the stream gradient increases, and wide floodplain habitats

become sparser. Rock rip-rap habitats (RRR) predominate, with only a single band of riparian hardwoods separating the river from the upland forest. Wider floodplains are found at the confluences of major tributaries, such as Glade Creek in Raleigh county.

The gradient of the river continues to increase throughout the Gorge. Downstream from Thurmond, large talus blocks of sandstone from the cliffs above become the dominant riparian shoreline. Between Meadow Creek and Fayette Station, the dominant geologic strata is Pennsylvanian age non-marine sandstone, shale, and coal seams, which are relatively hard and conducive to cliff formation (Fuerst 1981).

The soils underlying riparian habitats and adjacent slopes between Hinton and Buffalo Creek, near Thayer, are of the Calvin-Gilpin association (USDA 1984). They are moderately deep, well drained, and medium textured. Interspersed with the Calvin-Gilpin association are soils of the Monongehela-Kanawha-Chalgrin association. These soils are deep, nearly level to strongly sloping, and moderately well drained. They are acid and lime influenced, and are found on stream terraces and high and low floodplains (USDA 1984). These soils exist at three sites between Hinton and Meadow Creek: 1) Bass Lake Camp/Summers Co. Rec. Facility; 2) Sandstone/164 area; and 3) Coal industry site/Meadow Creek. All of these sites probably once contained the richest floodplain forests, but were also the most attractive sites for development.

Along the river between Buffalo Creek and Fayette Station are soils of the Steep rock land-Dekalb-Gilpin association (USDA 1975).

They consist of rough broken sandstone cliffs on uplands and are moderately deep, well drained, and coarse textured. These soils are also found along some of the major tributary streams.

Ridgetop habitat sites border between the Steep rock land-Dekalb-Gilpin association and the Dekalb-Gilpin-Ernest association which are moderately deep, well drained, and moderately to medium coarse textured soils. They are mostly sloping to very steep soils on dissected uplands and deep, moderately well drained, mostly sloping or steep soils on foot slopes (USDA 1975).

HABITAT DESCRIPTIONS

The plant communities along the NRGNR are diverse. Riparian habitats are associated with floodplains in the southern part of the Gorge and steep rocky slopes in the northern part. Several habitats exist on non-flooded terraces between riparian and upland sites. These include farmland and old fields. Upland habitats include mixed hardwoods, tributary stream borders, and pine-dominated ridgetops A general description of each NRGNR habitat as defined by us, including their dominant overstory and understory vegetative components follows (Table 1).

(1) Stunted sycamore/willow habitats (SSW) consist of sycamore, black willow, and river birch saplings heavily damaged by flooding. The understory is predominantly cobble and boulder. This habitat occupies the lowest terrace and is the most frequently flooded.

(2) Sycamore/willow/birch/silver maple habitats (SWB) are the dominant riparian habitat in the southern two-thirds of the NRGNR. They are composed primarily of sycamore, black willow, river birch, silver maple, and honey locust (Gleditsia triacanthos). although some variation occurs between sites. Typically, these are dense stands of small diameter trees (<8 inches) that occur on sites of deposition, such as floodplains and islands. The soils are sandy mud. Understories vary depending on amount of sunlight reaching the forest floor and frequency of flooding.

(3) Mature sycamore habitats (SYC) are similiar to SWB habitats, but are composed primarily of large sycamores. This habitat is probably not as common as it once was due to human occupancy along the river and the resulting removal of large trees. These areas also appear to be preferred camping sites among river recreationalists.

(4) Willow habitats (W) are similiar to SWB habitats, but black willow is the dominant species. This is an uncommon habitat usually found on sandy soils and beaches.

(5) Riparian Virginia pine (RVP) is an unusual riparian habitat, with the overstory dominated by Virginia pine. The understory is composed of shrubs and grasses, with cobble and sandy soil. It is found at three sites between Hinton and 164 bridge.

(6) Hemlock rip-rap (HRR) habitats occur along the river where upland slopes >30% meet the river. They are principally composed of hemlock, oaks (Quercus sp.), Ohio buckeye (Assculus glabra), and

other upland hardwoods. A good example of this habitat exists at the base of the cliffs near the I64 bridge, river left.

(7) Rock rip-rap (RRR) habitats, similiar to HRR habitats, are the most common habitat type between Meadow Creek and Thurmond (Maps 1-10). They are found on slopes >30% and consist of upland hardwood species. Large rocks account for most of the understory.

(8) Boulder (B) habitats are common between Thurmond and Fayette Station. They consist of large talus sandstone blocks that have fallen from the surrounding cliffs. Some riparian trees (i.e. sycamore, silver maple, etc) grow near the river's edge, with upland hardwoods slightly above. Sweet gum (Liquidambar stvraciflua) also is associated with this habitat and apparently does not occur elsewhere in the NRGNR.

(9) Farmland (FAR) habitats are found on high floodplains and non-flooded terraces in the southern area of the NRGNR. They are open fields or meadows, grazed by livestock or planted in corn. They often include exotic tree species.

(10) Old field (OLD) habitats are located on non-flooded terraces (since completion of Bluestone Dam) primarily in the southern area of the NRGNR. They are usually abandoned homestead or farming sites with heavy underbrush, thorns, and forbs.

(11) Cedar field (CDR) habitats are similiar to OLD habitats, but represent a later successional stage as illustrated by the growth of red cedar (Juniperus virginiana). An example of this type is found at Sandstone Falls State Park.

(12) Tributary stream gorge (TSG) habitats are found bordering most tributary streams in the NRGNR. They are composed of hemlock, yellow birch (Betula lutea), red maple (Acer rubrum), and buckeye. The understories commonly include rhododendron and ferns. They are usually cool and moist,

(13) Upland hardwood (UP1) and (UP2) habitats cover the sides of the NRGNR from the border with floodplain forests to ridgetops. Species composition is primarily red oak (O. rubrum), tulip poplar (Liriodendron tulipiferia), black cherry (Prunus serotina), maples, and hickories (Carva sp.). Species composition varies with elevation and aspect. South-east facing slopes are referred to as UP1; north-west facing slopes are referred to as UP2.

(14) Ridgetop (RGT) habitats are found along the rim of the Gorge on the plateaus. Species composition includes Virginia pine, white pine (Pinus strubus), hemlock, chestnut oak (O. prinus) scrub oak (0. ilicifolia), and upland hardwoods. Examples of these habitats are found at overlooks at Grandview State Park and Beauty mountain.

(15) Developed (DEV) habitats refer to areas along the river where the natural riparian vegetation has been replaced by homes, trailers, and industry.

(16) Disturbed (DIS) habitats include roadways, strip mines, and clearcuts; areas where the natural upland vegetation has been altered.

TABLE 1. HABITAT CLASSIFICATIONS ALONG THE NEW RIVER GORGE NATIONAL RIVER, W.V. 1984-85.

HABITAT CLASS.	MAJOR OVERSTORY	UNDERSTORY	GROUND COVER	SLOPE	GENERAL DISTRIBUTION
		RIPARIAN HABITATS			
MATURE SYCAMORE (SYC)	sycamore slippery elm honey locust	poison ivy	sand grasses self-heal ragweed ox-eye daisy	0-10%	Hinton-Thurmond
	Description: sites of deposition, usually at bends in the river or islands. Occurring on sandy soils, usually little understory, often as a result of heavy camping impacts.				
WILLOW (W)	black willow		sand mud grasses	0-20%	near Prince
	Description: similiar to above, soils contain more sand. pure willow stands are not common in the Gorge.				
SYCAMORE WILLOW BIRCH (SWB)	honey locust, silver maple	buckeye poison ivy	sand, mud cobble stinging nettle ragweed	0-10%	Hinton-Cunard
	Description: similiar to willow and sycamore, usually more cobble in the soil.				
STUNTED SYCAMORE/ WILLOW (SSW)			grasses cobble water willow	0%	Glade-Cunard
	Description: cobble and boulder understory, trees stunted growth due to flooding damage, stripped of soil, often submerged, especially in spring.				
HEMLOCK/ RIP-RAP (HRR)	hemlock yellow birch		rock	>45%	I64 area
	Description: rock rip-rap area dominated by hemlocks and upland hardwoods, little understory.				
RIPARIAN VIRGINIA PINE (RVP)	virginia pine river birch sycamore	hazel alder	grasses	0-10%	Hinton-I64 bridge area
	Description: small clumps of pines within young SWB habitat, an unusual riparian community type.				

ROCK RIP-RAP (RRR)	red oak sycamore river birch		rock	>30%	Meadow Creek-Fayette Station

Description: little or no vegetation, slope usually greater than 30%, common in northern 2/3 of the Gorge.

BOULDER (B)	sycamore yellow birch sweet gum		large rock	>30%	Cunard-Rt 19

Description: large rock boulders, associated with the northern 1/5 of the Gorge where the river is narrow and the slopes are steep.

DEVELOPED (DEV)	varied	varied	grasses, bare soil	0-20%	Hinton area

Description: areas along the river heavily altered by man. Driveways, homes, trailers, and docks are common.

NON-FLOODED TERRACE HABITATS

FARMLAND (FAR)	sycamore locust bl. willow	swamp rose hazel alder spicebush	grasses bluets blue-eyed grass yarrow blue false indigo swartweed joe-pye weed day lily	0-10%	Hinton area

Description: areas lightly grazed by livestock, tree density usually thin, understory consists of shrub clumps, grasses, and abundant forbs due to adequate sunlight penetrating to the ground layer.

CEDAR FIELD (CDR)	red cedar	multiflora rose blackberries	grasses(Triticum) deptford pink prickly dewberry		non-riparian terraces

Description: old field and homestead areas, grasses and blackberries are the predominant understory, fields have been invaded by red cedar.

OLD FIELD (OLD)		blackberries	grasses		non-riparian terraces

Description: old fields, tall grasses and thorns, periodic cutting prevents it from becoming the above mentioned cedar field habitat.

UPLAND HABITATS

UPLAND HARDWOODS (UP1,UP2)	oaks, maples, hickories beech tulip poplar black cherry	witch hazel hornbeam sumac striped maple wild grape	rich organic soils mayapple trilium christmas fern daisy fleabane purple-flowering rasberry	>30%	upland slopes surrounding the NRGNR

Description: mixed hardwood forests on steep slopes, species composition of the habitats varies with slope, elevation, and aspect. Borders with roadsides produce greater variety of understory vegetaion.

TRIBUTARY STREAM GORGES (TSG)	hemlock, yellow birch buckeye	ferns mosses	organic soils exposed rock	entire Gorge area

Description: usually hemlock and mixed hardwood stands associated with the secondary streams entering the NRGNR, sunlight penetration restricted. Similiar to upland hardwoods.

RIDGETOPS (RGT)	Virginia pine White pine Hemlock Scrub oak	rhododendron bracken fern	sandstone cliffs	Grandview St. Pk. Beauty Mtn

Description: areas situated on the gorge rim, usually dry, and weather beaten, sandstone cliffs and ledges.

DISTURBED AREAS (DIS)	usually none		grasses wildflowers	weathered soils	I64 bridge area, old strip mines

Description: areas disturbed by construction activities, such as road grades (I64) and abandoned strip mines. Exposed ground cover, numerous wild flowers.

TABLE 2. CHARACTERISTIC VEGETATION ASSOCIATED WITH AQUATIC HABITATS.

SPECIES
EMERGENTS
Arrowhead (Sagittaria sp.
Pickerel weed (Pondederia cordata)
Lizard tail (Sauruus cernuus)
Water willow (Justica sp.)
SUBMERGENTS
Curly pondweed (Potamogeton crispus)
Elodea (Elodea canadensis)
Wild celery (Vallisneria americana)
Water stargrass (Heteranthera dubia)
Slender naiad (Najas minor)

TABLE 3. CHARACTERISTIC VEGETATION ASSOCIATED WITH STUNTED SYCAMORE, WILLOW HABITATS.

SPECIES	AREA	BLOOMING DATE
TREES		
Sycamore (Platanus occidentalis)	1,2	
River birch (Betula nigra)	1,2	
Black willow (Salix nigra)	1,2	
Silver maple (Acer saccharinum)	1,2	
SHRUBS		
Smooth sumac (Rhus glabra)	2	
FLOWERING PLANTS		
Jewelweed, spotted (Impatiens capensis)	1	
Jewelweed, pale yellow (Impatiens pallida)	1	
Daisy fleabane (Erigeron annuus)	1	
Buttercup (Ranunculus sp.)	1	
Water speedwell (Veronica anagallis-aquatica)	1	
Poison Ivy (Rhus radicans)	1	
Purple milkweed (Asclepias purpurascens)	1	
Spiderwort (Tradescantia virginiana)	1,2	
Sedge (Caryx sp.)	1	
Water willow (Justica sp.)	1,2	

1=Terry, 2=Hinton.

TABLE 4. CHARACTERISTIC VEGETATION ASSOCIATED WITH SYCAMORE, WILLOW, AND BIRCH (SWB) RIPARIAN HABITATS.

SPECIES	AREA	BLOOMING DATES
TREES		
American elm (Ulmus americana)	1,3	
Black willow (Salix nigra)	4	
Boxelder (Acer negundo)	2	
Catalpa (Catalpa speciosa)	4	
Fringetree (Chionanthus virginicus)	5	5/5
Hop hornbeam (Ostrya virginiana)	1	
River birch (Betula nigra)		
Slippery elm (Ulmus rubra)		
Sycamore (Platanus occidentalis)		
Silver maple (Acer saccharinum)		
Paw paw (Asimina triloba)		
Honey locust (Gleditsia triacanthos)		
SHRUBS		
Buttonbush (Cephalanthus occidentalis)	3	
Hazel alder (Alnus serrulata)	3	
Dogwood (Cornis stoleniferia)	3	
Smooth azalea (Rhododenron arborescens)	3	
Hog peanut (Amphicarpa bracteata)	1	
FLOWERING PLANTS		
Bedstraw (Galium sp.)	1	5/1
Bluebells (Mertensia sp.)	1	5/1
Buttercup (Ranunculus sp.)	3	5/30
Cardinal flower (Lobelia cardinalis)	4	7/15
Chicory (Chicorium intybus)	4	6/13
Common mullein (Verbascum thapus)	6	7/15
Creeping yellow cress (Rorippa islandica)		
Crown vetch (Coronilla varia)	4	6/16
Day lily (Hemerocallis fulva)	4	6/13
False blue indigo (Baptisia australis)	3	5/30
Fringed loosestrife (Lysimachia ciliata)	1	7/30
Golden ragwort (Senecio aureus)	1	5/1
Great lobelia (Lobelia siphilitica)	4	8/18
Heal-all mint (Prunella vulgaris)	3	5/30
Hedge bindweed (Convolvulus sepium)	4	9/6
Horse nettle (Solanum carolinense)		6/20
NY Ironweed (Veronia noveboracensis)	6	8/15
Jewelweed, pale yellow (Impatiens pallida)	1	7/30
Jewelweed, spotted (Impatiens capensis)	1	7/30
Joe-Pye weed (Eupatorium dubium)		
Larkspur (Delphinium sp.)		
Late goldenrod (Solidago gigantea)	4	7/30
Mistflower (Eupatorium coelestinum)	4,6	8/18
Moneywort (Lysimachia nummularia)	3	5/30
Pale spike lobelia (Lobelia spicata)	6	9/7
Field bindweed (Convolvulus arvensis)	6	7/15
Spring cress (Cardamine bulbosa)	1	5/1

Running tickseed (Coryopis auriculata)	3	5/30
Sensitive plant (Cassia nictitans)	1	5/1
Smooth phlox (Phlox glaberrima)	6	7/15
Stinging nettles (Urtica dioica)	1,2	5/1
Tick-trefoil (Desmodium sp.)	4	9/6
Trumpet creeper (Campis radicans)	4	7/20
Violet (Viola sp.)	1	5/1
Virginia creeper (Parthenocissus quinquefolia)	3	
White wood aster (Aster divaricatus)	4	9/5
Wild potato vine (Ipomoea pandurata)	1	7/30
Wild sage (Salvia lyrata)	1	
Wingstem (Actinomeris alternatifolia)	4	9/6
Trout lily (Erythronium americanum)	3	5/30
Smartweed (Polygonum sp.)		
GRASSES/SEDGES		
Rush sp. (Scirpus americanus)	3	
Spikerush (Elecharis sp.)	1	
Sedge (Caryx sp.)	1	
Horsetail (Equisetum sp.)	3,7	

* 1=Terry SB, 2=BUS, 3=Glade creek, 4=FBF, 5=River Rd., 6=I64 riparian, 7=Long Bottom

TABLE 5. CHARACTERISTIC VEGETATION ASSOCIATED WITH SYCAMORE RIPARIAN HABITATS.

SPECIES	AREA	BLOOMING DATES
TREES		
Sycamore (Platanus occidentalis)		
River birch (Betula nigra)		
Slippery elm (Ulmus rubra)		
Boxelder (Acer negundo)		
Black walnut (Juglans nigra)		
Silver maple (Acer saccharinum)		
Kentucky Coffee tree (Gymnocladus dioica)		
Tree of Heaven (Ailanthus altissima)		
SHRUBS		
Spicebush (Lindera benzoin)		
Smooth sumac (Rhus glabra)		
FLOWERING PLANTS		
Poison Ivy (Rhus radicans)		
Va creeper (Parthenocissus quinquefolia)		
Stinging nettle (Urtica dioica)		
Jewelweed, spotted (Impatiens capensis)		5/18
Gill-over-the-ground (Glechoma hederacea)		
Daisy fleabane (Erigeron annuus)		5/18
White clover (Trifolium repens)		5/18
Yellow iris (Iris pseudacorus)		5/18
Asiatic dayflower (Commelina communis)		6/20
Tickseed sunflower (Bidens aristosa)		8/13
Ox-eye (Heliopsis helianthodes)		8/13
Great lobelia (Lobelia siphilitica)		8/13
NY Ironweed (Veronia noveboracensis)		8/13
Wild senna (Cassia hebecarpa)		7/23
False dragonhead (Physostegia virginiana)		7/23
Bouncing bet (Saponaria officinalis)		7/23
Sensitive plant (Cassia nictitans)		7/23
Wingstem (Actinomeris alternifolia)		7/23
Bee-balm (Monarda didyma)		7/23
Sedge (Cyparis sp.)		
Panic grass (Panicum sp.)		
Blue-eyed grass (Sisyinchium montanum)		5/18

sites at Sandstone Falls State Park and directly below Brooks Falls.

TABLE 6. CHARACTERISTIC VEGETATION ASSOCIATED WITH RIPARIAN VIRGINIA PINE HABITATS.

SPECIES	AREA	BLOOMING DATES
TREES		
Virginia pine (Pinus virginiana)		
Sycamore (Platanus occidentalis)		
River birch (Betula nigra)		
Black willow (Salix nigra)		
American elm (Ulmus americana)		
Green ash (Fraxinus pennsylvanica)		
Quaking aspen (Populus tremuloides)		
Black walnut (Juglans nigra)		
SHRUBS		
Red-osier dogwood (Cornus stolonifera)		
Speckled alder (Alnus rugosa)		
FLOWERING PLANTS		
Spiderwort (Tradescantia virginiana)		5/18
Lyre-leaved sage (Salvia lyrata)		
Blue false indigo (Baptisia australis)		
Tickseed (Coreopsis lanceolata)		5/18
Beardtongue (Pentemon sp.)		

sites along River Rd. and near I64 bridge, river right.

TABLE 7. CHARACTERISTIC VEGETATION ASSOCIATED WITH HEMLOCK-RIP-RAP AND ROCK-RIP-RAP HABITATS.

SPECIES	BLOOMING DATES
TREES	
Basswood (Tilia americana)	
Cucumber magnolia (Magnolia acuminata)	
Ohio buckeye (Aesculus glabra)	
Red maple (Acer rubrum)	
American beech (Fagus grandifolia)	
Hemlock (Tsuga canadensis)	
Green ash (Fraxinus pennsylvanica)	
Sycamore (Platanus occidentalis)	
Black walnut (Juglans nigra)	
Tulip poplar (Liriodendron tulipifera)	
Paw paw (Asimina tribola)	
Red Oak (Quercus rubra)	
SHRUBS	
Maple-leaf viburnum (Viburnum acerifolium)	
Spicebush (Lindera benzoin)	
Ball-blet fern	
FLOWERING PLANTS	
Poison Ivy (Rhus radicans)	
Tall bellflower (Campanula americana)	7/15
Enchanters nightshade (Circarea quadrisulcata)	7/23
Wild ginger (Asarum canadense)	

site at river left I64 bridge.

TABLE 8. CHARACTERISTIC VEGETATION ASSOCIATED WITH BOULDER HABITATS.

SPECIES	AREA BLOOMING DATES
TREES	
River birch (Betula nigra)	
Sycamore (Platanus occidentalis)	
Slippery elm (Ulmus rubra)	
Boxelder (Acer negundo)	
Sweet gum (Liquidambar styraciflua)	
Black locust (Robinia pseudoacacia)	
Green ash (Fraxinus pennsylvanica)	
Musclewood (Carpinus caroliniana)	
Hickory (Carya sp.)	
Silver maple (Acer saccharinum)	
Cucumber magnolia (Magnolia acuminata)	
SHRUBS	
Spicebush (Lindera benzoin)	
FLOWERING PLANTS	
Poison Ivy (Rhus radicans)	
Va creeper (Parthenocissus quinquefolia)	
Wild potato vine (Ipomoea pandurata)	
Lyre-leaved sage (Salvia lyrata)	5/9
Golden ragwort (Senecio aureus)	

site near Fayette Station bridge.

TABLE 9. CHARACTERISTIC VEGETATION ASSOCIATED WITH CAMP BROOKSIDE, A HABITAT SIMILIAR TO RVP, BUT ON A NON-FLOODED TERRACE.

SPECIES	BLOOMING DATES
TREES	
Virginia pine (Pinus virginiana)	
Tulip poplar (Liriodendron tulipiferia)	
Silverbell tree (Helesis carolina)	
Black cherry (Prunus serotina)	
Chestnut oak (Quercus prinus)	
Flowering dogwood (Cornis florida)	
Red maple (Acer rubrum)	
Silver maple (Acer saccharinum)	
Sugar maple (Acer saccharum)	
Red cedar (Juniperus virginiana)	
Redbud (Cercis canadensis)	
Musclewood (Carpinus caroliniana)	
Green ash (Fraxinus pennsylvanica)	
Southern crab apple (Malus augustifolia)	
Fringetree (Chionanthus virginicus)	5/1
SHRUBS	
Downy serviceberry (Amelanchier spicata)	
Black haw (Viburnum prunifolium)	
Rhododendron (Rhododendron sp.)	
Hackberry (Celtis sp.)	
Blueberry (Vaccinium sp.)	
Huckleberry (Gaylussacia sp.)	
FLOWERING PLANTS	
St. Johns wort (Hypericum sp.)	
Dwarf plantain (Goodyera repens)	
Wood spurge (Euphorbia sp.)	
Dwarf dandelion (Krigia virginica)	
Heal-all mint (Prunella vulgaris)	
Ox-eye (Heleopsis heleanthodes)	
Wild potato vine (Ipomoea pandurata)	
Whorled rosinweed (Silphium trifoliatum)	
Sensitive plant (Cassia nicotans)	
Stary campion (Silene stellata)	
Beggar-tick (Bidens sp.)	
Pencil flower (Stylosanthes biflora)	
Butterfly weed (Asclepias tuberosa)	
Golden Alexander (Zesia sp.)	
Golden rod (Solidago sp.)	
Tickseed (Coryopsis pubescens)	
Flowering spurge (Euphorbia corollata)	
Small flowered phacelia (Phacelia dubia)	

Solomons Seal (Polygonatum biflorum)
False Solomons seal (Smilacina racemosa)
White violet (Viola striata)
Kidneyleaf buttercup (Ranunculus abortivus)
Stonecrop (Sedum sp.)
Sweet Cicely (Osmorhiza claytoni)
Wood sorrel (Oxalis violacea)
Common ragweed (Ambrosia artemisiifolia)
Moss pink (Phlox subulata)
Rock cress (Arabis sp.)
Rattlesnake plantain (Goodyera sp.)
Virginia cowslip (Mertensia virginica)
Cream violet (Viola striata)
Wild bergamot (Monarda media)
Garden phlox (Phlox paniculata)
False blue indigo (Baptisia australis)
Knodding onion (Allium cernuum)
Bouncing bet (Saponaria officinalis)
Black-eyed susan (Rudbeckia hirta)
Sedge (Cyperus sp.)
Sedge (Caryx sp.)
Turkey foot grass
Panic grass (Panicum stypatum)
Melic grass (Melica mutica)
Three-square sedge (Sciurpus americanus)
Cutgrass

TABLE 10. CHARACTERISTIC VEGETATION ASSOCIATED WITH FARM HABITATS.

SPECIES	AREA	BLOOMING DATES
TREES		
Southern crab apple (Malus augustifolia)		
Black locust (Robinia pseudoacacia)		
Black walnut (Juglans nigra)		
Chinese chestnut (Castanea mollissima)		
Red mulberry (Morus rubra)		
SHRUBS		
Multi-flora rose (Rosa multiflora)		
Spicebush (Lindera benzoin)		
FLOWERING PLANTS		
Yucca (Yucca filamentosa)		6/27
Horse nettle (Solanum carolinense)		6/20
Sharp-winged monkey flower (Mimulus alatus)		6/20
Purple milkeed (Asclepias purpurascens)		
Deptford pink (Dianthus armeria)		
Blue false indigo (Baptisia australis)		
Heal-all mint (Prunella vulgaris)		
Poison Ivy (Rhus radicans)		
Yarrow (Achillea millefolium)		
Blue-eyed grass (Sisyrinchium sp.)		
Bluets (Houstonia caerulea)		
Daisy fleabane (Erigeron annuus)		
Wood anenome (Anemone quinquefolia)		
Spotted Joe-pye weed (Eupatorium maculatum)		

sites located near I64 bridge and across the river from Sandstone.

TABLE 11. CHARACTERISTIC VEGETATION ASSOCIATED WITH OLD FIELDS AND CEDAR FIELD HABITATS.

SPECIES	AREA	BLOOMING DATES
TREES		
Honey locust (Gleditsia triacanthos)	2	
Boxelder (Acer negundo)	2	
Red cedar (Juniperus virginiana)	2	
Redbud (Cercis canadensis)	2	
American elm (Ulmus americana)	2	
SHRUBS		
Staghorn sumac (Rhus typhina)	1,2	
Multiflora rose (Rosa multiflora)	1,2	
Blackberry (Rubus allegheniensis)	1,2	
FLOWERING PLANTS		
Hollow Joe-pye-weed (Eupatorium fistulosum)	1	
Wild senna (Cassia hebecarpa)	1	
Bouncing bet (Saponnaria officinalis)	1	
Wild potato vine (Ipomoea pandurata)	1	
Asiatic dayflower (Commelina communis)	1	
St. Johns wort (Hypericum sp.)	1	
Butterfly weed (Asclepias tuberosa)	1	
Spotted knapweed (Centaurea maculosa)	1	7/30
Jewelweed, pale yellow (Impatiens pallida)	1	
Bluecurls (Trichostema dichotomum)	1	7/30
Smaller forget-me-not (Myosotis laxa)	2	5/18
Golden alexanders (Zizia aurea)	2	
Henbit (Lamium amplexicaule	2	5/18
Rock selaginella moss	2	
Deptford pink (Dianthus armeria)	2	6/19
Rough-fruited cinquefoil (Potentilla recta)	2	6/19
Daisy fleabane (Erigeron annuus)	2	6/19
Yarrow (Achillea millefolium)	2	6/19
Purple milkweed (Asclepias purpurascens)	2	6/19
Wheatgrass (Triticum sp.)	2	
Prickly dewberry (Rubus flagellaris)	2	
Poison Ivy (Rhus radicans)	1	

1=Terry launch, 2=Sandstone Falls cedar field.

TABLE 12. CHARACTERISTIC VEGETATION ASSOCIATED WITH TRIBUTARY STREAM GORGE HABITATS.

SPECIES	AREA	BLOOMING DATES
TREES		
Yellow birch (Betula lutea)	1,2	
Red maple (Acer rubrum)	1,2	
Tulip poplar (Liriodendron tulipifera)	1,2	
Hemlock (Tsuga canadensis)	1,2	
American beech (Fagus grandifolia)	1	
Ohio buckeye (Aesculus glabra)	1,2	
Slippery elm (Ulmus rubra)	2	
Flowering dogwood (Cornis florida)	2	
Sycamore (Platanus occidentalis)	2	
Musclewood (Carpinus caroliniana)	2	
Witchhazel (Hamamelis virginiana)	2	
SHRUBS		
Catawba rhododendron (Rhododendron catawbiense)		
Great rhododendron (Rhododendron maximum)		
Spicebush (Lindera benzoin)		
Christmas fern		
FLOWERING PLANTS		
Smooth aster (Aster laevis)	3	9/24
Jewelweed, spotted (Impatiens capensis)		
Mayapple (Podophyllum peltatum)	2	5/18
Jack in the pulpit (Arisaema atrorubens)	2,4	
Red trilium (Trillium erectum)	4	5/18
Violet (Viola sp.)		
Canada violet (Viola canadensis)		
Solomons seal (Polygonatum biflorum)		

1=Babcock, 2=Fall Branch, 3=Laurel Creek, 4=Mill Creek.

TABLE 13. CHARACTERISTIC VEGETATION ASSOCIATED WITH UPLAND HARDWOOD 1 HABITATS.

SPECIES	AREA	BLOOMING DATES
TREES		
Black cherry (Prunus serotina)		
Red oak (Quercus rubra)		
Green ash (Fraxinus pennsylvanica)		
Red maple (Acer rubrum)	3	
Striped maple (Acer pennsylvanicum)		
Flowering dogwood (Cornis florida)	3	
Ohio buckeye (Aesculus glabra)		
Tulip poplar (Liriodendron tulipera)		
White oak (Quercus alba)		
Silverbell tree (Helesia carolina)	3	
Shagbark hickory (Carya ovata)	3	
Bladdernut tree (Staphylea trifolia)	3,1	
American beech (Fagus grandifolia)	3	
Black gum (Nyssa sylvatica)	3	
Cucumber magnolia (Magnolia acuminata)	3	
Fraser magnolia (Magnolia fraseri)		5/5
Boxelder (Acer negundo)		
Russian olive (Elaeagnus augustifolia)	1	
Persimmon (Diospyros virginiana)		
SHRUBS		
Christmas fern		
Spicebush (Lindera benzoin)		
Viburnum (Viburnum sp.)	3	
Maple-leaf viburnum (Viburnum acerifolium)		
Rattlesnake fern (Botrichum virginiana)		
Wood fern (Dryopterus sp.)		
FLOWERING PLANTS		
Poison Ivy (Rhus radicans)		
Stinging nettle (Urtica dioica)	3	
Spotted wintergreen (Chimaphilia maculata)	3	
Jack-in-the-pulpit (Arisaema atrorubens)	3	
Wild ginger (Asarum canadense)	3	
Twin leaf (Jeffersonia diphylla)	3,1	
Mayapple (Podophyllum peltatum)	3,1	
Va creeper (Parthenocissus quinquefolia)		
Sweet Cicely (Osmorhiza claytoni)	3	5/1
Gill-over-the-ground (Glechoma hederacea)	3	5/1
Bloodroot (Sanguinaria canadensis)	3	5/1
Blue phlox (Phlox divaricata)	3	5/1
Larkspur (Delphinium sp.)	3	5/1
Wood violet (Viola palmata)	3	5/1

Solomons Seal (Polygonatum biflorum)		
Daisy fleabane (Erigeron annuus)		
Stonecrop (Sedum sarmentosum)	3	
Meadow Rue (Thalictrum sp.)	3,1	
Hog peanut (Amphicarpa bracteata)	3	
Avens (Geum sp.)		
Cinquefoil (Potentilla sp.)		
Hairy meadow parsnip (Thaspium barbinoda)		
Sheep sorrel (Rumex acetosella)		
Lyre-leaved sage (Salvia lyrata)		
Melic grass (Melic mutica)		
Mustard (Cardamine sp.)	3	
Larger blue flag (Iris versicolor)	4	
Joe-pye weed (Eupatorium dubium)		
Dutchmans pipe (Aristolochia durior)	1	5/30
Honewort (Cryptotaenia canadensis)	1	5/30
Spikerush (Elecharis sp.)	1	
Sedge (Caryx crinita)		
Sedge (Caryx grisea)		
Water speedwell (Veronica anagallis-aquatica)	1	5/30
Mint (Meehania sp.)		
Goatsbeard (Tragopogon pratensis)		
Rough-fruited cinquefoil (Potentilla recta)		
Sessile-flowered trilium (Trillium sessile)		
Common polypody (Polypodium virginianum)		
Sweet William catchfly (Silene armeria)	3	7/30
Thin-leaved coneflower (Rudbeckia triloba)		
Virgin's bower (Clematis virginiana)		
Purple-flowering rasberry (Rubus odoratus)		

1=Mill Creek, 3=Terry, 4=River Rd.

TABLE 14. CHARACTERISTIC VEGETATION ASSOCIATED WITH UPLAND HARDWOOD 2 HABITATS.

SPECIES	AREA	BLOOMING DATES
TREES		
Black cherry (Prunus serotina)		
Red oak (Quercus rubra)		
Green ash (Fraxinus pennsylvanica)	1	
Slippery elm (Ulmus rubra)		
Striped maple (Acer pennsylvanicum)		
Sugar maple (Acer saccharum)		
Ohio buckeye (Aesculus glabra)		
Tulip poplar (Liriodendron tulipera)		
White oak (Quercus alba)		
Chestnut oak (Quercus prinus)		
Witchhazel (Hamamelis virginiana)		
SHRUBS		
Christmas fern		
Spicebush (Lindera benzoin)		
FLOWERING PLANTS		
Wild stonecrop (Sedum ternatum)	2	4/30
Wild geranium (Geranium maculatum)	1,2	
Golden ragwort (Senecio aureus)	2	
Sweet Cicely (Osmorhiza claytoni)	2	
Larkspur (Delphinium sp.)	2	
Blue phlox (Phlox divaricatus)	2,1	
Poison Ivy (Rhus radicans)		
Mayapple (Podophyllum peltatum)	1	
Bloodroot (Sanguinaria canadensis)	1	
Solomons seal (Polygonatum biflorum)	1	
False Solomons seal (Smilacina racemosa)	1	
Daisy fleabane (Erigeron annuus)	1	
Violet (Viola sp.)		
Bush clover (Lezpedeza sp.)	2	
Bottle brush grass	2	
Common evening primrose (Oenothera biennis)	2	7/30
Jewelweed, spotted (Impatiens capensis)	1	
Hairy wood mint (Blephilia hirsuta)		7/30
Butterfly weed (Asclepias tuberosa)		7/30
Asiatic dayflower (Commelina communis)		7/30
Queen Annes Lace (Daucus carota)	1	7/30
Woodland sunflower (Helianthus divaricatus)	1	7/30
Tall bellflower (Campanula americana)	1	7/30
Purple-flowering rasberry (Rubus odoratus)	1	
Dutchman's pipe (Aristolochia durior)		

1=McKendree Rd, 2=Rt 20.

TABLE 15. CHARACTERISTIC VEGETATION ASSOCIATED WITH RIDGETOP HABITATS.

SPECIES	AREA
TREES	
American Holly (Ilex opaca)	1
Big tooth aspen (Populus grandidentata)	1
Black birch (Betula lenta)	1,2
Post oak (Quercus stellata)	1
Scrub oak (Quercus ilicifolia)	1
Chestnut oak (Quercus prinus)	1,2
Sassafras (Sassafras albidum)	1
Virginia pine (Pinus virginiana)	1
White pine (Pinus strubus)	2
Red maple (Acer rubrum)	1,2
Tulip poplar (Liriodendron tulipifera)	1,2
Hemlock (Tsuga canadensis)	1,2
American beech (Fagus grandifolia)	2
SHRUBS	
Mountain laurel (Kalmia latifolia)	1,2
Catawba rhododendron (Rhododendron catawbiense)	1,2
Great rhododendron (Rhododendron maximum)	1,2
Greenbrier (Smilax sp.)	1
Bracken fern (Pteridium aquilinum)	2

1=Beauty Mountain, 2=Grandview State Park.

TABLE 16. CHARACTERISTIC VEGETATION ASSOCIATED WITH WETLAND HABITATS.

SPECIES
SHRUBS
Rose Bay Rhododendron
St. Johns wort (Hypericum sp.)
FLOWERING PLANTS
Beetleweed (Galax aphylla)
Pink Lady slipper (Cypripedium acaule)
Lily of the valley (Maianthemum canadense)
Small round leaved orchis (Orchis rotundifolia)
Bur-reed (Sparganium sp.)

site on Kate's Branch.

TABLE 17. CHARACTERISTIC VEGETATION ASSOCIATED WITH CLIFFS, ROADSIDES, AND RAILROAD TRACKS.

SPECIES	AREA	BLOOMING DATES
SHRUBS		
Red bud (Cercis canadensis)	1	
Hairy lip fern (Chelanthes lanosa)	2	
Kudzu-vine	3	
FLOWERING PLANTS		
Purple milkweed (Asclepias purpurascens)	1	
Daisy fleabane (Erigeron annuus)	1	
Everlasting pea (Lathyrus latifolius)	1	
Chicory (Chicorium intybus)	1	
Fire pink (Silene virginica)	2	
Moss pink (Phlox subulata)	2	
Morning glory (Ipomoea purpurea)	1,3	
Butterfly weed (Asclepias tuberosa)	1	
Red clover (Trifolium pratense)	1	
Mallow (Sida hermaphodite)	1	7/23
Teasel (Dipsacus laciniatus)	1	7/23
Burdock (Arctium minus)	1	7/23
Wingstem (Actinomeris alternatfolia)		
Woodland sunflower (Helianhus divaricatus)		
Late purple aster (Aster patens)	1	9/25
Pokeweed (Phytolacca americana)	3	9/7
Biennial gaura (Gaura biennis)	3	9/7

1=roadside, 2=shale cliff, 3=railroad tracks.

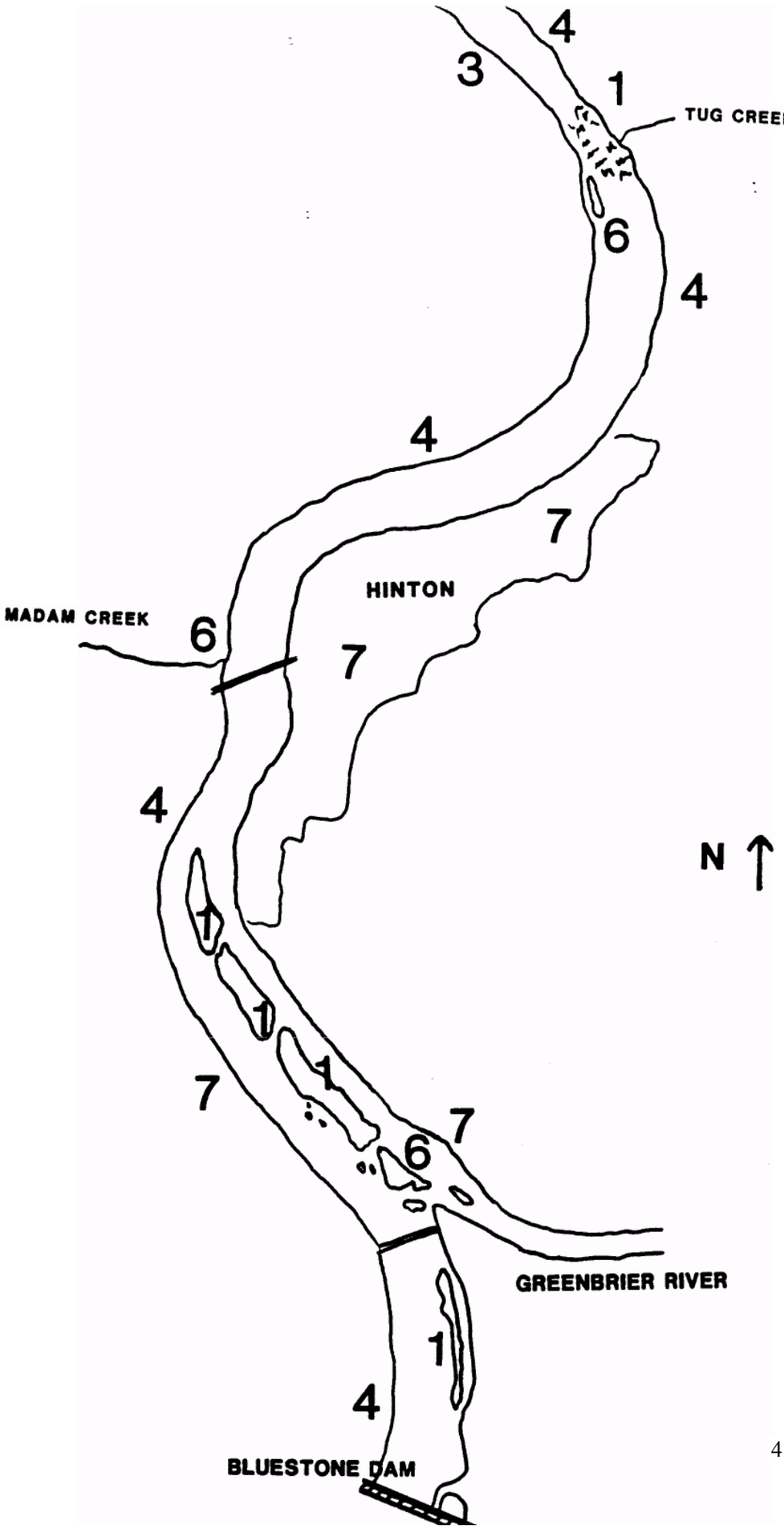
HABITAT MAPS
OF THE
NEW RIVER GORGE NATIONAL RIVER

The following ten (10) pages illustrate all sections of the New River Gorge National River from Bluestone Dam to Marr Branch near Ames.

Key to habitat classifications:

1 = Sycamore, willow, birch riparian habitats (SWB)
2 = Mature sycamore riparian habitats (SYC)
3 = Riparian Virginia pine habitats (RVP)
4 = Rock rip-rap habitats (RRR)
5 = Hemlock rip-rap habitats (HRR)
6 = Stunted sycamore, willow riparian habitats (SSW)
7 = Developed or disturbed habitats (DEV) and (DIS)
8 = Willow riparian habitats (W)
9 = Boulder riparian habitats (B)
10 = Tributary stream gorge habitats (TSG)
11 = West facing upland hardwoods (UP2)
12 = East facing upland hardwoods (UP1)
13 = Farmland habitat (FAR)
14 = Old field habitat (OLD)
15 = Cedar field habitats (CDR)
16 = Ridgetop habitats (RGT)

SCALE = 1 : 24000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MADAM CREEK
GREENBRIER RIVER
BLUESTONE DAM
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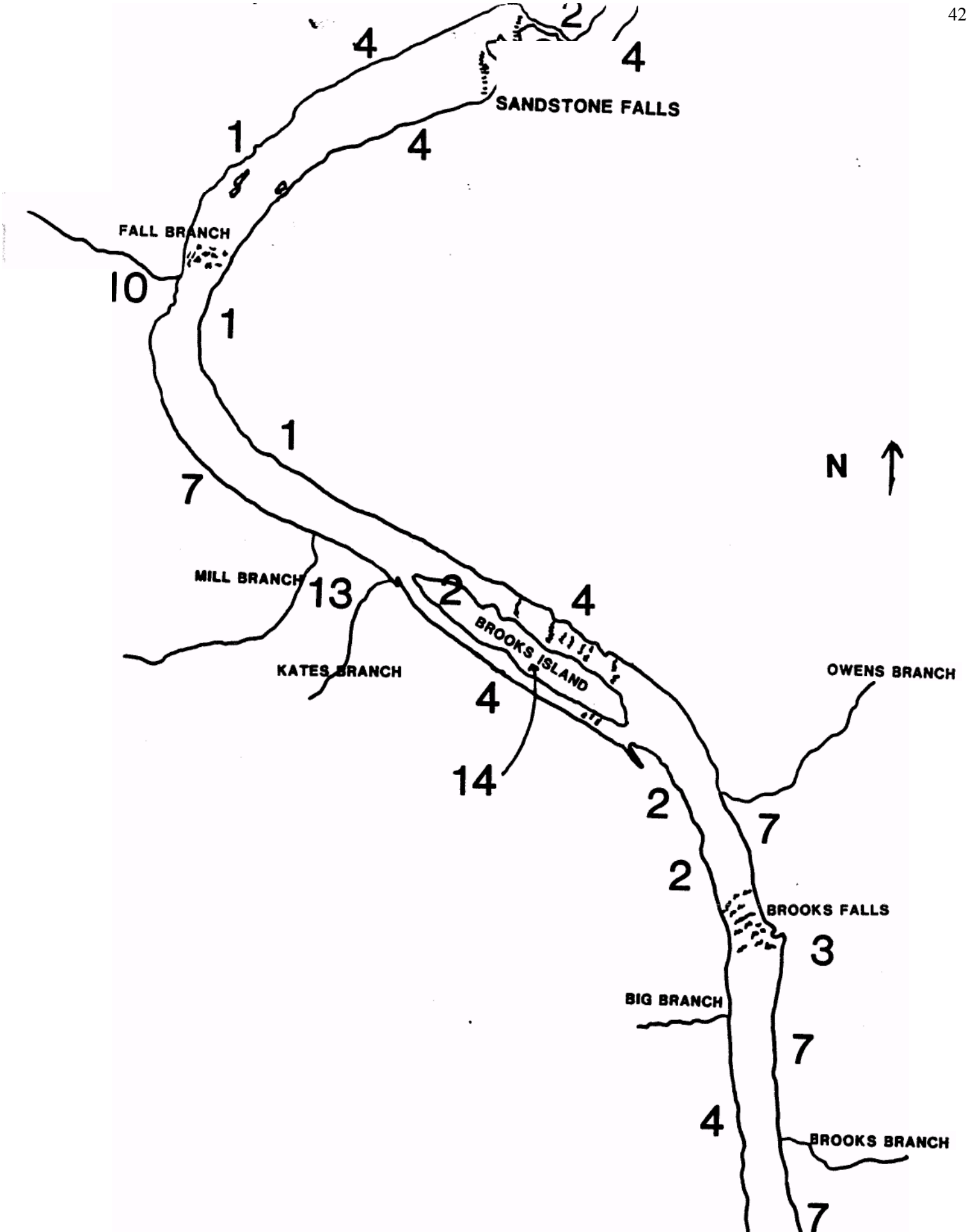
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FALL BRANCH
MILL BRANCH
KATES BRANCH
BROOKS ISLAND
OWENS BRANCH
BROOKS FALLS
BIG BRANCH
BROOKS BRANCH
N
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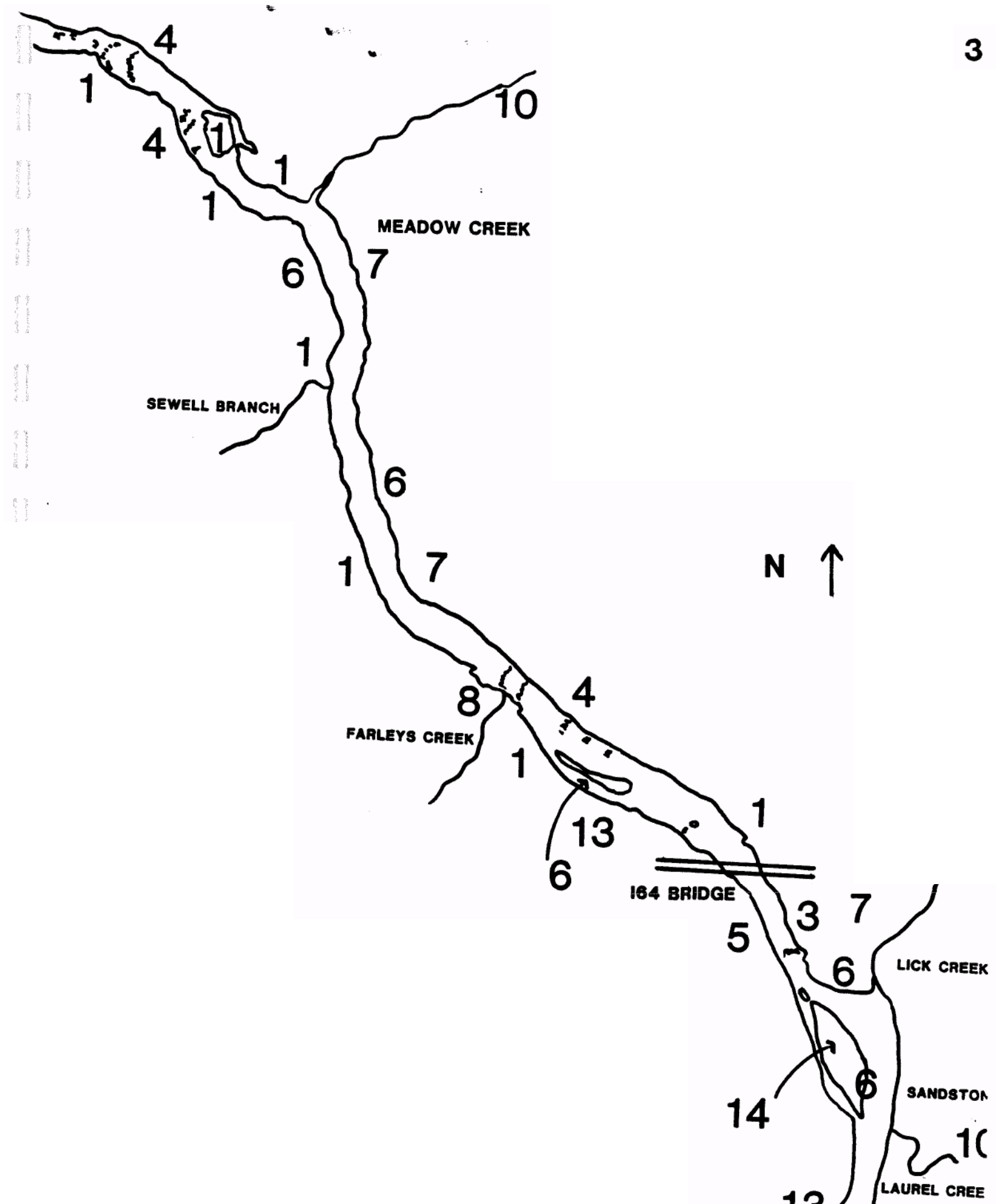
7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SEWELL BRANCH
FARLEYS CREEK
I64 BRIDGE
LICK CREEK
SANDSTON
LAUREL CREE
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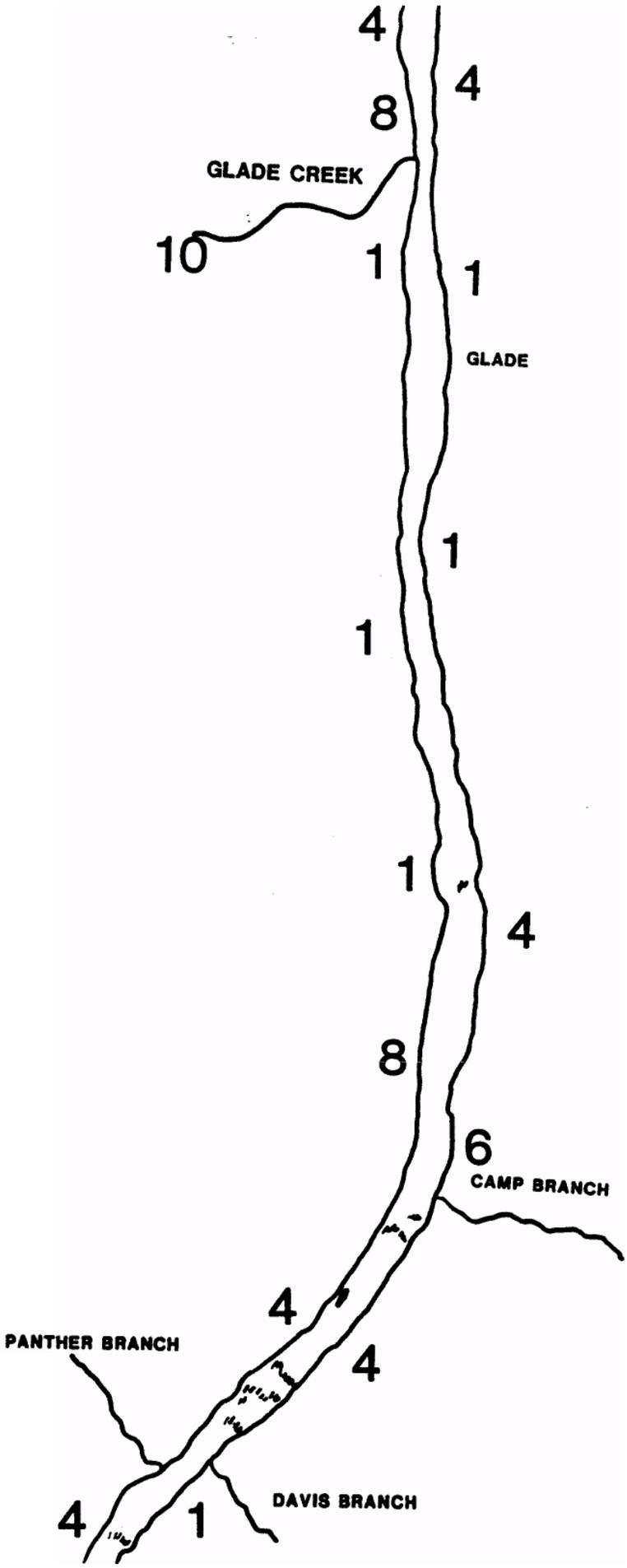
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GLADE
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4
8
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CAMP BRANCH
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4
PANTHER BRANCH
4
1
DAVIS BRANCH
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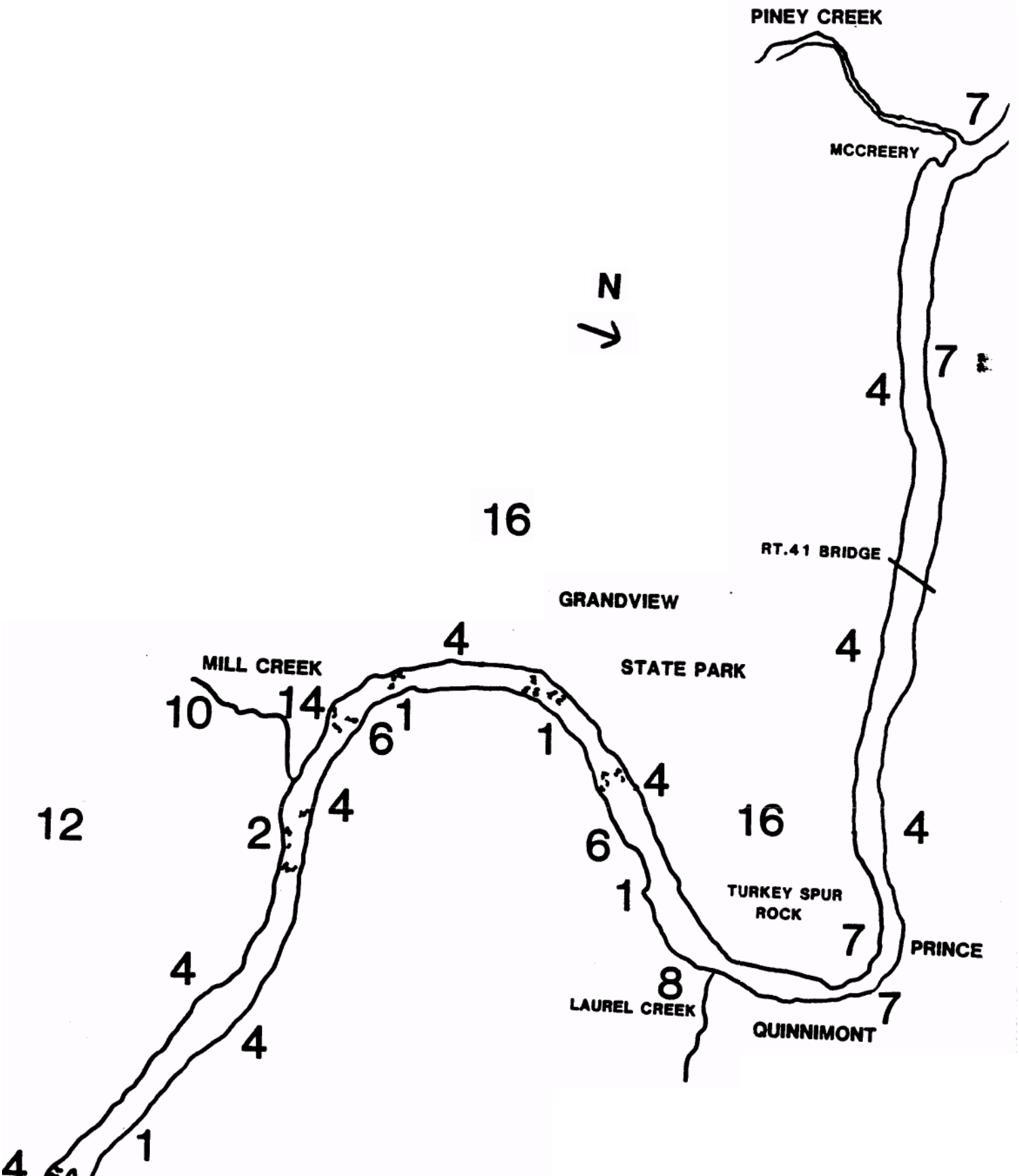
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MCCREERY
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RT.41 BRIDGE
GRANDVIEW
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MILL CREEK
STATE PARK
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14
6
1
1
4
12
2
4
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ROCK
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PRINCE
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LAUREL CREEK
QUINNIMONT
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1
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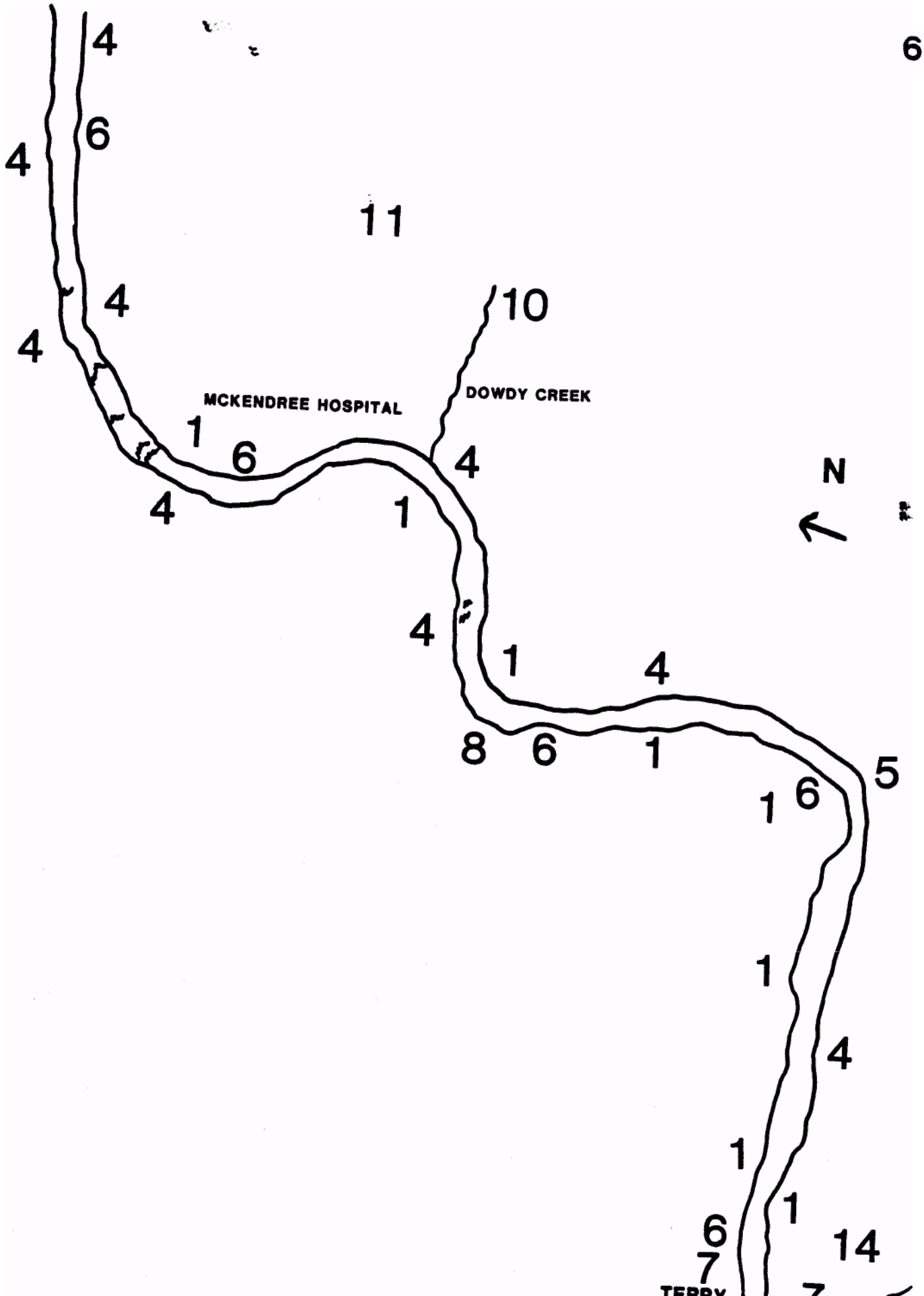
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DOWDY CREEK
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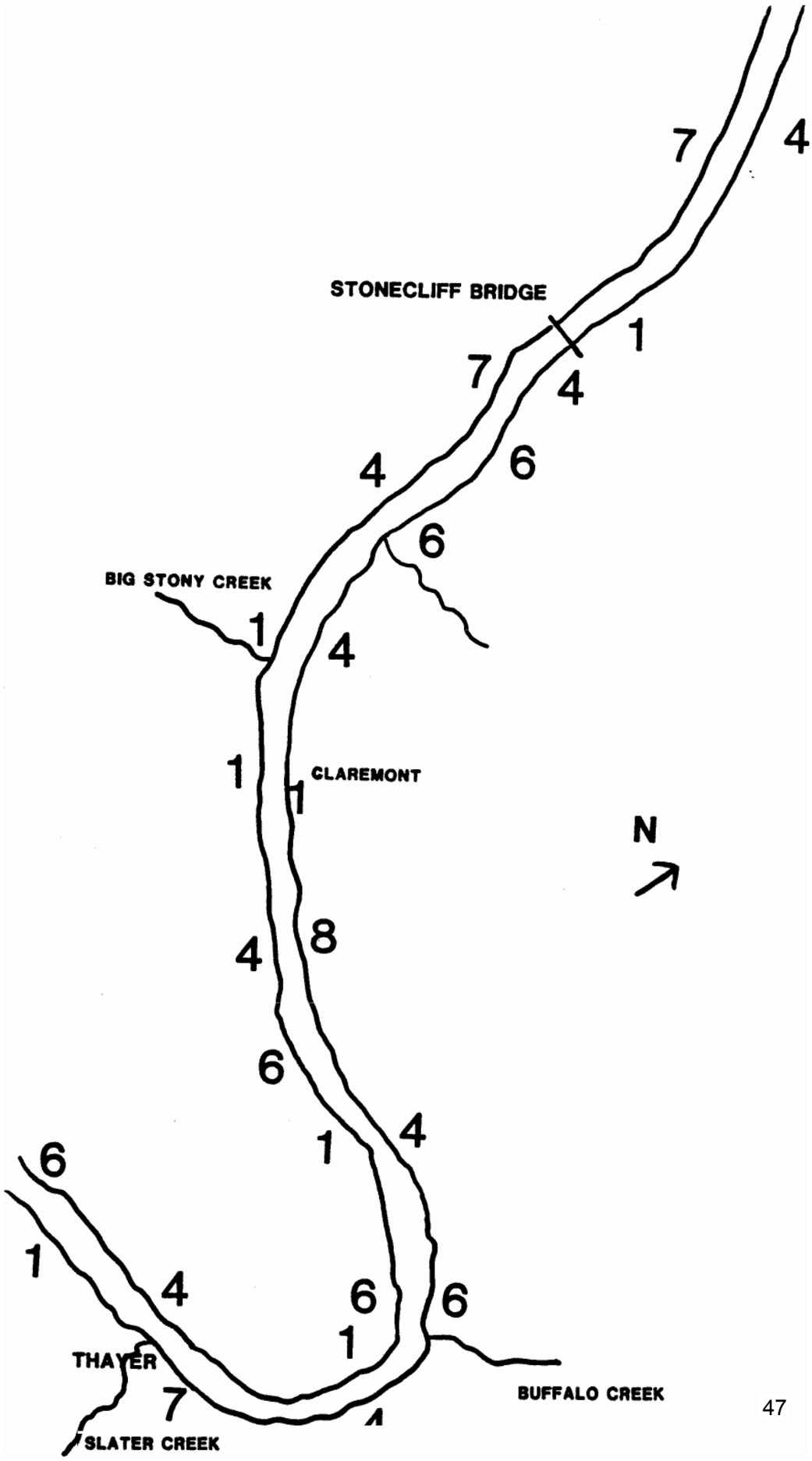
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THAYER
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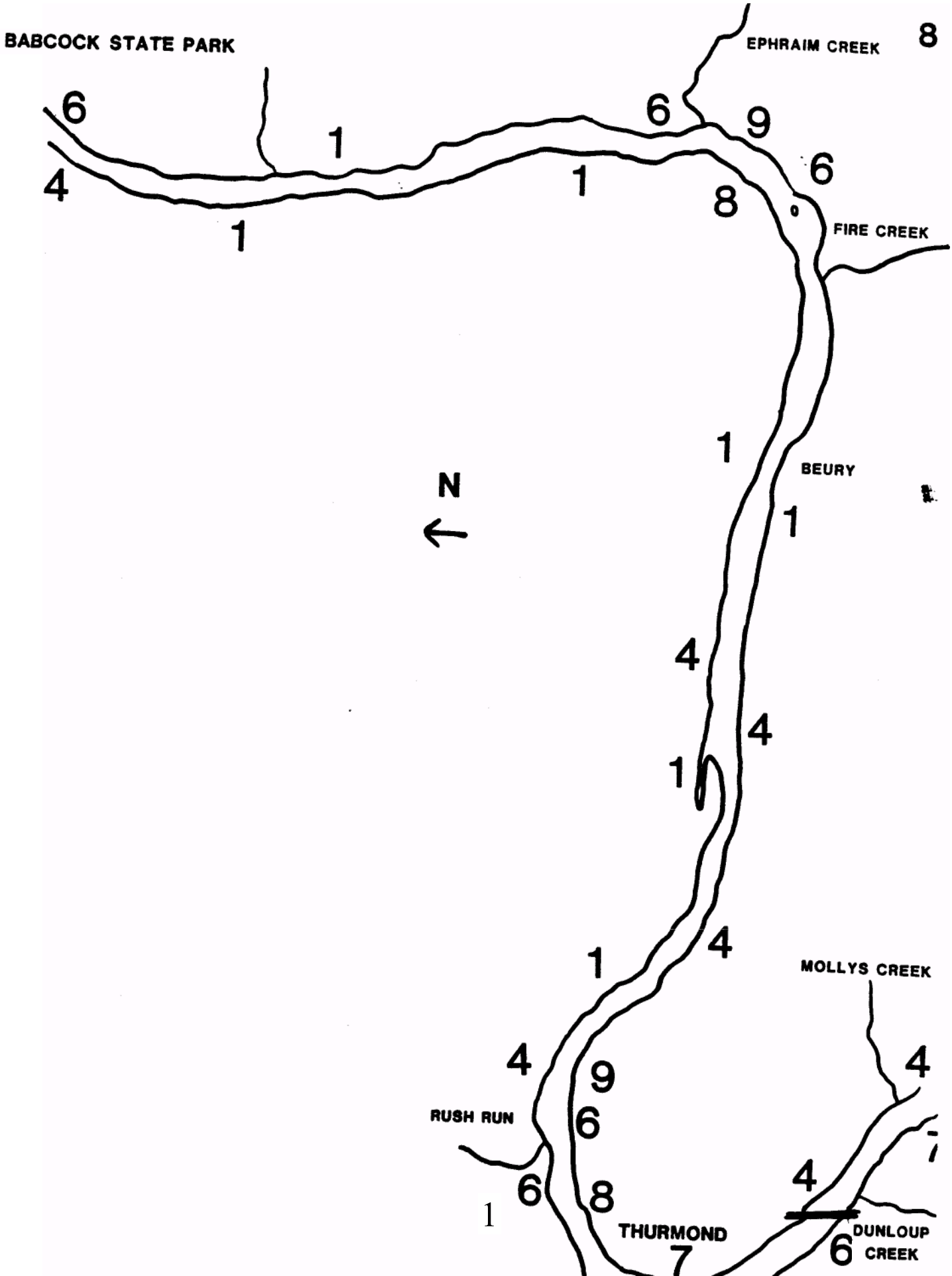
BUFFALO CREEK
SLATER CREEK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FIRE CREEK
BEURY
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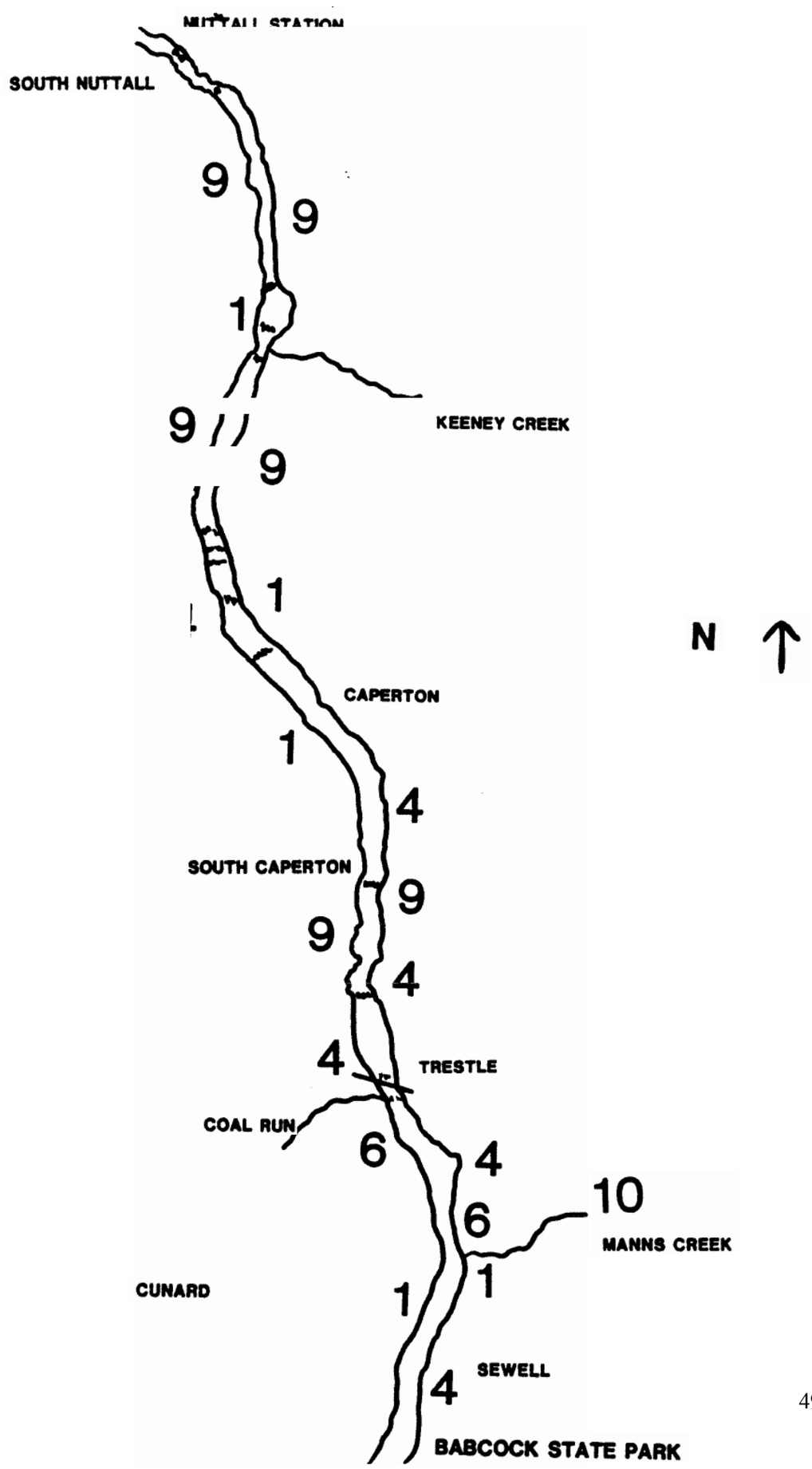
MOLLYS CREEK
RUSH RUN
THURMOND
DUNLOUP CREEK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KEENEY CREEK
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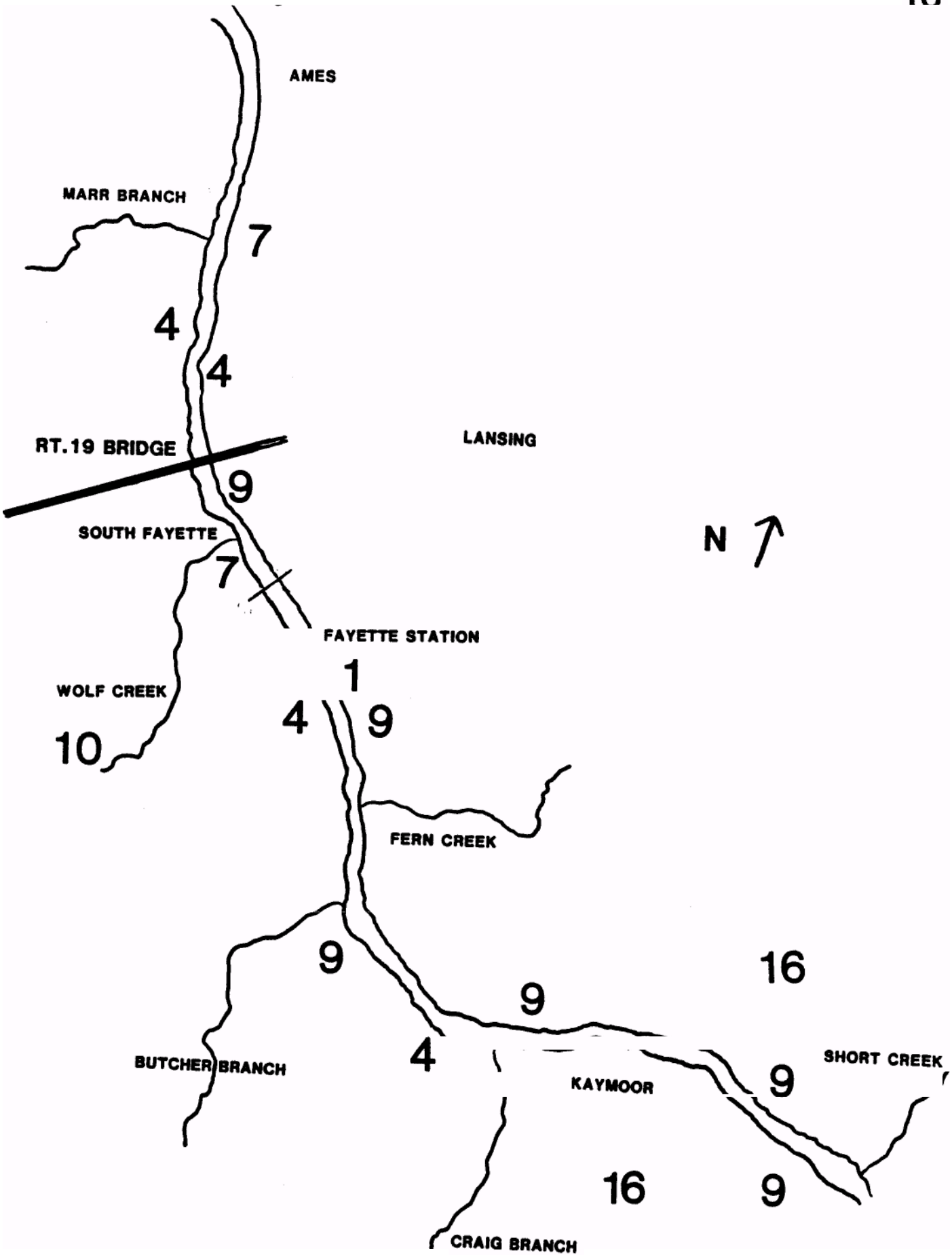
1
N
CAPERTON
1
4
SOUTH CAPERTON
9
9
4
4
TRESTLE
COAL RUN
6
4
10
6
MANNS CREEK
CUNARD
1
1
SEWELL
4
BABCOCK STATE PARK


AMES
MARR BRANCH
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RT.19 BRIDGE
LANSING
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SOUTH FAYETTE
N
7
FAYETTE STATION
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WOLF CREEK
4
9
10
FERN CREEK
9
16
9
4
BUTCHER BRANCH
SHORT CREEK
KAYMOOR
9
16
9
CRAIG BRANCH

WILDLIFE

SONGBIRDS

METHODS

During April-June 1984 and April-June 1985 we censused songbirds in various habitats in the southern and middle sections of the Gorge. Study sites were located in various riparian habitats between Hinton and Meadow Creek, as well as upland sites along McKendree Road and the dirt road below Grandview State Park. The habitats sampled included floodplain forests, old fields, farmland, and upland hardwood forests (Map 11).

During April-June 1985 we censused sites, predominantly in the northern parts of the Gorge. Habitats censused included ridgetop forests, forests surrounding tributary streams, upland hardwoods, and some riparian forests.

We censused songbirds using the variable circular plot method (Reynolds et al 1980). Observers from a stationary point within a site counted all birds seen or heard during a 10 minute period. Each detection was recorded as a distance from the observer in 10 meter intervals (i.e. 0-10m, 11-20m, etc.). All censuses were conducted between dawn and 9: 30AM when the birds were most active. Censuses

were not conducted during periods of heavy rain or unseasonally cold weather.

We calculated the densities *of* all species of songbirds for which we had an adequate number of observations using non-parametric statistical procedures (E.0. Garton, University of Idaho). Density estimates were obtained from observations of singing, mature males. We interpreted the presence of a singing male to indicate that the bird had selected the particular habitat for breeding purposes. We did not calculate densities during April-June 1985, but did compile species lists for those habitats.

Winter songbird and habitat use data were also collected during December 1984-March 1985 (Table 21). Habitats sampled for winter songbirds were the same as those sampled during April-June 1984.

RESULTS AND DISCUSSION

We observed 96 and 58 species of songbirds during Spring 1984 and 1985, respectively (Tables 19 and 20). We calculated densities for 65 songbird species observed during Spring 1984 (Table 18). These data are reported as the number of singing males per hectare.

Numerous species of songbirds breed and rear young in NRGNR riparian habitats. Some species of warblers such as the bay-breasted (Dendroica castanea), blackpoll (D. striata), and chestnut-sided (D. pennsylvanica) did not nest in the Gorge, but used the riparian

habitats along the river as migration corridors to breeding areas farther north.

During the survey we found that some songbird species were associated exclusively with riparian forests, while other species were found only in upland forests. Many species frequented a variety of habitats, but were more abundant in certain types (Table 18). For example, song sparrows (Melospiza melodia), and common grackles (Quiscalus quiscula) were found in all habitats but were most abundant in RVP and SYC habitats. American goldfinches (Carduelis tristis) were most common in old field habitats, while red-eyed vireos (Vireo olivaceus) were most abundant in upland hardwoods. Scarlet tanagers (Piranga rubra) were found in floodplain and upland forests, but avoided old fields and farmland. Cerulean (D. cerulea) and hooded warblers (Vilsonia citrina) were found only at higher elevations in upland forest types. All species of swallows were closely associated with riparian forests. Some species showed close associations with certain plants or trees, such as Bay-breasted warblers which were observed in eastern hemlocks in both HRR and RGT habitats.

A comparison of censuses conducted on developed riparian sites (i.e. Bass Lake Camp), and undisturbed riparian forests, illustrated that woodland warblers were absent from developed sites (Table 20).

During the winter months, riparian habitats were used by songbirds for food and cover. Carolina chickadees (Parus carolinensis) were observed feeding on Virginia pine cones in RVP habitats, while white-breasted nuthatches (Sitta carolinensis)

foraged under the loose bark of river birch in SWB habitats. Yellow-rumped warblers (D. coronata), winter residents only, fed heavily on mayflies during an early hatch in February. Blue jays (Cvanocitta cristata) were seen on riparian sites during the winter, but remained in upland hardwoods during the summer months. Dark-eyed juncos, (Junco hymenalis), white throated sparrows (Zonotrichia albicollis), and brown creepers (Certhia americana) were abundant in riparian habitats during the winter. All three species breed farther north in summer.

Migrant species began to return to the NRGNR around the first of March (Table 21). During this time winter residents, such as the yellow-rumped warblers, began their prenuptial molt.

The effects of flow changes on songbird communities *is* unclear. High waters during the early summer nesting season might flood low level or ground nests. Heavy flooding scours the herbaceous under-story cover of riparian communities and could deplete seed foods and insects on which many songbirds feed.

NEW RIVER GORGE

IVER

MAP 11

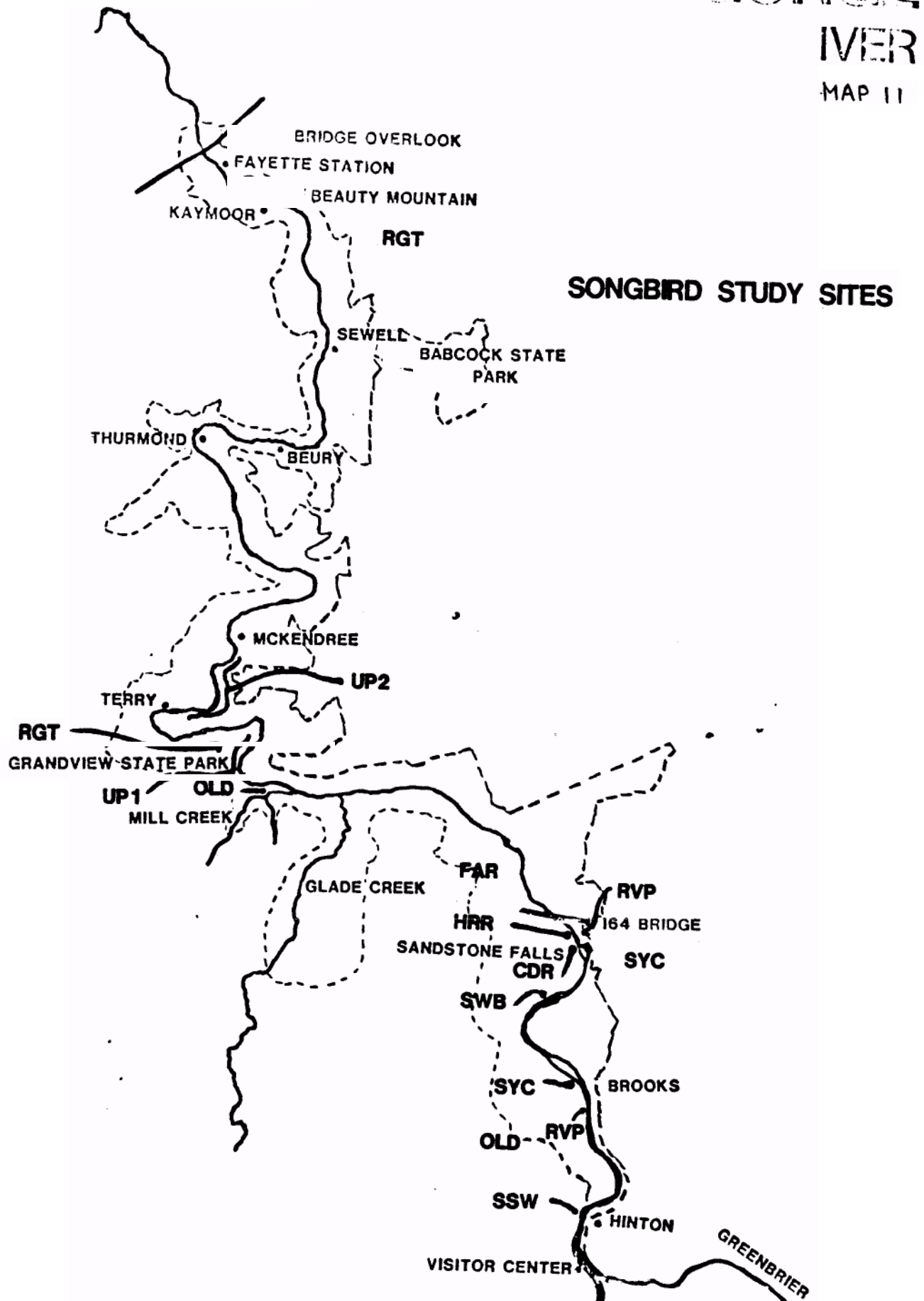


TABLE 18. SONGBIRD DENSITIES (SINGING MALES PER HECTARE) IN THE SOUTHERN AND MIDDLE SECTIONS OF THE NRGNR, W.V. APRIL-JUNE 1984.

	HABITAT TYPES									
	********RIPARIAN********				********TERRACES********				**UPLAND**	
SPEC.	RVP	SYC	SWB	SYC	OLD	CDR	OLD	FAR	UP1	UP2
Acadian flycatcher			1.01						.20	.44
Black&white warbler	-	-							.16	1.18
Barn swallow	-	.45			-					
Belted kingfisher	-	-	-							
Blue jay									.05	-
Bluebird, eastern								-		
Cardinal, northern	.56	.55	.18	.25	.36	.13	2.83		.80	.35
Catbird	.76	-		1.52	1.51	2.02	.80	.09		
Cerulean warbler									-	.14
Chat, yellow-breasted					.18	-	.25			
Chickadee, carolina	3.41	1.14	1.26	-				.76	.48	.55
Chimney swift	.57			-	6.80			-	.04	.04
Chipping sparrow						-		-	-	
Cowbird					-			.25	.16	-
Crow, American	.05	.37	1.42	.73		.28	-	.18	.05	-
Downy woodpecker	1.70	-	.43	-	1.14	2.02		1.77	.48	.15

	********RIPARIAN********				********TERRACES********				**UPLAND**	
	RVP	SYC	SWB	SYC	OLD	CDR	OLD	FAR	UP1	UP2
Field sparrow						-				
Flicker, northern		-		.51	.55					
Great-crested flycatcher		.18	.25	.18	-	.18		-	-	
Gnatcatcher, blue-gray			.76	-	2.02	-		.45	.56	1.38
Goldfinch	1.70	2.53	1.52	.36		2.27	.76	1.77	1.13	1.57
Grackle	40.93	13.64	3.28	17.05	12.13	1.81	7.96	5.68	.11	
Hooded warbler										1.77
Hummingbird, ruby th.				-	4.55			-		-
Indigo bunting	.14		.09	1.14		.57	1.59		1.13	.66
Kentucky warbler							6.37		.64	.07
Kingbird, eastern				-						
Killdeer								-		
Meadowlark								.09		
Least flycatcher						1.01				
Louisiana waterthrush		4.55	-	-	-		.71		.04	

	********RIPARIAN********				********TERRACES********				**UPLAND**	
	RVP	SYC	SWB	SYC	OLD	CDR	OLD	FAR	UP1	UP2
Mockingbird	-			-	.18					
Mourning dove	.50				.55	1.14				
Northern oriole	-	.85	.43		.55	-		-		
Nuthatch, whitebreasted	-	.36	.57						.15	
Orchard oriole					-			-		
Parula warbler			-	-					.32	-
Pewee	.27	.36	.55	.55	1.42	.18		.71	.32	.10
Phoebe	-	.28	.14		.18	3.41	-	.57		.15
Pileated woodpecker			.19				-		.03	.07
Red-bellied woodpecker						-		-	-	
Redstart	-		.14				1.41		1.42	
Redwing blackbird	3.53	-	.09	.57	2.84	3.13		.36		
Red-eyed vireo	1.26	1.14	2.78	1.52	.18	.25	1.99	.71	3.11	3.34
Robin	3.41	.18	.43	.18	3.54	.73			.05	
Rough-winged swallow								.14		
Scarlet tanager	.06	.18	.13				-	.03	.64	.15

	********RIPARIAN********				********TERRACES********				**UPLAND**	
	RVP	SYC	SWB	SYC	OLD	CDR	OLD	FAR	UP1	UP2
Solitary vireo				-						
Song sparrow	7.39	4.04	2.53	1.42	3.54	1.42	.40	2.53	.20	-
Starling	-				.28	.28		1.07		
Swainsons thrush	-									
Titmouse, tufted		.55	.25	.55	-	.09		.85	.31	.78
Towhee, rufous-sided				-	-	.28				.20
Tree swallow	1.27	-	.71	1.52	-			.18		
Veery	-									
Warbling vireo	2.27			.85	.28					
Waxwing, cedar	13.06	.51	2.27	1.52	2.56	10.23		3.28		
Worm-eating warbler									.32	.44
Wood thrush		.36	.18	.28					.66	.44
Wren, carolina		.28	.82	.57		.09	.40	4.55	.88	.20
White-eyed vireo			-	-			.76			
Yellow warbler	1.01	-	.57	2.02	1.42	.85	-	3.98	-	-
Yellow Throat, common	.14			-		1.52	2.12			
Yellow-throated vireo				-		-				
Yellow-throated warbler				.18				.28	.08	.07

TABLE 19. BIRD SPECIES OBSERVED DURING CENSUSES OF THE NRGNR, W.V., APRIL-JUNE 1984.

	SWB	SYC	RVP	FAR	OLD	CDR	UP1	UP2
Yellow-billed cuckoo	X			X				
Ruby-throated hummingbird		X		X	X			X
Chimney swift		X	X	X	X		X	X
Northern flicker	X	X			X			
Pileated woodpecker	X						X	X
Downy woodpecker	X	X	X	X	X	X	X	X
Red-bellied woodpecker				X		X	X	
Great Crested flycatcher	X	X		X	X	X	X	
Least flycatcher *						X		
Acadian flycatcher	X						X	X
Eastern phoebe	X		X	X	X	X		X
Eastern wood-pewee	X	X	X	X	X	X	X	X
Eastern kingbird		X		X				
Rough-winged swallow				X				
Tree swallow	X	X	X	X	X			
Barn swallow	X			X	X			
Cliff swallow				X				
American crow	X	X	X	X	X	X	X	X
Blue jay							X	X
Tufted titmouse	X	X		X	X	X	X	X
Carolina chickadee	X	X	X	X			X	X
Brown thrasher						X		
Northern mockingbird		X	X		X			
Gray catbird	X	X	X	X	X	X		
Carolina wren	X	X		X		X	X	X
Wood thrush	X	X		X			X	X
Swainsons thrush *			X					
Veery			X	X				
American robin	X	X	X	X	X	X	X	
Eastern bluebird				X				
White-breasted nuthatch	X		X				X	
Blue-gray gnatcatcher	X	X		X	X	X	X	X
Starling			X	X	X	X		
Warbling vireo		X	X		X			
Solitary vireo *		X						
Yellow-throated vireo						X		
Red-eyed vireo	X	X	X	X	X	X	X	X
White-eyed vireo	X	X						
Yellow warbler	X	X	X	X	X	X	X	X
Chestnut-sided warbler *	in HRR only							
Blackpoll warbler *			X					
Bay-breasted warbler *				X				
Yellow-rumped warbler *			X					
Yellow-throated warbler	X	X		X			X	X
Common yellowthroat		X	X	X	X	X		
Hooded warbler								X
Black-and-white warbler	X						X	X
American redstart	X		X	X			X	
Worm-eating warbler							X	X
Blackburnian warbler *				X				

TABLE 19. BIRD SPECIES OBSERVED DURING CENSUSES OF THE NRGNR, W.V. APRIL-JUNE 1984 (CON'T).

	SWB	SYC	RVP	FAR	OLD	CDR	UP1	UP2
Parula warbler	X	X					X	X
Cerulean warbler							X	X
Kentucky warbler				X			X	X
Louisiana waterthrush	X	X			X		X	
Yellow-breasted chat					X	X		
Eastern meadowlark				X				
Brown-headed cowbird				X	X	X	X	X
Common grackle	X	X	X	X	X	X	X	
Red-winged blackbird	X	X	X	X	X	X		
Northern oriole	X		X	X	X	X		
Orchard oriole				X	X			
Cedar waxwing	X	X	X	X	X	X		
Northern cardinal	X	X	X		X	X	X	X
Dickcissel *						X		
Rose-breasted grosbeak				X				
Indigo bunting	X	X	X		X	X	X	X
Scarlet tanager	X		X	X			X	X
American goldfinch	X	X	X	X	X	X	X	X
House finch			X					
Rufous-sided towhee		X			X	X		X
Field sparrow						X		
Chipping sparrow				X			X	
Song sparrow	X	X	X	X	X	X	X	X
House sparrow	in town of Hinton							
Wild turkey							X	
Ruffed grouse							X	X
Woodcock			X					
Mourning dove			X		X	X		
Rock dove	in town of Hinton							
Belted kingfisher	X							
Green-backed heron	X							
Great blue heron	X							
Mallard	X							
Black duck	X							
Wood duck	X							
Canada goose	X							
Common loon *	on river							
American coot *	on river							
Killdeer	X							
Solitary sandpiper	X							
Spotted sandpiper	X	and RRR and B						
Coopers hawk							X	
Red-tailed hawk	X			X				
Red-shouldered hawk	X							
Osprey *	X	X						
Turkey vulture	X							
TOTAL SPECIES	50	35	33	45	34	32	37	31

* not believed to breed in the NRGNR; RRR=rock riprap habitat, B=boulder habitat, HRR=hemlock riprap habitat.

TABLE 20. BIRD SPECIES OBSERVED IN THE NRGNR, W.V. 1985.

	OCCURRENCE BY HABITAT TYPE						
	SSW	HRR	TSG	DEV	RGT	B	WET
Yellow-billed cuckoo					X		
Ruby-throated hummingbird					X	X	
Chimney swift	X			X			X
Northern flicker					X	X	
Pileated woodpecker					X		
Downy woodpecker					X		
Hairy woodpecker		X					
Great-crested flycatcher					X		X
Eastern phoebe		X		X	X	X	
Eastern wood-pewee				X	X		
Rough-winged swallow		X	X			X	
Tree swallow				X			
Barn swallow				X	X		
American crow	X	X			X	X	
Blue jay					X	X	X
Tufted titmouse		X	X		X	X	
Carolina chickadee		X	X		X	X	
Gray catbird	X			X	X	X	
Carolina wren		X	X	X			
Wood thrush		X			X		
American robin		X		X	X		
White-breasted nuthatch		X		X	X		X
Red-breasted nuthatch					X		
Ruby-crowned kinglet					X		
Blue-gray gnatcatcher		X			X	X	
Starling				X	X		
Warbling vireo				X			
Red-eyed vireo		X			X	X	
White-eyed vireo					X		X
Yellow warbler				X		X	
Bay-breasted warbler					X		
Yellow-rumped warbler					X		
Yellow-throated warbler		X			X	X	
Hooded warbler					X		X
Black-and-white warbler					X	X	
American redstart		X					

TABLE 20. BIRD SPECIES OBSERVED IN THE NRGNR, W.V. 1985.(CON T)

	OCCURRENCE BY HABITAT TYPE *						
	SSW	HRR	TSG	DEV	RGT	B	WET
Parula warbler		X	X				
Black-throated green warb.					X		
Black-throated blue warb.			X				
Louisiana waterthrush		X	X				
Ovenbird					X		
Yellow-breasted chat					X		
Brown-headed cowbird					X		
Common grackle	X			X	X		
Red-winged blackbird	X			X			
Northern oriole				X			
Northern cardinal		X	X	X	X		
Rose-breasted grosbeak					X		
Indigo bunting					X	X	
Scarlet tanager					X		
Summer tanager					X		
American goldfinch	X	X		X	X		
House finch	X						
Rufous-sided towhee					X		X
Field sparrow					X		
Chipping sparrow				X	X		
Song sparrow	X	X		X	X	X	
Mourning dove					X		
TOTAL SPECIES	8	19	8	19	44	16	7

* SSW=stunted sycamore willow, HRR=hemlock rip-rip, TSG=tributary stream gorge, DEV=developed riparian, RGT=ridgetop, B=boulder riparian, WET=wetland.

TABLE 21. WINTER SONGBIRDS IN THE NRGNR. 16 JANUARY 1985-14 MARCH 1985.

	OCCURRENCE BY HABITAT TYPE								
	SWB	SYC	RVP	HRR	SSW	FAR	OLD	CDR	UP1	UP2
Carolina wren	X	X	X	X			X	X	X	X
White-breasted nuthatch	X	X	X					X	X	
Song sparrow	X	X	X	X	X	X	X	X		
House sparrow *	X									
Crow	X		X			X	X	X	X	X
Meadowlark						X				
Mockingbird								X		
White-throated sparrow *		X	X				X	X		
Rufous-sided towhee								X		
Eastern bluebird	X	X				X		X	X	
Yellow-rumped warbler *	X	X						X		
Northern cardinal						X		X	X	X
Golden-crowned kinglet *								X		
Hairy woodpecker *	X	X								
Downy woodpecker	X	X	X				X	X	X	X
Yellow-bellied sapsucker	X	X							X	
Red-bellied woodpecker	X									
Pileated woodpecker	X								X	
Fox sparrow *		X	X							
Killdeer	X	X								
Kingfisher	X									
Dark-eyed junco *		X	X	X		X			X	X
Carolina chickadee	X	X	X			X	X	X	X	X
Black-capped chickadee *										X
Goldfinch	X							X		
Tufted titmouse	X	X				X		X	X	X
Winter wren *		X				X			X	
Chipping sparrow	X								X	
Starling				X	X					
Blue Jay		X						X		
Brown creeper *	X	X								
Cedar waxwing								X		
Northern flicker	X						X	X		X
Robin 2-18-85	X	X						X		
Mourning dove						X				
Phoebe 2-20-85				X						
Ring billed gulls	frequently seen along river Feb-March									

EARLY RETURNING MIGRANTS

Common grackle 3-1-85	X				X					
Red-wing blackbird 3-1-85	X				X					
Gr. crest. fly. 3-4-85	X									
Tree swallow 4-3-85		X								
Wood thrush 4-3-85	X									
Yell.throated warb. 4-3-85	X									
Louisiana waterthrush 4-14				X						
Brown-headed cowbird 4-14						X				

* not counted during summer breeding season.

TABLE 22. MISCELLANEOUS SONGBIRD IDENTIFICATIONS AND THEIR LOCATIONS IN THE NRGNR, W.V. 1984-85.

SPECIES	YEAR	LOCATION	HABITAT
Yellow-billed cuckoo	7-11-84	Long Bottom	SYC
	4-30-85	GV St.Pk.	RGT
Dickcissel	6-18-84	Sandstone Falls	CDR
Brown Thrasher	5-11-84	Sandstone Falls	CDR
House finch	5-27-84	River Rd.	OLD
	4-20-85	Rt.20, Hinton	SSW
Field sparrow	1984	Sandstone Falls	OLD
Blackpoll warbler	5-18-84	River Rd.	RVP
Yellow rumped warbler	5-18-84	River Rd.	RVP
Chestnut-sided warbler	4-25-84	I64 bridge area	HRR
Bay-breasted warbler	5-18-84	I64 bridge area	HRR
Blackburnian warbler	6-22-84	I64 bridge area	FAR
Eastern bluebird	1984	Long Bottom	FAR
	1984	I64 bridge area	FAR
Bank swallow	5-11-84	Long Bottom	FAR
Cliff swallow	5-11-84	Long Bottom	FAR
Rough winged swallow	1984-5	abundant along river	
Summer tanager	5-28-85	Beauty mountain	RGT
Rock dove	1984-5	Hinton	DEV
House sparrow	1984-5	Hinton	DEV
Black-throated blue warbler	5-27-85	Babcock St. Pk.	TSG
	5-4-85	McKendree Rd.	UP2
Black-throated green warbler	4-26-85	SS Falls overlook	UP2
Common Nighthawk	1985	McKendree Rd.	UP2
Red-breasted nuthatch	9-25-85	Beauty mountain	RGT
Rose-breasted grosbeak	4-30-85	GV St.Pk.	RGT
Ovenbird	4-30-85	GV St.Pk.	RGT
Hooded Warbler	4-30-85	GV St.Pk	RGT
Ruby-crowned Kinglet	4-30-85	GV St.Pk.	RGT
Pine Warbler	5-1-85	Camp Brookside	
Black and white Warbler	7-18-85	Brooks Island	SYC
Blue Jay	5-27-85	River Road	OLD
Willow Flycatcher	6-4-85	I64 area	FAR
Black-throated Green Warbler	9-25-85	Beauty mountain	RGT
OBSERVED BY BROOKS BIRDING CLUB 1954 AND OR 1975, BUT NOT THIS STUDY			
Whip-poor-will (Caprimulgus vociferus)			Unknown
Golden-winged warbler (Vermivora chrysoptera)			"
Canada warbler (Wilsonia canadensis)			"
Northern bobwhite (Colinus virginianus)			"

WATERFOWL

SUMMER

During summer 1984 and 1985, Canada geese (Branta canadensis) and mallards (Anas platyrhynchos) were the most conspicuous waterfowl species in the NRGNR, although wood ducks (Aix spousa) and ruddy ducks (Oxyura jamaicensis) were also observed (Table 23). Canada geese are increasing their numbers throughout West Virginia, (W. V. DNR 1983) and along the New River as well (Table 25). Mallards and Canada geese nested in riparian habitats, some in areas with high human disturbance. Some nests were located below spring flow levels leaving them susceptible to unusually high summer flows. One mallard nest was discovered on 28 April 1984 within this range.

WINTER

The waterfowl population on the New River peaked during mid-winter. Censuses were conducted between Bluestone Dam and Sandstone Falls several times each month during January-March 1985 (Table 24). The designated study sections included 1) Bluestone Dam to Rt. 20 Bridge, 2) Rt. 20 to the rapid above Summers Co. Recreational Facil-ity, 3) Recreational Facility to Brooks Falls, 4) Brooks Falls through Long Bottom pool, and 5) the area directly above Sandstone Falls. These sites included pool and riffle habitats. Surveys

conducted in northern areas of the Gorge indicated little use by waterfowl.

Concentration sites included the areas directly below Bluestone Dam and directly above Sandstone Falls. These areas are relatively shallow and provide dabbling (puddle) ducks accessibility to invertebrates and aquatic plants such as eel grass (Vallisneria americana) and elodea (Elodea canadensis). Waterfowl species commonly observed were black ducks (A. rubripes), mallards, widgeon (A. americana), and gadwall (A. strepera). During February 1985, mute swans (Cygnus olor) were observed near Hinton. This was the first record for this species in the NRGNR.

Diving ducks utlized the more open, deeper pools in the New River. Common winter species included flocks of goldeneye (Bucephala clangula) and hooded mergansers (Lophodytes cuccullatus). Occasionally red-breasted mergansers (Mergus serrator) were observed. Several groups of domestic ducks inhabit the river near Bluestone Dam and Bass Lake Camp.

High flows in mid-winter would be detrimental to wintering dabbling duck populations. High flows may scour weed beds and submerge them below the surface and out of reach. Dabbling ducks were observed to congregate in beds of the emergent plant, water willow (Justica sp.), where they find food and cover. High flows scour these emergent weed beds as well. The effects of high flows on diving ducks is not certain, but since high flows and muddy water usually go together, it is probable that high flows would make it more difficult for diving ducks to capture fish and other food items.

Other species of waterfowl have been observed on Bluestone Lake and the New River towards Virginia (Table 25). Several of these species probably frequent the NRGNR, but were not encountered during this survey.

TABLE 23. SUMMER OCCURRENCES OF WATERFOWL, SHOREBIRDS, AND WADING BIRDS IN THE NRGNR, W.V. 1984-85.

SPECIES	YEAR	LOCATION	HABITAT
Common merganser	6-20-84	Sandstone Falls	riverine
Black duck	1984		
Mallard	1984-5	abundant along river	
Wood duck	1984-5	Summers Co. Rec. Fac.	SWB
Ruddy duck	6-24-85	Summers Co. Rec. Fac.	
Canada geese	1984-5	Summers Co. Rec. Fac.	SWB
Horned Grebe	9-12-85	Bass Lake Camp	in river
Common Loon	4-12-84	I64 bridge area	in river
Spotted sandpiper	1984-5	abundant along river	
Killdeer	1984	I64 bridge area	SWB
Lesser Yellowlegs	5-06-85	I64 bridge area	
Common tern	5-18-85	Brooks Falls	above river
Double-crested cormorant	6-19-85	Sandstone	in river
Green-backed heron	1984-5	abundant along river	
Great blue heron	1984	Panther Branch,	water willow

TABLE 24. RESULTS OF WINTER WATERFOWL SURVEY, NRGNR, W.V. 1985.

SPECIES	DATE	LOCATION DAM-2B	H-REC	BL-BF	BF-AD	SSF	TOTAL
Goldeneye	1/16/85	2	42	2		17	63
Canada geese		1			22		23
Hooded merganser		1	13	4	5	2	25
Mallard		1	20				21
Black duck		2		1	4	45	52
Mute swan		3					3
Ringneck			1				1
Canada geese	1/30/85	67	32	9		24	132
Mallard		12	11	7		34	64
Black duck		19	2	2		53	76
Hooded merganser		8	1	2			11
Mute swan		3					3
Goldeneye			23	5			28
Ringneck			1				1
Pied-billed grebe			1				1
Goldeneye	2/8/85	5		2			7
Mallard	*(5)	5		6			11
Black duck		6					6
Hooded merganser		4					4
Canada geese		38					38
Widgeon?		1					1

TABLE 24. RESULTS OF WINTER WATERFOWL SURVEY, (con't).

SPECIES	DATE	DAM-2B	H-REC	BL-BF	BF-AD	SSF	TOTAL
Black duck	2/18/85					33	33
Mallard	*(2)	2		5		1	8
Lesser scaup		1					1
Canada geese		9					9
Hooded merganser		2					2
Black duck	2/20/85					57	57
Hooded merganser	*(4)				5	2	7
Goldeneye				5	11		16
Goldeneye	3/1/85	6		10		9	25
Hooded merganser	*(9)	2					2
Mallard				2			2
Goldeneye	3/2/85			10		16	26
Red-breasted merganser	3/8/85				2		2
Pied-billed grebe					1		1
Lesser scaup	3/10/85	2					2
Wood duck			2				2
Mallard	4/3/85	2	2		2		6
Wood duck			2				2
Widgeon					2		2

* (#) = number of gates open at Bluestone Dam during the survey.

DAM-2B=Bluestone dam to Rt.20 bridge, H-REC=Rt.20 bridge to rapid above Summers Co. Rec. Facility, BL-BF=Bass lake to Brooks Falls, BF-AD=Brooks Falls to Long Bottom, SSF=area directly above Sandstone Falls.

TABLE 25. MID-WINTER WATERFOWL SURVEY BY WVDNR, 1981-85, BLUESTONE LAKE AND NEW RIVER, W.V. TO VA. BORDER.

SPECIES	DATE	NUMBER OBSERVED
Mallard	January 1, 1981	757
Black duck		215
Redhead		7
Scaup (sp)		32
Goldeneye		15
Bufflehead		21
Mallard	January 1, 1982	30
Black duck		18
Ringneck duck		11
Goldeneye		26
Bufflehead		120
Mallard	January 1, 1983	39
Black duck		41
Ringneck duck		17
Goldeneye		14
Bufflehead		42
Mallard	January 7, 1984	48
Black duck		5
Goldeneye		22
Bufflehead		96
Canada geese		50
Mallard	January 7, 1985	90
Black duck		52
Gadwall		2
Pintail		1
Scaup (sp)		17
Bufflehead		23
Canada geese		69

Note: this data from WVDNR, Wildlife Resources Division

WADING BIRDS AND SHOREBIRDS

Wading birds, such as green-backed herons (Butorides striatus) and great blue herons (Ardea herodias) utilized river banks for feeding and cover during the summer months (Table 23). Herons were commonly observed in areas with submergent weedbeds, such as elodea, or emergent plants, such as water willow or lizard tail (Sauruus cernuus). These weeds harbor small fish and invertebrates on which these wading birds feed.

Shorebirds, including spotted sandpipers (Actitus macularia) and killdeer (Charadrius vociferus) were frequently observed foraging along the muddy banks of the river (Table 23). Double-crested cormorants (Phalacrocorax aurItus) and common terns (Sterna hirundo) were occasionally seen and were considered transients.

During the winter months, large groups of ring-billed gulls (Larus delawarensis) were also observed on the river between Bluestone Dam and the I64 bridge.

RAPTORS

Various raptor species were observed in the NRGNR during 1984-85 (Table 26). Turkey vultures (Cathartes aura) were commonly observed in riparian habitats, perched either in large dead trees, or on large rocks (Table 26). Their abundance appears to be greatest in the northern section of the Gorge, probably because of the pres-

ence of cliffs which are used for nesting (Coleman 1986). Black vultures (Coragyps atratus) were occasionally seen in association with turkey vultures, although their numbers were much less.

Ospreys (Pandion haliaetus) were observed in the NRGNR in both years of the study during the month of September. No nesting individuals were found. Those observed were believed to have been migrating from northern areas.

Night time censuses were conducted for owls in March and April 1985 along the dirt road below Grandview State Park using a portable cassette player, which broadcast owl calls of several species. We, however, did not elicite any responses. Barred (Strix varia) and screech owls (Otus asio) were heard along the river near Bass Lake Camp during July-August 1985. One Great-horned owl (Bubo virginianus) was observed in a riparian forest upstream from Sandstone Falls State Park. It was seen or heard in that area regularly between April 1985 and October 1985.

TABLE 26. RAPTORS OBSERVED IN THE NRGNR, W.V. 1984-85.

SPECIES	YEAR	LOCATION	HABITAT
Red-tailed hawk	1984-5	Long Bottom	SYC
	1985	I64 bridge area	cliffs
	1985	Thayer	cliffs
Red-shouldered hawk	8-21-84	Brooks Falls	SWB
	8-28-85	overlook SS Falls	UPl
Broad-winged hawk	6-24-85	Kates Branch	wetland
	9-25-85	Beauty mountain	RGT
Rough-legged hawk	9-12-85	near Thayer	in air
Coopers hawk	8-24-84	Grandview Rd.	UPl
Sharp-shinned hawk	9-25-85	Beauty Mtn	RGT
	9-17-85	I64 bridge area	HRR
Osprey	8-25-84	Mill-Glade Cr. above	river
	9-11-84	Long Bottom	"
	9-13-84	near McKendree	"
	9-13-85	Bass Lake Camp	"
Turkey vulture	1984-5	Panther Branch	RRR
	1984	Fire Creek	SSW
	1985	north of Terry	SWB
	1985	Beauty Mtn	RGT
Black vulture	1985	Panther Branch	RRR
Golden Eagle	7-19-85	Glade Creek above	river
Great-horned owl	1985	Long Bottom	SWB
Barred owl	1985	Bass Lake Camp	SWB
Screech owl	1985	Bass Lake Camp	SWB

GAMEBIRDS

Wild turkeys (Meleagris gallopayo) and ruffed grouse (Bonasa umbellus) were commonly observed along McKendree road and the dirt road below Grandview State Park. Turkey tracks were also found on the dirt road (trail) between Mill creek and Glade Creek. A hen turkey with 11 poults was seen there 27 May 1984. Neither turkeys nor grouse were seen on riparian sites, although one woodcock (Philohela minor) was observed in a RVP site in June 1984.

MEDIUM AND LARGE MAMMALS

METHODS

The occurrence of mammals on various sites was determined by trapping, track and scat surveys, scent station visits, and sightings. National live traps were used in an attempt to capture mammals utilizing riparian and upland habitats.

Scent stations were constructed using 1m x 1m plexiglass boards, covered with blue chalk. Bait scent was placed on the center of the board. Some stations attracted oppossums (Didelphis marsupialis) and raccoons (Procyon lotor) but their tracks were of-ten obscured by rain or heavy dew. Thus, we discontinued this method early in the 1984 field season.

Thereafter, mammal use of habitats was determined by track surveys during which an observer walked along the river bank for a known distance and recorded all tracks encountered near the water's edge (Table 27). Tracks occasionally paralleled the banks for great distances, then disappeared upland only to reappear later along the river. Because it was difficult to determine whether these tracks belonged to the same animal, track counts were used only to determine species use of the habitats sampled and not abundance.

Track counts were also conducted along upland dirt roads and trails to sample the mammal species in those habitats (Table 27).

During December 1984, a questionaire was mailed to licensed trappers in the NRGNR asking for their opinion on the status of furbearing mammals in the Gorge. However, no responses were received.

DISCUSSION

During track surveys we observed tracks from 11 mammalian species at 26 different locations (Table 27). Oppossums were found in all habitats sampled and were the only species captured in National live traps. Striped skunk (Mephitis mephitis) and raccoon occurred in most habitats but did not seem particularly abundant. Road-killed striped skunks were identified along Rt. 20 near Brooks and near Babcock State Park. Spotted skunks (Spilogale putorius) may occur in the NRGNR, (Grossenheider 1975) but were not verified.

Tracks of a weasel (Mustela sp.) were found in February:1985 at Mill creek, a tributary stream gorge habitat (TSG). Attempts to capture weasels with traps baited with scent were not successful.

Bobcat (Lynx rufus) tracks were encountered occasionally along seldom used upland roads. One gray fox (Urocyon cinereoargenteus) was observed during the study in an old field near Sandstone Falls State Park. Red fox (Vulpes fulva) were seen on farmland near Long Bottom, on a riparian floodplain at Glade Creek, and crossing the I64 road grade. Fox tracks were frequently seen on upland surveys but were not identfied to species.

Dog (Canis familiaris) tracks were seen in every habitat type sampled within the NRGNR. Dogs without collars were frequently observed. We do not know what effect wild dogs have on wildlife within the NRGNR, but it is an item needing further investigation. Personnel from Grandview and Little Beaver State Parks believed that wild dog populations were quite large and were responsible for deer deaths in those areas.

Black bears (Ursus americanus) occur in the NRGNR, and have been sighted frequently on the ridgetops in Grandview State Park (H. Boggs, pers. comm.). The personnel working on this study did not see any bears, but received one reliable report of a bear swimming the river near Thayer in August 1984.

Woodchucks (Marmota monax) and cottontail rabbits (Sylvilagus floridanus) were sighted in riparian and upland habitats, but were usually associated with grassy openings. They were most abundant on non-flooded river terraces, usually old fields and farmland.

Three species of tree squirrels were identified in the NRGNR during the study, and each inhabited a different habitat type. Eastern fox squirrels (Sciurus niger) were found in riparian forests and on farmland bordered by trees on the non-flooded terraces. Eastern gray squirrels (S. carolinensis) were found in the mixed hardwood forests that cover the slopes of the NRGNR. Only one specimen of the red squirrel (Tamiasciurus hudsonicus) was observed and it was in a Virginia pine-hemlock ridgetop forest at Beauty mountain overlook.

One specimen of the southern flying squirrel (Glaucomys volans) was captured in a Sherman-live trap set in a SWB habitat near the Summers Co. Recreational Facility. Upon release it retreated to a hole in a large sycamore (Platanus occidentalis).

White-tail deer (Odocoileus virginianus) were abundant in the NRGNR. Deer tracks were commonly encountered in both upland and riparian habitats. Deer used riparian forests for cover and also fed on a variety of succulent plants found in the understory. Twice, deer were observed swimming across the river in the Glade Creek area and individuals were observed on Brooks Island during July 1985.

Feral goats were observed on upland slopes at three locations during 1984 and 1985. It is not known what effects they may have on other wildlife and vegetation. They were observed near the I64 bridge (river left), near Laurel Creek (Sandstone), and on the slopes next to Brooks Island (river right).

Fisher (Martes pennanti) and wild boar (Sus scrofa) do not in-habit the NRGNR, but have been introduced in nearby areas. The

fisher was reintroduced into northeastern West Virginia by the DNR in the mid-1970's. Since that time they have been slowly expanding their range. They inhabit the spruce and pine forest type, and could expand into the pine-dominated ridgetop sites around the NRGNR. Wild boar have been reported in hunting kills in Wyoming and Raleigh Counties and according to DNR personnel, are also expanding their range. They are known to cause damage to understory vegetation by their 'rooting' behavior. They would likely prefer moist uplands and riparian forests within the NRGNR.

Aquatic furbearing mammals inhabiting the NRGNR include beaver (Castor canadensis), muskrat (Ondatra zibethica), and mink (Mustela vison). All three species are common throughout.

Beaver activity sites were characterized as either active or inactive, based on sightings, freshness of cuttings, or tracks (Map 12). Beaver are dependent upon riparian vegetation for food and shelter and commonly cut river birch, black willow, and hazel alder (Alnus serrulata). Beaver occurring in the NRGNR den in river banks, rather than build lodges. They are more common in the southern section of the Gorge where more river floodplain habitat exists. They are susceptible to flow flucuations. Flood waters scour away river banks and collapse dens. High flows between April and July, when the young are born, could result in kit mortality.

Muskrats are abundant in the New river and inhabit the same habitat as beaver. Dens of the two species were often found near each other. Presence of muskrats was often determined by middens of asiatic clam (Corbicula fluminea) shells.

Mink were commonly sighted along the New River, and their tracks were found along most mud and sand banks. Mink are also susceptible to mortality from flooding. Several young mink (N=4) were observed in a rock den one half meter above the level of the river (2800 cfs) on 19 June 1985 below Sandstone Falls in a RRR habitat. Although these young were old enough to move themselves away from rising water, newborn animals might not survive.

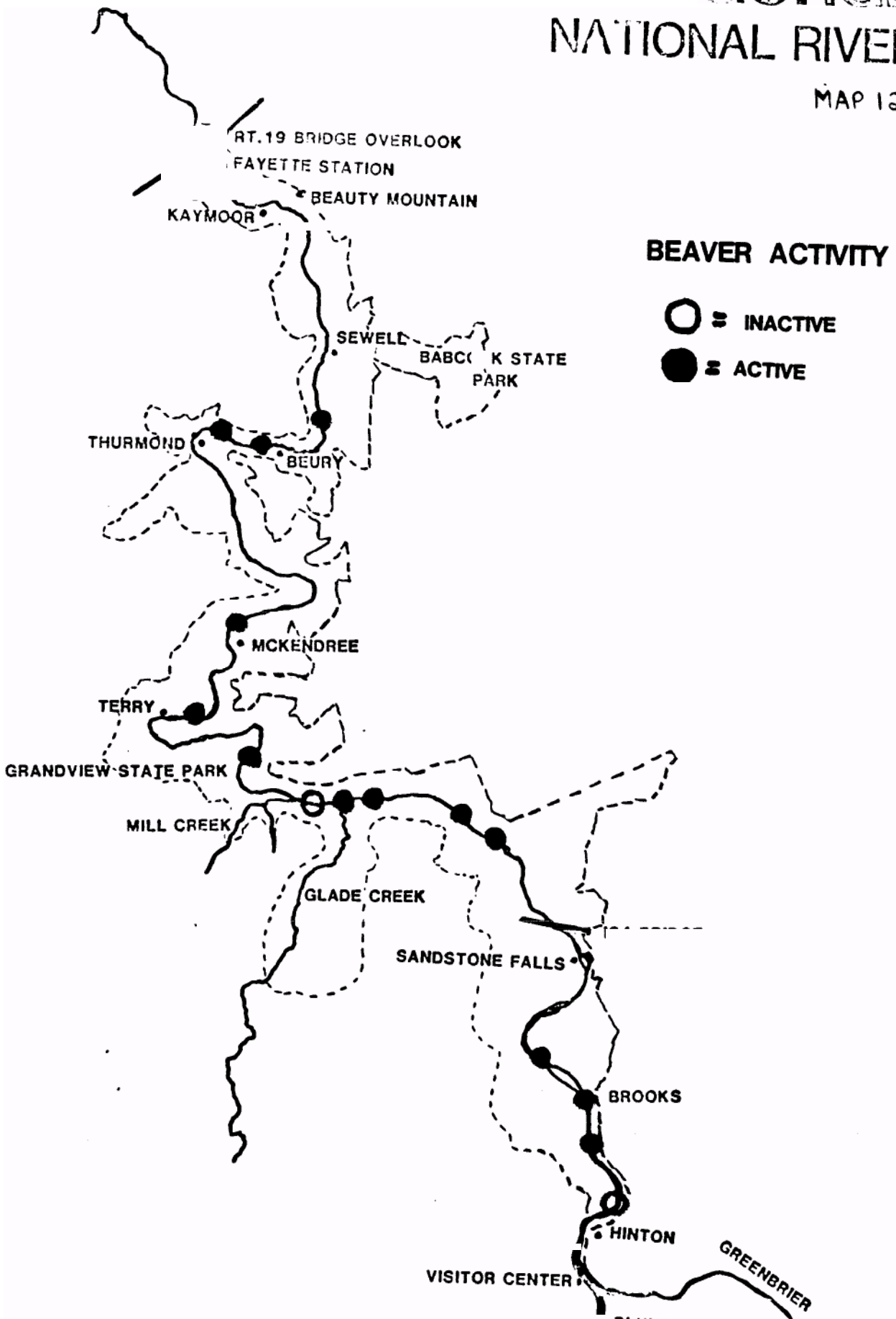
TABLE 27. RESULTS OF TRACK SURVEYS FOR LARGE AND MEDIUM SIZED MAMMALS IN THE NRGNR, W.V. 1984-85.

HABITAT LOCATION	SPECIES * WTD	BOB	FOX	DOG	CAT	RAC	OPS	SKU	MNK	MUS	BEV
JUNE-SEPTEMBER 1984											
SYC-river rd, Brooks Falls							X				
SWB-river left,north Terry				X		X			X	X	X
SWB-river right, north Terry				X	X	X				X	X
opposite Terry, river right	X				X	X	X		X	X	
UP1-north of Terry, river left	X			X	X	X	X				
SWB- near Thayer						X			X		X
SWB/RRR Glade to Mill Cr.	X				X	X	X		X	X	
UP1-Mill Cr. to Glade Cr.	X	X				X		X			
SWB-Camp Branch	X			X		X	X				X
SWB-Meadow Cr. to Panther Br.	X					X	X			X	X
SWB-Laurel Creek				X					X	X	X
SWB-Glade Cr.bridge river left	X					X	X		X	X	
SWB-Glade Cr.bridge river right	X			X							X
SWB-mouth of Glade Creek	X		X	X		X			X	X	X
SWB-mouth of Mill Cr.	X								X		
W-below Arbuckle Creek, left				X					X		
W-below Arbuckle Creek, right											X
SWB-near Jump rock, river right						X			X		X
SWB-Fire Creek, river right				X		X					X
SWB-Fire Creek, river left				X		X					X
MAY-AUGUST 1985											
B-Fayette Station,river right				X		X					X
SWB-mouth of Glade Creek				X		X	X				X
UP1-Mill Cr. to Glade Cr.	X			X		X	X				
RRR-Sandstone Falls,river right									X		
SYC-Brooks Island	X										X
SWB-Long Bottom, left			X								

*wtd=whitetail deer, bob=bobcat, fox=fox, dog=dog, cat=house cat, rac=raccoon, ops=oppossum, sku=skunk, mnk=mink, mus=muskrat, bev=beaver.

NEW RIVER GORGE
NATIONAL RIVER

MAP 12



SMALL MAMMALS:

METHODS

Small mammals were trapped using two techniques. Initially, Sherman live trap grids were established in different riparian habitats. Each trapping grid contained two 50 meter transects with six stations on each transect. Each station had two traps, situated at the nearest log, rock, or other debris that provided cover. Trapping grids were established on upland sites as well to look for differences in species composition.

Beginning in July 1984 we also used drift fences with pitfall buckets on both riparian and upland sites (Table 28). The fences consisted of a 50 foot x 14 inch roll of aluminum flashing. The bottom 2 inches were buried in the soil and three 5-gallon plastic buckets were installed at 25 foot intervals along the fence. Smaller one gallon buckets without fences were installed along the bases of cliffs in the tributary habitats. Shrews trapped were identified to species in the lab by skull characteristics.

DISCUSSION

Trapping in riparian habitats during summer 1984 yielded only deer mice (Peromyscus maniculatus) and eastern chipmunks (Tarmias striatus). Habitats trapped included SSW, SWB, RVP, and SYC. Seven

other species were captured in the upland habitats using the drift fence (Table 28). We found no differences in trapping success between riparian sites (17.7%) and upland sites (20.0%) for deer mice ($P>0.05$).

We captured no small mammals using the drift fence on the riparian site during 1984, but deer mice and chipmunk were captured in Sherman traps. During 1985, the drift fence was erected on the same riparian site downstream from Terry, river left. Woodland jumping mice (Napeozapus insignis) and short-tailed shrews (Blarina brevicauda) were captured. Flow flucuations were likely responsible for the differences in small mammal communities between the two summer study periods. Summer 1984 was a period of high flows, with the riparian site occasionally inundated. Summer 1985 was a period of relatively low flow and the riparian site was submerged only once during August (Table 29). It is likely that with regular flooding, the only small mammals able to recolonize quickly would be deer mice and eastern chipmunks. Other species of mice and shrews would be excluded from these communities by high flows. The small mammal communities of the upland sites remained the same between summers.

TABLE 28. SMALL MAMMAL IDENIFICATIONS IN HABITATS WHERE DRIFT FENCES WERE USED, NRGNR, W.V. 1984-85.

SPECIES	(TSG) FALL BRANCH	(SWB) NORTH OF TERRY	(UP1) MILL-GLADE	(UP2) MCKENDREE HOSPITAL
Woodland jumping mouse	X	X	X	X
Deer mouse	X	X	X	X
Pine vole	X			X
Shorttail shrew	X	X	X	X
Smoky shrew	X		X	X
Masked shrew	X		X	X
Long-tail shrew	X			
Hairy-tailed mole	X			

TABLE 29. Mean monthly flow discharges in cubic feet per second (cfs) on the New River at Hinton, W.V. for 1984 water year and 1985 water year.

MONTH	OCT 83-SEPT 84	OCT 84-SEPT 85
October	4392	2889
November	5408	4960
December	12820	6314
January	6383	7884
February	19430	10954
March	16080	8268
April	20150	5379
May	16250	6704
June	4879	2815
July	4700	2389
August	6439	5022
September	2637	2144

Eastern woodrats (Neotoma floridana) were found along talus slopes at the Grandview State Park overlook, and along Fall Branch.

One specimen of the house mouse (Mus musculus), a non-native species was captured in Bass Lake Camp.

Red-backed voles (Cleithonomys gapperi) were found in upland habitats, along the dirt road below Grandview State Park and on the jeep trail between Babcock State Park and Sewell, but only in association with hemlocks, damp leaf litter, and large, moss-covered rocks. Other species occurring in upland habitats included masked shrews (Sorex cinereus), smoky shrews (Sorex fumeus), and pine voles (Pitymys pinetorum). One long-tail shrew (Sorex dispar) was captured along Fall branch, and one meadow vole (Microtus pennsyIvanicus) was captured in a moist clearing on Beauty mountain.

Several other species of small mammals may occur in the NRGNR, but were not encountered in this study (Grossenheider 1975)(Table 35).

TABLE 30. SMALL MAMMAL HABITAT ASSOCIATIONS IN THE NRGNR, W.V. 1984-85.

HABITAT	LOCATION	# TIMES SAMPLED	SPECIES DM	WJ	MV	RB	PV	SS	LT	MS	ST	EW	EC
	JUNE-SEPTEMBER 1984												
RVP	River rd, near Hinton	3	X										X
SWB	River rd, Sandstone Falls	4	X										
SWB	Summers Co. Athletic Fac.	2	X										X
SWB	1 mile north, Meadow Cr.	1	X										
*SWB	north of Terry, river left	-											
SWB	north of Terry, river left	4	X										
SYC	River rd, Brooks Falls	4	X										
RRR	river right, SS Falls	2	X										
OLD	River rd, near Hinton	2	X								X		
OLD	Sandstone Falls St. Pk.	1	X										
CDR	Sandstone Falls St. Pk.	1	X										
*UP1	upland, near Mill Cr.	-	X	X				X		X	X		
UP1	upland, near Mill Cr.	2	X										
TSG	Fall Branch	2	X									X	
	FEBRUARY-MARCH 1985												
UP1	road below GV St. Pk.	2				X							
OLD	at Mill Cr.	2	X										
TSG	at Mill Cr.	2	X										X
RVP	I64 bridge area	2	X										
HRR	I64 bridge area	2	X										

* indicates a site where drift fences/pitfalls were used.
All others were trapped using Sherman live traps.

DM=deer mouse, WJ=woodland jumping mouse, MV=meadow vole,
RB=red-backed vole, PV=pine vole, SS=smoky shrew,
LT=long-tail shrew, MS=masked shrew, ST=shorttail shrew,
EW=eastern woodrat, EC=eastern chipmunk.

TABLE 31. SMALL MAMMAL HABITAT ASSOCIATIONS IN THE NRGNR, W.V. APRIL-AUGUST 1985.

HABITAT	LOCATION	# TIMES SAMPLED	SPECIES DM	WJ	MV	RB	PV	SS	LT	MS	ST	EW	EC
APRIL-AUGUST 1985													
SWB	Sewell	2	X										X
*SWB	north of Terry river left	-	X	X							X		
DEV	Bass Lake Camp		eastern mole, house mouse										
UP2	Babcock St. Pk.	2	X			X							
*UP2	McKendree Hospital site	-	X	X			X	X		X	X		
*TSG	Fall Branch	-	X	X			X	X	X	X	X		
RGT	Grandview St. Pk.	1										X	
RGT	Beauty mountain	2	X		X								

* indicates a site where drift fences/pitfalls were used.
All others were trapped using Sherman live traps.

DM=deer mouse, WJ=woodland jumping mouse, MV=meadow vole,
RB=red-backed vole, PV=pine vole, SS=smoky shrew,
LT=long-tail shrew, MS=masked shrew, ST=shorttail shrew
EW=eastern woodrat, EC=eastern chipmunk.

MOLES AND BATS

Mole traps set on several riparian and upland sites met with limited success. One eastern mole (Scalopus aquaticus) was captured by hand in a floodplain forest, near Summers Co. Athletic facility and one hairy-tailed mole (Parascalops breweri) was captured in a pitfall trap in the tributary habitat along Fall Branch. Mole tunnels were seen in many riparian habitats where the soil was organic, not sandy.

Attempts to capture bats were not successful. Mist nets were erected along the river at dusk during summer 1985 but were avoided by the bats. Bats were seen flying along the edges of the river at several locations between Hinton and I64 bridge, but could not be identified to species." During April 1986, several eastern pipistrel bats (Pipistrellus subflavus) were found in drift mines near the abandoned mining town of Kaymoor. Several other species probably occur in the NRGNR and may use old drift mines for roosting and winter hibernaculum (Table 35).

REPTILES AND AMPHIBIANS

METHODS

We used several techniques to sample reptiles and amphibians in the NRGNR. Some habitats, such as the edges of tributary streams

and talus slopes were intensively searched by turning rocks and logs. Several species of amphibians were captured in pitfall traps with drift fences. Aquatic turtles were captured in baited hoop net traps and unbaited fyke nets. Some turtles were captured in baskets constructed of poultry netting nailed to the sides of basking logs.

The most productive herptile surveys were conducted at night by automobile. On warm, humid, rainy nights during the summer months, large numbers of frogs, toads, salamanders, and snakes were found on roads (Table 32). An animal's habitat was recorded as that from which it was facing. This was necessary in areas such as River road, near Hinton, where the road was the dividing line between riparian and upland habitats.

DISCUSSION

Few salamanders were found in riparian habitats. Terrestrial salamanders do not colonize sites that are frequently flooded. One red-backed salamander (Plethodon cinereus) was captured in a pitfall bucket near Terry in July 1985. During night road cruises, some two-lined salamanders (Eurycea bislineata) appeared to be traveling from riparian sites. However, daytime searches of these habitats did not turn up any specimens.

The greatest numbers and diversity of salamanders were found in the tributary streams (Table 33). Streams sampled included Fall Branch, Glade Creek, Mill Creek, Dowdy Creek, and Mann's Creek in

Babcock State Park. The black-bellied salamander (Desmognathus quadramaculatus), listed as 'special concern' by WVDNR, and the northern spring salamander (Gyrinophilus porphyriticus) were found only in Dowdy Creek in the NRGNR. The presence of these species may indicate good water quality.

The green salamander (Aneides aneus), another species of 'special concern' was found at several wet sandstone cliffs in the NRGNR. These include cliffs along Fall Branch, and the cliffs at the main overlook at Grandview State Park. Several other species of rare salamanders have been recorded for the New River Gorge area by other herpetologists, but were not found during this study (Table 35).

Common species of anurans included bullfrogs (Rana catesbeiana), green frogs (R. clamitans), american toads (Bufo americanus), and fowler's toads (B. fowleri). American toads were frequently found on riparian sites, although Fowler's toads were more numerous in upland hardwoods. Bullfrogs were found along the river associated with quiet backwaters. Bullfrog tadpoles were observed in the river near Summers Co. Recreation Facility during August 1985, a year of low flows. Some older local citizens noted that bullfrogs were numerous along the river prior to construction of Bluestone Dam. Frogs need streambank cover to hide from predators and tadpoles require relatively stable water conditions in which to develop.

Two amphibian breeding ponds were discovered in non-riparian habitats in the NRGNR. A small hardwood swamp at the site of the McKendree Hospital was used by spring peepers (Hyla crucifer),

woodfrogs (R. sylyatica), and the rare 'status undetermined' Jefferson's salamander (Ambystoma jeffersonianum). Another breeding pond for Jefferson's salamander was located at Sandstone Falls State Park. This small duckweed covered pothole between an open cedar field and the river should be protected. Amphibian breeding ponds are usually semi-permanent bodies of water, free of fish. Discovery of the Jefferson's salamander in the NRGNR represents the first records for Fayette and Raleigh counties.

Ditches alongside dirt roads throughout the Gorge were utilized as breeding habitat by red-spotted newts (Notophthalmus viridescens), mountain chorus frogs (Pseudacris brachyphonac), and green frogs.

Mudpuppies (Necturus maculosus) were found in the riverine habitat. Adult specimens were found under rocks in pool habitats, whereas small immature individuals were captured in submergent weedbeds. Fishermen reported capturing them on fishing tackle during early spring, referring to them as waterdogs, or water lizards.

Intensive searches were conducted for another large aquatic salamander, the hellbender (Cryptobranchus alleganiensis). Although this species has been found by members of this study team in the New River in Virginia, none were found in the NRGNR. Local fishermen have provided descriptions of what seem to be hellbenders, but all have stated that they have not seen one in many years. Hellbenders require clear, well oxygenated water, and it is possible that frequent muddy flows from the Greenbrier river and mine runoff from

other tributaries have impacted this species. Hellbenders' are listed as 'endangered' by WVDNR and several other states.

Different species of snakes were found in all habitat types sampled in the NRGNR (Table 33). The northern water snake (Nerodia sipedon) and the queen snake (Regina septemyittata) were closely associated with the river and riparian habitats. Both feed on fish, frogs and other small prey. Queen snakes prey heavily on crayfish; thus also were found in tributary stream habitats.

Copperheads (Agkistrodon contortix mokasen) were common on exposed rock outcroppings and talus slopes in upland habitats in the NRGNR, but were never found in riparian habitats. Accounts of copperheads from fishermen and rafters are most probably northern water snakes. Reports of timber rattlesnakes (Crotalus horridus) were obtained from local residents, and although it *is* certain they occur in upland habitats, they were not encountered during this study.

Fence lizards (Sceloporus undulatus) were found on dry upland sites and along cliffs. A large population was also found at an old excavation near Fall Branch. Another lizard, the five-lined skink (Eumeces fasiatus) was encountered twice during the study. One was seen on the old bridge across Glade Creek (Raleigh Co.) and another ran across River road, near Fall Branch. A rare lizard, the coal skink (E. anthracinus) may occur around cliffs in the northern part of the Gorge. It was not encountered during this study. It is listed as 'special concern' by WVDNR.

The terrestrial eastern box turtle (Terrapene Carolina) was found in all habitats sampled in the NRGNR. Within the riverine habitat, five species of turtle were found (Table 34). Two subspecies of painted turtles (Chrysemys picta) are represented in the NRGNR, (picta) and (marginata). In most places, the Applachian mountains separate the two sub-species. However, since the New river cuts across the mountains from east to west, the two sub-species are in contact and do interbreed. Most painted turtles in the NRGNR show traits of both subspecies. The common snapping turtle (Chelydra serpentina), called 'mud' turtle by local residents, was abundant in the NRGNR, as was the musk turtle (Sternotherus odoratus), also called 'stinkpot' or 'pot'. Musk turtles are commonly caught on hook and line by fishermen.

The river cooter (Pseudemys concinna) was discovered in the NRGNR in 1984. This represents a range extension for the species (Buhlmann and Vaughan 1985). Populations exist in the New river from Hinton to the I64 bridge. They have not been seen farther downstream. A population exists in Bluestone reservoir and individuals have also been seen a few miles up the Greenbrier from its confluence with the New. River cooters are found in pools with slow moving water, basking sites, and aquatic weedbeds. They do not occur in riffle habitats. Turtle habitat in general, decreases with distance downstream from Hinton, and is poor in the lower Gorge. Flow flucuations may impact river cooters in the NRGNR by scouring aquatic weedbeds, preventing access to basking sites, and possibly

inundating nesting areas. The results of a complete ecological study of the river cooter are currently being summarized at Virginia Tech. One male map turtle (Graptemys geographica) was captured near Brooks Island during July 1985, and a female was sighted at the same location. Further study is needed to determine this species status in the New River.

TABLE 32. RESULTS OF NIGHT ROAD SURVEYS FOR HERPTILES IN THE NRGNR, W.V. 1984-85.

SPECIES	Rt.41	Rt.25	Rt.20	River Rd.
Two-lined salamander	X	X		X
Red salamander	X			
Spotted salamander	X		X	
Seal salamander	X	X		
northern dusky salamander				X
Slimy salamander			X	X
Long-tailed salamander			X	
Red-spotted newt		X		
Gray treefrog	X	X		X
Spring peeper	X	X	X	X
Mountain chorus frog			X	
American toad		X		X
Fowlers toad			X	
Wood frog	X		X	
Pickerel frog			X	X
Green frog				X
Bullfrog				X
Garter snake				X
Northern water snake			X	X
Queen snake				X
Milk snake				X
Northern ringneck snake				X

Routes:
1) Rt.41 traveled from Park boundary sign to McCreery--Upland hardwood habitat type.
2) Rt.25 traveled from Thurmond to Park boundary sign--Tributary stream gorge habitat type.
3) Rt.20 traveled from Bass Lake Camp to Sandstone --Upland hardwood habitat type.
4) River road traveled from Hinton to Sandstone Falls State Park--boundary between riparian floodplain and upland hardwood habitat types.

TABLE 33. REPTILES AND AMPHIBIANS OBSERVED IN THE NRGNR, W.V. 1984-85.

	SWB	TSG	UP1	DIS
FROGS AND TOADS				
pickerel frog (Rana palustris)	X			
bullfrog (R. catesbeiana)	X			
green frog (R. clamitans)			X	
wood frog (R. sylvatica)			X	
gray treefrog (Hyla sp.)			X	
spring peeper (Hyla crucifer)			X	
mtn chorus (Pseudacris brachyphona)			X	
American toad (Bufo americanus)	X	X	X	X
Fowlers toad (Bufo fowleri)			X	
SALAMANDERS				
red-spotted newt (N. viridescens)			X	
slimy (Plethodon glutinosus)		X	X	
red-backed (P. c. cinereus)		X	X	
green (Aneides aneus)		X		
two-lined (Eurycea b. bislineata)		X	X	
long-tailed (Eurycea longicauda)			X	
spotted (Ambystoma maculatum)			X	
Jefferson s (A. jeffersonianum)			X	
n. dusky (Desmognathus f. fuscus)		X		
mtn. dusky (D. ochrophaeus)		X		
black-bellied (D. quadramaculata)		X		
seal (D. monticola)		X		
no. spring (Gyrinophylis porphyriticus)		X		
northern red (Pseudotriton r. ruber)		X	X	
SNAKES				
ringneck (Diadophis p. edwardsi)			X	X
red-bellied (Storeia occipitomaculata)		X		
garter (Thamnophis s. sirtalis)			X	X
rough green (Opheodrys aestivus)			X	
milk (Lampropeltis triangulum)			X	
black rat (Elaphe o. obsoleta)	X		X	
black racer (Coluber constrictor)			X	
n. water (Natrix s. sipedon)	X			
queen (N. septemvittata)	X			
copperhead (Agkistrodon c.mokasen)				X
LIZARDS				
5-lined skink (Eumeces fasciatus)			X	
n.fence (Sceloporus undulatus)				X
TURTLES				
e. box (Terrapene c. carolina)	X		X	

TABLE 34. AQUATIC HERPTILES OBSERVED IN THE NRGNR, W.V. 1984-85.

SPECIES	STATUS	HABITAT DESCRIPTION
Common musk turtle	A	pools and backwaters
Common snapping turtle	A	pools and backwaters
Painted turtle	C	backwaters
River cooter	U	pools and backwaters
Common map turtle	R	pools
Northern water snake	C	pool edges with cover
Queen snake	C	pool and riffle edges
Mudpuppy	U	pools, backwaters, and riffles
Bullfrog	U	backwaters

Status: A=abundant, C=common, U=uncommon, R=rare.

TABLE 35. VERTEBRATES THAT MAY OCCUR IN THE NRGNR.*

SPECIES	PROBABLE HABITAT
Ravine salamander (Plethodon richmondi)	UP2, TSG
Valley and Ridge salamander (Plethodon hoffmani)	UP2, TSG
Cumberland plateau woodland salamander (P. kentucki)	UP2, TSG
Wehrles salamander (Plethodon wehrleri)	UP2, TSG
Marbled salamander (Ambystoma opacum)	UP2
Four-toed salamander (Hemidactylium scutatum)	UP2
Midland mud salamander (Pseudotriton montanus)	TSG
Cave salamander (Eurycea lucifuga)	limestone caves
Hellbender (Cryptobranchus alleghenensis)	river riffles
Coal skink (Eumeces anthracinus)	RGT, UP1
Broad-headed skink (Eumeces laticeps)	UP1
Timber rattlesnake (Crotalus horridus)	UP1, RGT
Eastern ribbon snake (Thamnophis sauritus)	UP1, SWB
Northern brown snake (Storeria dekayi)	UP1
Eastern hognose snake (Heterodon platyrhinos)	DIS, OLD
Smooth green snake (Opheodrys vernalis)	UP1, SWB
Eastern worm snake (Carphopis amoenus)	UP1, UP2
Spiny softshell turtle (Trionyx spiniferus)	river pools
Pygmy shrew (Microsorex hoyi)	UP1, UP2, TSG
Northern water shrew (Sorex palustris)	TSG
Southeastern shrew (Sorex longirostris)	UP1, UP2, TSG
Southern bog lemming (Synaptomys cooperi)	Wetlands
Yellow-nose vole (Microtus chrotorrhinus)	UP2
White-footed mouse (Peromyscus leucopus)	all
Starnose mole (Condylura cristata)	UP2
Little brown bat (Myotis lucifugus)	For all bats:
Keen myotis (Myotis keeni)	limestone caves,
Indiana bat (Myotis sodalis)	sandstone cliffs,
Small-footed bat (Myotis subulatus)	mine shafts
Silver-haired bat (Lasionycterus noctivagans)	barns,
Red bat (Lasiurus borealis)	
Big brown bat (Eptesicus fuscus)	
Hoary bat (Lasiurus cinereus)	
Evening bat (Nycticeius humeralis)	
Western big-eared bat (Plecotus townsendi)	
Eastern big-eared bat (Plecotus refinesquei)	
Least weasel (Mustela rixosa)	OLD
Long-tailed weasel (Mustela frenata)	UP1, UP2
Spotted skunk (Spilogale putorius)	UP1, UP2
Northern flying squirrel (Glaucomys sabrinus)	
Eastern mountain lion (Felis concolor)	
Coyote (Canis latrans)	

*not encountered, but within the known geographic range.

MISCELLANEOUS INSECTS AND BUTTERFLIES:

During the course of the study, we kept a list of unusual in-sects and butterflies encountered (Table 36). It became obvious that some species were closely associated with riparian habitats and might be affected by river flows. Butterflies are often noticed by park visitors and included as 'wildlife'.

TABLE 36. BUTTERFLIES, MOTHS, AND OTHER INSECTS ENCOUNTERED IN THE NEW RIVER GORGE NATIONAL RIVER, W.V. 1984-85.

SPECIES	DATE	LOCATION
Pipevine Swallowtail (Papilio philenor)		most floodplains
Spicebush Swallowtail (Papilio troilus)	5-17	floodplains
Tiger Swallowtail (Papilio glaucus)		floodplains, OLD
Giant Swallowtail (Papilio cresphontes)		uplands
Zebra Swallowtail (Papilio marcellus)	5-16	floodplains
Red-spotted Purple (Limenitis arthemis)	8-15	uplands,floodplain
Common Sulphur (Colias philidice)		OLD
Alfalfa (Colias eurytheme)	5-17	floodplain, OLD
Diana (Speyeria diana)		floodplain
Pearl Crescent (Phyciodes tharos)		
Little Blue (Leptotes sp.)		
Little Wood Satyr (Euptychia cymela)	5-18	floodplain
Mitchells Satyr (Euptychia mitchellii)	5-18	Brooks Falls,SYC
Mourning Cloak (Nymphalis antiopa)	4-10	McKendree UP2
Question Mark (Polygonia interrogationis)	6-27	floodplain,TSG
Red Admiral (Vanessa atalanta)	8-20	floodplain
Great-Spangled Fritillary (Speyeria cybele)	5-17	OLD
Monarch (Danaus plexippus)	8-15	floodplain
Silver-Spotted Skipper (Epargyreus clarus)	5-17	floodplain
Luna Moth (Actias luna)		uplands
Io Moth (Automeris io)	6-20	floodplain
Cecropia Moth (Hyalophora cecropia)		uplands
Imperial Moth		floodplain
Praying Mantis		OLD
Hellgramite		floodplain
Milkweed beetle	6-27	FAR

CONCLUSIONS

Each habitat classification in the NRGNR has its own unique plant and animal community. Human altered habitats, such as farmland and strip mines provide habitat for species that might not be naturally abundant here.

Floodplain habitat in the NRGNR is limited. Past development and human disturbance have altered most gently sloping or flat sites in the Hinton to Meadow Creek area. Less impacted floodplain forest habitat exists in the Glade Creek area and between Terry and Mr. Stone's residence, river left. The latter sites are impacted seasonally by campers, fishermen, and off-road vehicles. Impacts to riparian habitats in the northern section of the Gorge appear to be limited by the lack of access and maintenance by rafting companies.

It is difficult to assess the effects of flow flucuations on riparian habitats and vegetation. During the two summer field seasons, we experienced relatively high flows (1984) and low flows (1985). Although we did not quantify differences between years, we made some qualitative assessments.

During 1984 the growth of aquatic, submergent weedbeds was less than in 1985. Presumably, this is because of the scouring and erosion that accompanies high discharges. Weedbeds provide habitat and food for fish, turtles, waterfowl, furbearers, and others. Abundance of forage fish, such as shiners, was much greater in 1985 (see

section 4). This is largely attributable to aquatic plant production.

In 1984 the understories of riparian forests were less dense. Certain colorful wildflowers, such as mistflower (Eupatorium coelestinum), cardinal flower (Lobelia cardinalis), and trumpet creeper (Campis radicans) were not observed in 1984, yet were common in riparian understories in 1985. On some heavily flooded areas ground cover consisted of mudflats due to the scouring action of high water. Consequently, small mammal species diversity was less in 1984 than in 1985 on the same study sites. It is likely that nest mortality occurs in ground nesting birds and waterfowl due to flooding.

To predict the total change to riparian habitats due to flow alterations would take years of study. However, it is conceivable that with hydropower flows, floodplain forests of SWB, SYC, and Willow types would be eroded away, and replaced by SSW types. Be-cause of the harsh environment in which the SSW habitat exists, both floral and faunal species diversity is low.

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SCIENTIFIC NOMENCLATURE FOR AVIAN FAUNA IN THE NRGNR.

Gavia immer Common Loon
Podilymbus podiceps Pied-billed Grebe
Podiceps auritus Horned Grebe
Phalacrocorax auritus Double-crested Cormorant
Ardea herodias Great Blue Heron
Butorides striatus Green-backed Heron
Cyanus olor Mute Swan
Branta canadensis Canada Goose
Aix sponsa Wood Duck
Anas rubripes Black Duck
Anas platyrhynchos Mallard
Anas strepera Gadwall
Anas americana American Widgeon
Aythya affinis Lesser Scaup
Bucephala clancrula Common Goldeneye
Lophodytes cuccullatus Hooded Merganser
Mergug merganser Common merganser
Merous serrator Red-breasted Merganser
Oxyura jamaicensis Ruddy Duck
Coraayps atratus Black Vulture
Cathartes aura Turkey Vulture
Pandion haliaetus Osprey
Accipter striatus Sharp-shinned Hawk
A. cooperii Cooper s Hawk
Buteo lineatus Red-shouldered Hawk
B. platypterus Broad-winged Hawk
B. jamaicensis Red-tailed Hawk
Aquila chrysaetos Golden Eagle
Bonasa umbellus Ruffed Grouse
Meleaaris gallopavo Wild Turkey
Fulica americana American Coot
Charadrius vociferus Killdeer
Trinaa flavipes Lesser Yellowlegs
Actitus macularia Spotted Sandpiper
Scolopax minor American Woodcock
Larus delawarersis Ring-billed Gull
Sterna hirundo Common Tern
Columba livia Rock Dove
Zenaida macroura Mourning Dove
Coccyzus americanus Yellow-billed Cuckoo
Otus asio Eastern Screech-Owl
Bubo virqinianus Great Horned Owl
Strix varia Barred Owl
Chordeiles minor Common Nighthawk
Chaetura pelaaica Chimney Swift
Archilochus colubris Ruby-throated Hummingbird
Ceryle alcyon Belted Kingfisher
Melanerpes carolinus Red-bellied Woodpecker
Sphyrapicus variug Yellow-bellied Sapsucker
Picoides pubescens Downy Woodpecker
P. villosus Hairy Woodpecker
Colaptes auratus Northern Flicker

Dryocopus pileafcus Pileated Woodpecker
Contopus virens Eastern Wood-Pewee
Empidonax virescens Acadian Flycatcher
E. traillij. Willow Flycatcher
E. minimus Least Flycatcher
Sayornis phoebe Eastern Phoebe
Myiarchus crinitus Great. Crested Flycatcher
Tyrannus tyrannus Eastern Kingbird
Tachycineta bicolor Tree Swallow
Stelgidopteryx serripennis Northern Rough-winged Swallow
Riparia riparia, Bank Swallow
Hirundo pyrrhonota Cliff Swallow
H. rustica Barn Swallow
Cyanocitta cristata Blue Jay
Corvus brachyrhynchos American Crow
Parus atricapillus Black-capped Chickadee
P. carolinensis Carolina Chickadee
P. bicolor Tufted Titmouse
Sitta canadensis Red-breasted Nuthatch
S. carolinensis White-breasted Nuthatch
Certhia americana Brown Creeper
Thryothorus ludovicianus Carolina Wren
Troglodytes troglodytes Winter Wren
Regulus satrapa Golden-crowned Kinglet
R. callendula Ruby-crowned Kinglet
Polioptila caerulea Blue-gray Gnatcatcher
Sialj.a sialis Eastern Bluebird
Catharus fuscescens Veery
C. ustulatus Swainson s Thrush
Hylocichla mustelina Wood Thrush
Turdus migratorius American Robin
Dumetella carolinensis Gray Catbird
Mimus polyglottos Northern Mockingbird
Toxostoma rufum Brown Thrasher
Bombycilla cedrorum Cedar Waxwing
Sturnus vulaaris European Starling
Vireo griseus White-eyed Vireo
V. solitarius Solitary Vireo
V. flavifrons Yellow-throated Vireo
V. qilvus Warbling Vireo
V. olivaceus Red-eyed Vireo
Parula americana Northern Parula Warbler
Dendroica petechia Yellow Warbler
D. pennsylvanica Chestnut-sided Warbler
D. caerulescens Black-throated Blue Warbler
D. coronata Yellow-rumped Warbler
D. virens Black-throated Green Warbler
D. fusca Blackburnian Warbler
D. dominica YeHow-throated Warbler
D. pinus Pine Warbler
D. castanea Bay-breasted Warbler

D. striata Blackpoll Warbler
D. cerulea Cerulean Warbler
Mnlotilta varia Black-and-white Warbler
Setophacra ruticilla American Redstart
Helmitheros vermivorus Worm-eating Warbler
Seiurus aurocapillus Ovenbird
S. motacilla, Louisiana Waterthrush
Oporornis formosus Kentucky Warbler
Geothlypis trichas Common Yellowthroat
Wilsonia citrina Hooded Warbler
Icteria virens Yellow-breasted Chat
Piranga rubra Summer Tanager
P. olivacea Scarlet Tanager
Cardinalis cardinalis Northern Cardinal
Pheucticus ludovicianus Rose-breasted Grosbeak
Passerina cyanea Indigo Bunting
Spiza americana Dickcissel
Pipilo erythrophthalmus Rufous-sided Towhee
Spizella passerina Chipping Sparrow
S. pusilla Field Sparrow
Passerella iliaca Fox Sparrow
Melospiza melodia Song Sparrow
ZQnotrichia albicollis White-throated Sparrow
Junco hyemalis Dark-eyed Junco
Acrelaius phoeniceus Red-winged Blackbird
Sturnella macrna Eastern Meadowlark
Ouiscalus quiscula Common Crackle
Molothrus ater Brown-headed Cowbird
Icterus spurius Orchard Oriole
I. galbula Northern Oriole
Carpodacus mexicanus House Finch
Carduelis tristis American Goldfinch
Passer domesticus House Sparrow

APPENDIX 1. Minimum monthly temperatures in the New River Gorge National River for the period 1977-1985.

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
77-78	11.5	5.0	3.0	1.0	0	1.5	10.0	12.0	22.0	23.5	25.5	22.0
78-79	12.5	8.0	3.5	2.0	1.0	4.5	10.5	13.0	18.0	20.5	24.0	19.5
79-80	9.0	7.5	4.0	3.5	1.5	2.0	9.5	11.0	21.0	24.0	26.5	21.0
80-81	11.5	7.5	3.0	2.0	2.0	5.5	10.0	14.5	18.5	24.0	22.5	17.5
81-82	13.0	6.0	2.0	2.0	2.0	5.5	9.5	14.0	18.0	25.0	23.5	10.5
82-83	--	9.0	5.0	1.5	3.0	5.0	8.5	14.5	19.0	24.5	26.0	19.5
83-84	--	--	--	--	--	--	--	--	--	--	--	--
84-85	--	--	--	--	--	--	--	--	--	--	--	--

APPENDIX 2. Maximum monthly flow discharges in the New River Gorge National River for the period 1974-1985.

YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
74-75	14200	9100	20300	32700	44600	55900	35800	27900	27800	6680	6250	22100
75-76	40100	17400	10100	49100	20300	12200	24200	12300	34600	6990	3530	3860
76-77	56100	14300	31700	5800	38400	39400	53800	10300	6500	4650	4250	6320
77-78	15900	52100	29900	50400	38600	51300	48300	30800	9240	7850	14300	3370
78-79	2340	3690	15700	50400	43200	56500	30600	34200	24400	9060	7350	41200
79-80	25000	29000	19300	38500	13700	40800	45900	21600	9230	14300	8670	2870
80-81	4560	7060	5410	3230	17800	11600	16800	42600	33000	8300	2570	7640
81-82	15200	3850	18600	44000	55400	39100	19100	13000	56700	8280	6790	5100
82-83	5800	32800	36600	10000	36900	45500	54300	25200	9460	6100	3180	2330
83-84	20200	13600	29800	13900	62500	45000	38700	48200	8840	6950	31900	11200
84-85	6100	17200	13300	29300	33300	16700	8900	32400	5120	5500	24500	5050