APPENDIX G

POPULATION TRENDS OF MANAGEMENT INDICATOR SPECIES ON THE GEORGE WASHINGTON AND JEFFERSON NATIONAL FORESTS

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INTRODUCTION

Under the National Forest Management Act (NFMA) the Forest Service is charged with providing for a diversity of plant and animal communities consistent with overall multiple-use objectives. Management Indicator Species (MIS) are a planning tool used to accomplish this requirement (36 CFR 219.19). They are selected during forest planning "because their population changes are believed to indicate the effects of management activities" (36 CFR 219.19(a)(1)) on important elements of plant and animal diversity. They and their habitat needs are used to set management objectives and minimum management requirements, to focus effects analysis, and to monitor effects of Forest Plan implementation. The George Washington and Jefferson Forest Plans are designed to provide habitat conditions needed to maintain viable populations of all MIS, along with other species that use similar habitats.

Wildlife, fish, and plant species are managed in cooperation with the Virginia Department of Game and Inland Fisheries (VDGIF), Virginia Department of Conservation and Recreation – Division of Natural Heritage (VDCR-DNH), West Virginia Department of Natural Resources (WVDNR), and the Kentucky Department of Fish and Wildlife Resources (KDFWR). The respective states set policy for hunting and fishing regulations and law enforcement programs. The Forest Service manages fish and wildlife habitat conditions. This discussion focuses on the habitat conditions that support the wildlife populations that are managed by the States.

This report focuses on the effects of Forest Service management on the habitat conditions that support Management Indicator Species.

A. Identification of Management Indicator Species

1. George Washington Revised Plan Management Indicator Species

Table 1 shows the MIS for the George Washington National Forest (GWNF) (Plan pages 2-8 and 2-9; GWNF FEIS, Appendix J). Each MIS has a relationship with a certain type of preferred habitat. The habitat preferred by the species is discussed under each species discussion.

Table 1. George Washington National Forest MIS

Ecological Indicators	Threatened and Endangered Species	Demand Species
Cave Dwelling Bats	Indiana Bat	Black Bear*
Brown Headed Cowbird	Northern Flying Squirrel	Eastern Wild Turkey*
Worm-eating Warbler	Peregrine Falcon	White-tailed Deer*
Ovenbird	Bald Eagle	
Cow Knob Salamander	James Spinymussel	
Tiger Salamander	Shale Barren Rockcress	
Common Flicker*	Swamp Pink	
Pileated Woodpecker*	Northern Bulrush	
Native Brook Trout*		
Sunfish Family (Centrarchid)*		
Yellow Pine Community		
Old Growth Forest Types		

*Common MIS to the Jefferson National Forest

2. Jefferson Plan Management Indicator Species

Table 2 shows the MIS for the Jefferson National Forest (JNF) (JNF Plan pages IV-20). Seven species are the same as those MIS identified for the GWNF. Only the Barred Owl, as an MIS, is unique to the JNF. Each MIS has a relationship with a certain type of preferred habitat. The habitat preferred by the species is discussed under each species discussion.

Table 2. Jefferson National Forest MIS

Management Indicator Species
Common Flicker
Pileated Woodpecker
White-tailed Deer
Wild Turkey
Black Bear
Barred Owl
Wild Trout
Sunfish Family

B. Trend in Forest Service Management Activities Associated with MIS Habitats

Table 3 through Table 9 display historic trends in key management activities across the Forests.

Table 3. Transportation System Trend on the Jefferson National Forest

	Total Forest	Open Year-round Or Seasonally		Closed Year-round	
Year	(Miles)	(Miles)	(Percent of Total)	(Miles)	(Percent of Total)
1984	1,043	930	89	113	11
1986	1,132	990	87	142	13
1996	1,198	970	81	228	19
1999	1,212	1,017	84	195	16
2003	1,202	669	56	533	44

Table 4. Transportation System Trend on the George Washington National Forest

	Total Forest	Open Year-round Or Seasonally		Closed Year-round	
Year	(Miles)	(Miles)	(Percent of Total)	(Miles)	(Percent of Total)
1984	1,330	1,170	88	160	12
1993	1,760	1,050	60	710	40
1999	1,700	1,012	60	688	40
2003	1,798	973	54	825	46

Table 5. Management Activities Trend on George Washington National Forest Only

Year	Timber Harvest (Acres)	Timber Cut (Million Bd. Ft.)	Prescribed Burning (Acres)	Gypsy Moth Aerial Spraying (Acres)	Road Construction (Miles)
1976	N/A	26.6	N/A	0	N/A
1977	N/A	16.9	N/A	0	N/A
1978	N/A	18.2	N/A	0	N/A
1979	N/A	17.3	N/A	0	11
1980	N/A	25.7	N/A	0	16
1981	N/A	37.4	0	0	24
1982	N/A	29.8	115	0	N/A
1983	N/A	34.2	N/A	0	N/A
1984	N/A	36.4	117	0	N/A
1985	N/A	44.9	N/A	0	49.7
1986	N/A	32.2	189	0	36.6
1987	N/A	35.9	146	200	24.9
1988	3,966	40.5	40	8,395	24.6
1989	3,492	41.7	37	4,098	16.3
1990	3,265	33.6	1,092	8,121	2.3
1991	3,396	36.9	170	4,368	11.9
1992	4,082	38.2	970	2,198	7.8
1993	3,271	35.2	1,870	6,855	4.4
1994	2,993	37.2	795	4,735	3.8
1995	2,707	33.4	1,741	4,800	4.5
1996	1,964	27.4	1,339	2,015	6.17
1997	3,215	24.8	1,465	3,000 Research	2.7
1998	1,449	24.0	6,564	3,000 Research	0.7
1999	1,284	21.7	5,523	0	3.2
2000	1,254	17.9	4,172	0	0.1
2001	1,162	15.8	3,135	3,695	2.8
2002	881	14.7	2,322	2,183	0.3
2003	789	13.0	7,188	0	0.0

N/A: Information Not Available

Volume Harvested utilizes 0.66 conversion factor from cubic feet for comparison with previous years.

Table 6. Management Activities Trend on Jefferson National Forest Only

Year	Timber Harvest (Acres)	Timber Cut (Million Bd. Ft.)	Prescribed Burning (Acres)	Gypsy Moth Aerial Spraying (Acres)	Road Construction (Miles)
1976	N/A	16.8	N/A	0	N/A
1977	N/A	8.8	N/A	0	N/A
1978	N/A	6.8	N/A	0	N/A
1979	N/A	14.5	N/A	0	20
1980	N/A	15.1	N/A	0	21
1981	N/A	17.3	N/A	0	26
1982	N/A	17.1	N/A	0	N/A
1983	N/A	21.8	N/A	0	N/A
1984	N/A	21.2	N/A	0	40.1
1985	N/A	28.0	N/A	0	33.1
1986	2,854	30.6	466	0	23.9
1987	2,498	25.7	983	0	18.1
1988	2,945	28.7	935	16,334	18.7
1989	1,850	21.2	1,232	13,818	7.2
1990	1,897	28.9	1,718	0	3.0
1991	2,699	32.5	1,411	0	8.5
1992	2,023	19.1	963	343	4.8
1993	2,397	25.4	1,245	0	7.7
1994	2,438	20.1	1,233	0	2.6
1995	1,715	22.3	1,353	0	1.3
1996	1,218	17.7	775	0	1.25
1997	1,682	9.4	2,323	0	1.0
1998	1,293	11.3	5,310	0	0.6
1999	942	14.8	2,462	0	0.0
2000	1,115	9.6	994	0	0.0
2001	795	7.3	2,715	643	0.0
2002	332	4.3	3,228	2,706	0.0
2003	226	3.8	3,207	0	0.2

N/A: Information Not Available

Volume Harvested utilizes 0.66 conversion factor from cubic feet for comparison with previous years.

Table 7. Combined Management Activities Trend Across Both Forests

Year	Timber Harvest (Acres)	Timber Cut (Million Bd. Ft.)	Prescribed Burning (Acres)	Gypsy Moth Aerial Spraying (Acres)	Road Construction (Miles)
1976	N/A	43.4	N/A	0	N/A
1977	N/A	25.7	N/A	0	N/A
1978	N/A	25.0	N/A	0	N/A
1979	N/A	31.8	N/A	0	31
1980	N/A	40.8	N/A	0	37
1981	N/A	54.7	N/A	0	40
1982	N/A	46.9	N/A	0	N/A
1983	N/A	56.0	N/A	0	N/A
1984	N/A	57.6	N/A	0	N/A
1985	N/A	72.9	N/A	0	82.8
1986	N/A	62.8	655	0	60.5
1987	N/A	61.6	1,129	200	43.0
1988	6,911	69.2	975	24,729	43.3
1989	5,342	62.9	1,269	17,916	23.5
1990	5,162	62.5	2,810	8,121	5.3
1991	6,095	69.4	1,581	4,368	20.4
1992	6,105	57.3	1,933	2,541	12.6
1993	5,668	60.6	3,115	6,855	12.1
1994	5,431	57.3	2,028	4,735	6.4
1995	4,422	55.7	3,094	4,800	5.8
1996	3,182	45.1	2,114	2,015	7.42
1997	4,897	34.2	3,788	3,000 Research	3.7
1998	2,742	35.3	11,874	3,000 Research	1.3
1999	2,226	36.5	7,985	0	3.2
2000	2,369	27.5	5,136	0	0.1
2001	1,957	23.1	5850	4,338	2.8
2002	1,213	19.0	5550	4,889	0.3
2003	1,015	16.9	10,395	0	0.2

N/A: Information Not Available
Volume Harvested utilizes 0.66 conversion factor from cubic feet for comparison with previous years.

C. Forested Age Class Distribution Trend

Management Indicator Species are monitored on the George Washington and Jefferson National Forests (GWJNF or Forests) through the use of both population data and habitat data. An evaluation of the trends in population data for each MIS is presented later in this document. Habitat condition is one of the primary factors influencing population levels for these species; and Table 8 and Table 9 assesse the trends in key habitat parameters.

Table 8. GWJNF Age Class Distribution for All Forested Land 1989 and 2000

	Jefferson National Forest				George Washington National Forest				Combined GW&JNFs			
Age	1989	%	2000	%	1989	%	2000	%	1989	%	2000	%
0-10	26269	3.9	14050	2.0	44367	4.3	25422	2.5	70636	4.1	39472	2
11-20	25682	3.8	18606	2.6	32524	3.1	29564	2.9	58206	3.4	48170	3
21-30	13122	1.9	21987	3.1	22987	2.2	32688	3.2	36109	2.1	54675	3
31-40	6967	1.0	15586	2.2	3309	0.3	22076	2.1	10276	0.6	37622	2
41-50	29840	4.4	8079	1.1	5490	0.5	3043	0.3	35330	2.1	11122	1
51-60	121277	17.9	29028	4.1	31822	3.1	5395	0.5	153099	8.9	34423	2
61-70	173584	25.6	117925	16.7	101660	9.8	30012	2.9	275244	16.1	147937	8
71-80	115851	17.1	184066	26.0	214257	20.7	97771	9.4	330108	19.3	281837	16
81-90	55392	8.3	125716	17.8	218002	21.1	211272	20.4	273394	16.0	336988	19
91-100	29911	4.4	62701	8.9	115456	11.2	226444	22.0	145367	8.5	289145	17
101-110	43927	6.5	27319	3.9	79291	7.7	114292	11.0	123218	7.2	141611	8
111-120	17835	2.6	46654	6.6	63294	6.1	76612	7.4	81129	4.7	123266	7
121-130	9499	1.4	18280	2.6	33702	3.3	60482	5.8	43201	2.5	78762	5
131-140	4860	0.7	11577	1.6	26012	2.5	33589	3.2	30872	1.8	45166	3
141-150+	3149	0.5	5902	0.8	42546	4.1	66351	6.4	45695	2.7	72253	4
TOTAL	677165	100	707476	100	1034719	100	1035013	100	1711884	100	1742489	100

(Source: Continuous Inventory of Stand Conditions (CISC) for GWJNF dataset of 12-1-89 and 3-16-00)

Table 9. GWJNF Age Class Distribution for All Forested Land 1989 and 2004 (last 15 years)

	Jefferson National Forest				George Washington National Forest				Combined GW&JNFs			
Age	1989	%	2004	%	1989	%	2004	%	1989	%	2004	%
0-10	26269	3.9	4167	1	44367	4.3	10835	1	70636	4.1	15002	0.9
11-20	25682	3.8	18303	3	32524	3.1	27261	3	58206	3.4	45564	2.6
21-30	13122	1.9	16178	2	22987	2.2	26279	3	36109	2.1	42457	2.5
31-40	6967	1.0	26355	4	3309	0.3	38930	4	10276	0.6	65285	3.8
41-50	29840	4.4	8086	1	5490	0.5	5102	1	35330	2.1	13188	0.8
51-60	121277	17.9	13861	2	31822	3.1	4077	0	153099	8.9	17938	1.0
61-70	173584	25.6	66707	9	101660	9.8	15297	2	275244	16.1	82004	4.8
71-80	115851	17.1	163347	23	214257	20.7	61378	6	330108	19.3	224725	13.0
81-90	55392	8.3	162151	23	218002	21.1	162741	16	273394	16.0	324892	18.9
91-100	29911	4.4	87287	12	115456	11.2	223469	22	145367	8.5	310756	18.0
101-110	43927	6.5	41877	6	79291	7.7	170983	17	123218	7.2	212860	12.4
111-120	17835	2.6	34052	5	63294	6.1	74508	7	81129	4.7	108560	6.3
121-130	9499	1.4	40014	6	33702	3.3	67878	7	43201	2.5	107892	6.3
131-140	4860	0.7	14125	2	26012	2.5	46137	5	30872	1.8	60262	3.5
141-150+	3149	0.5	9740	2	42546	4.1	80670	8	45695	2.7	90410	5.2
TOTAL	677165	100	706250	100	1034719	100	1015545	100	1711884	100	1721795	100

(Source: Continuous Inventory of Stand Conditions (CISC) for GWJNF dataset of 12-1-89 and GIS Stands Attribute Table of 3-29-04)

D. Monitoring and Evaluation of Individual Management Indicator Species

Management Indicator Species are monitored on the Forests through use of both population and habitat data. Habitat condition is one of the primary factors influencing population levels for these species; therefore, an assessment of trends in key habitat parameters also is important. In this section, population and habitat data for each MIS is discussed, with the Forest' data combined for MIS in common. Important differences in population trends or numbers between the Forests are highlighted where they occur.

Demand Species

1. White-tailed Deer

a. Reason For Selection: White-tailed Deer was selected because it is a species commonly hunted and its populations are therefore of direct interest. It's a species whose habitats may be influenced by management activities (GWNF FEIS Appendix page J-12, JNF FEIS, Appendix page D-3). White-tailed deer use a variety of habitat types. A mixture of habitat types and resulting edge insures an abundant food source is available throughout the year. Yet the fundamental relationship between white-tailed deer and its habitat is that it prefers browse associated with early successional forested areas and it eats large quantities of hard mast, such as acorns, that are found in more mature forests. Thus, a mosaic of forest age classes (GWNF FEIS, page 3-171) is preferred. The amount and distribution of both early successional habitat and habitat that provides hard mast is most likely to be influenced by management activities associated with timber sales. On private lands, deer spend much of their time in feeding on agricultural crops, such as alfalfa or soybeans.

b. Plan Habitat Objectives Related to MIS: For the GWNF, to maintain habitat for deer, a minimum of one percent of the forest should be in early successional stages of ages 1 through 12, while 10% should be hard mast bearing stands (in hardwood stands within age range from 40 to 120 years old) (GWNF FEIS, Appendix J, page J-5). For the JNF, a minimum of 69,000 acres (also 10 %) should be able to produce hard mast (JNF FEIS, Appendix B, page B-32).

The Plan identifies a minimum population of four deer per square mile or approximately 6,500 deer spread throughout the GWNF (GWNF FEIS, Appendix J, page J-13). The JNF should provide a minimum population of 5,390 deer (4.9 deer per square mile) (JNF FEIS, Appendix B, page B-32).

c. Description of Monitoring Method: Hunter harvest information is reported by state wildlife agencies. For deer harvested on National Forest System (NFS) land, the VDGIF and the WVDNR use a sex, age, and kill models to generate population estimates. They also compare population trends from spotlight counts. Additionally, the state agencies use physical condition data from check stations as an aid in assessing the health of the population. This information helps them (and the Forests) to determine if the population is approaching the carrying capacity of the habitat.

d. Habitat Trend for MIS: Table 8 and Table 9 compare age class data or age class acres on NFS land. Table 10 compares age class data or age class acres from the Forest Inventory and Analysis (FIA) for 1986 and 1992 for all forested land in Virginia.

Table 10. Forest Age Class, 1986 & 1992, All Virginia Forestland

(In Thousand Acres)

10-Year	Oak-Pine on All Virginia Forestland			Upland Hardwood on All Virginia Forestland		
Age Class	1986	1992	2001	1986	1992	2001
0-10	313	363	237	630	670	859
11-20	189	227	190	508	491	741
21-30	120	161	203	404	402	630
31-40	144	114	162	650	520	554
41-50	167	133	182	1,078	852	919
51-60	178	243	144	1,527	1,357	1,057
61-70	175	195	171	1,266	1,419	1,418
71-80	91	138	157	890	1,027	1,378
81+	103	151	153	1,135	1,461	2,191

e. Population Trend for MIS: Table 11through Table 13 display deer population trends received from the Virginia Department of Game and Inland Fisheries (VDGIF). Trend data were derived from a population index for each county. The population status in Virginia is monitored using an antlered buck harvest rate per square mile of habitat index. VDGIF routinely uses antlered buck harvest rates per unit area to provide a population index and monitor population status and changes in population status over time. A similar population index for West Virginia or Kentucky counties is not available at this time. Our assumption is that the overall trend is similar because of the similarity of management in the three states and the small (400) acreage in Kentucky.

Table 11. White-tailed Deer Population Index Trend Across the GWNF, 1994 to 2002

County	Percent National Forest in County	Ranger Districts Included	% Annual Change 1994-2002
Allegheny	56	James River, Warm Springs	-11
Amherst	19	Pedlar	-4
Augusta	30	Deerfield, Dry River, Pedlar	6
Bath	50	Deerfield, Warm Springs	-5
Frederick	2	Lee	-5
Highland	5	Deerfield, Dry River, Warm Springs	0
Nelson	6	Pedlar	+15
Page	13	Lee	+7
Rockbridge	17	Deerfield, James River, Pedlar	-6
Rockingham	25	Dry River, Lee, Warm Springs	+6
Shenandoah	23	Lee	+22
Warren	5	Lee	+2l

Table 12. White-tailed Deer Population Index Trend Across the JNF, 1994 to 2002

County	Percent National Forest in County	Ranger Districts Included	% Annual Change 1994-2002
Bedford	4	Glenwood	+6
Bland	31	Blacksburg, Wythe	-6
Carroll	2	Mt. Rogers	-5
Craig	55	Blacksburg, New Castle	-9
Dickenson	4	Clinch	+14
Giles	27	Blacksburg, New Castle, Wythe	+7
Grayson	11	Mt. Rogers	-19
Lee	4	Clinch	+17
Montgomery	8	Blacksburg	+10
Pulaski	9	Blacksburg, Wythe	+29
Roanoke	2	New Castle	+6
Scott	10	Clinch	-12
Smyth	25	Mt. Rogers, Wythe	+3
Tazewell	3	Wythe	-2
Washington	6	Mt. Rogers	-2
Wise	14	Clinch	0
Wythe	19	Mt. Rogers, Wythe	-2

Table 13. White-tailed Deer Population Index Trend Across Shared Counties, 1994 to 2002

County	Percent National Forest in County	Ranger Districts Included	% Annual Change 1994-2002
Botetourt	23	James River, New Castle	-5

The individual counties range from significant increasing trends (Pulaski 29%) to significant decreasing trends (Grayson -19%) to no change (Highland and Wise). Overall, public lands demonstrate a -1% trend (stable) whereas private lands in the same counties demonstrate a 5% increasing trend (M. Knox, VDGIF Deer Program Manager, Pers. Communication, 4/8/2004). Statewide, VDGIF reports a 9.8% increase in total number of deer harvested in 2003 compared to 2002 (www.dgif.state.va.us/hunting/va_game_wildlife/harvest_summaries.html). In 2000, VDGIF and WVDNR estimated deer populations at 49,418 individuals on the GWNF and 31,450 individuals on the JNF, respectively. Based on the overall stable population trend calculation, deer populations for 2003 are estimated to be at the same level on the GWNF and JNF, respectively.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Review of Table 8 and Table 9 shows that on the GWJNF there was a decrease in the amount of early successional habitat. Statewide, however, Virginia had an increase in early successional (0-10) forest habitats during the same period (VDGIF 1999). On the Forest, more mature forests, in combination with the decreased amount of cropland adjacent to the Forests, has caused a decline in total available deer habitat. A quote from the Virginia Deer Management Plan (VDGIF 1999) states: "A factor that has negatively influenced and will continue to influence deer on public land in western Virginia is deterioration in the quality of deer habitat. The habitat on National Forests over much of Virginia has progressively grown more mature to the point of becoming less desirable for deer."

Deer do best in areas where there is an interspersion of different age classes. These different age classes (or successional stages) vary in vegetative condition from low open shrublands to tall closed canopy forests. They tend to avoid areas where forest cover is too extensive, especially when canopy cover approaches 100% and shades out vegetation on the forest floor, as has happened in the National Forests as they have matured. Using wildlife habitat improvement funds, timber harvest, and prescribed fire, the Forests conducts thousands of acres of habitat improvement work annually, much of which benefits deer habitat quality.

The white-tailed deer is a game animal that is harvested throughout Virginia and West Virginia; therefore, population viability is not a concern. As a general rule, deer harvest on NFS land (as measured by Antlered Buck Harvest/Square Mile of Deer Habitat) is considerably lower than on private ownership (VDGIF, 1999). Overall, viability is well sustained for white-tailed deer on the GWJNF. Based on the results of our monitoring and evaluation, this species has the abundance and distribution across the Forests that will provide for its persistence into the foreseeable future.

g. Recommendation: No change in Plan direction is recommended for deer. Continue monitoring.

2. Black Bear

a. Reason For Selection: Black Bear was selected because it is a species commonly hunted and its populations are therefore of direct interest. It's a species whose habitats may be influenced by management activities (GWNF FEIS Appendix page J-12, JNF FEIS, Appendix page D-3). Black Bear are an opportunistic species that can thrive in a variety of habitats. It also requires remote habitat and a component of old trees (GWNF FEIS, Appendix page J-12). The black bear's most important habitat need is considered to be freedom from constant disturbance (GWNF FEIS, page 3-172). Therefore, road densities influence populations of black bear (JNF FEIS, Appendix page D-3). Thus, the single most important activity resource managers can undertake for black bear is access management (Lentz 1980, Carlock et al. 1983, Hamilton and Marchinton 1980, Miller 1975, Pelton 1980, Brody 1984). Access management does not refer to the prohibition of building or upgrading existing roads, but rather to their subsequent management. Roads themselves are not detrimental; it's the use of these roads by the public that affects the black bear. Proper management of open road densities is critical to black bear populations.

For purposes of this analysis, the key relationship between black bear and its habitat is that it prefers remote habitat away from people. That habitat preferably will also contain large hollow trees. These trees are typically quite old (depending on the species) and are therefore found in late successional or old growth areas. The amount and distribution of remote habitat (assumed to be Semi-primitive non-motorized or Semi-primitive recreation opportunity areas) and old growth is most likely to be influenced by management activities associated with prohibiting or limiting public use of existing roads and timber sales.

b. Plan Habitat Objectives Related to MIS: For the GWNF, to maintain old growth habitat for bear, a minimum of 2.5% of the forest should be in old growth (in hardwood stands older than 200 years old) (GWNF FEIS, Appendix J, page J-5). For the JNF, a minimum of 107,000 acres (15.5% of forest) should be remote (JNF FEIS, Appendix B, page B-32).

Extrapolating the remoteness factor from the JNF and the old growth factor from the GWNF leads to the conclusion that, across the combined forests, a minimum of 2.5% of the Forest should be in hardwood old growth (hardwood stands older than 200 years old) and a minimum of 15.5 % (271,000 acres) should be remote.

For the GWNF, the Plan identifies a minimum population level of one bear per 10 square miles, or 165 bears Forest-wide (GWNF FEIS, Appendix J, page J-13). The JNF should provide a minimum population of 155 bears (JNF FEIS, Appendix B, page B-32).

c. Description of Monitoring Method: Hunter harvest information is reported by state wildlife agencies, including sex, age, and total harvest data for bear harvested on NFS land. No simple methods exist for estimating key demographic parameters (recruitment rates, mortality rates, population growth rates, density) to assess black bear population status over large areas. Definitive estimates of these parameters can only be obtained through expensive, site-specific research. As in other states, the Virginia Department of Game and Inland Fisheries uses a combination of indices derived from harvest, nuisance activity, age structure, and miscellaneous mortalities to monitor status of black bear population (Virginia Black Bear Status Report - 1998 Virginia Department of Game and Inland Fisheries). Only Virginia data is used under the assumption that trends are the same in Kentucky and West Virginia.

d. Habitat Trend for MIS: See trend in old growth at Table 47 in this report. Table 14shows the trend in remote habitat. See transportation system trends in Table 3 and Table 4 earlier in this report.

Table 14. Inventoried Remote Habitat Trend by National Forest

(Thousand Acres)

	George Washington N.F.		Jefferson N.F.		
Year*	Semi-Primitive Motorized	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Semi-Primitive Nonmotorized	Total Acres
1985	156.3	144.5	71.7	105.9	478.4
1993/1996	203.0	167.0	76.0	126.0	572.0

*1985: JNF Final EIS, GWNF FEIS
1993: GWNF FEIS
1996: JNF, Draft Analysis of the Management Situation

e. Population Trend for MIS:

1. Harvest Hunting harvest data is the principal source of information for monitoring black bear population status in Virginia and West Virginia.

Bear harvest data generally indicated little change in harvest during the 10-year period from 1964-1973. In an effort to stimulate population growth, regulations were passed in 1974 to reduce overall bear harvest. As anticipated, subsequent harvests from 1974-1980 were below the previous 10-year harvest. However, beginning in 1981, harvests have steadily increased. Nine of the last 17 years have yielded record bear harvest. The harvest during all hunting periods has increased since 1970.

2. Response to Nuisance Bears Each complaint received about black bear problems has been handled by phone or by site investigation. As with harvested bears, these complaints and responses were recorded and summarized. The number of nuisance complaints has generally increased since 1980. Recorded complaints primarily represent only significant situations that might require special attention and or bear relocation. Since 1980, a total of 951 complaints have been recorded (Virginia Dept. of Game and Inland Fisheries - Virginia Black Bear Report - 1998).

3. Age Distribution Bear teeth were collected from 1970 through 1990 by encouraging hunters to voluntarily submit a premolar for analysis. Beginning in 1991, tooth collections became a required part of the bear checking process.

During the period from 1978-1990, on an average of 19.9% of the harvested bears had teeth submitted for age determination. Since 1991, the average tooth submission rate has increased to 91.4%.

Harvested bears have ranged in age from 0.5 to 26.5 years of age. Among other interpretations, age structures with an increasing proportion of young animals may suggest a growing population (Caughley, 1977) (Virginia Dept. of Game and Inland Fisheries - Virginia Black Bear Report - 1998).

Confirming results of other harvest and issuance information, population reconstruction in Virginia suggests that the female population has grown significantly at an average annual rate of 1.2%, that male mortality rates are higher than female mortality rates and that mortality does not differ by age class.

4. Miscellaneous Bear Mortality A franked, addressed postcard was used to report miscellaneous bear mortalities. This postcard was distributed to personnel in the VDGIF Law Enforcement Division, U.S. Forest Service, and the Shenandoah National Park. Vehicle collisions have been the principal cause of miscellaneous bear mortality. While reporting of miscellaneous bear mortality has been far from complete, the trend has been increasing.

5. Cooperative Alleghany Bear Study In 1994, the Cooperative Alleghany Bear Study was initiated to investigate population dynamics on Virginia's hunted bear population. A recently completed dissertation associated with this project (Klenzendorf 2002) was used to include updated population estimates.

Conclusion Combining trends in harvest, nuisance activity, age class, and miscellaneous mortality indices provide strong trend evidence of an increasing black bear population in Virginia and on GWJNF.

VDGIF uses the Downing method to perform black bear population reconstruction and determine population trends (D. Martin, VDGIF Black Bear Biologist, Pers. Communication, 5/21/2004). . Table 15 shows annual growth trends for males and females. Five years of harvest data is required to reconstruct one year of population estimates, as such the reconstructed population data is for the years 1989-1998. Both male and female populations exhibited an increasing trend. Overall total Black Bear populations are stable or increasing. In 2000, VDGIF and WVDNR estimated bear populations at 1,175 individuals on the GWNF and 747 individuals on the JNF, respectively. Based on the calculated population growth trend, bear populations for 2003 are estimated to be at 1,243 individuals on the GWNF and 790 individuals on the JNF, respectively.

Table 15. Virginia's Black Bear PopulationTrend, 1989 to 1998

(Downing Method)

Sex	Population Growth Trend (%) per year	R-Square	Significance
Male	+ 7.4	0.97	P<0.97
Female	+ 4.2	0.91	P<0.91

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Many factors are likely responsible for the increased bear populations on the GWJNF. The relative abundance and distribution of oak mast, primarily white oak, have a significant impact on bears in terms of natality, mortality, and movements (Pelton, 1989). The birth and survival of young bears are directly associated with oak mast crops. Increased movements associated with poor acorn crops often result in significantly increased mortality. The acres of older hardwood stands on the Forest have benefited bears through increased availability of den trees. In addition to older hardwood forests, bears also use a variety of other successional stages. Secondary foods (such as soft mast) can help buffer the effects of acorn shortages (Eiler, Wathen, and Pelton, 1989). Soft mast foods can be enhanced by forest management activities including prescribed burning and timber harvest (Wigley, 1993; Weaver, 2000). Important soft mast species—such as blackberries, blueberries, and huckleberries—often are more abundant in young forests.

From 1985 to 1996 there has been an increase in acres of Semi-Primitive Motorized (SPM) and Semi-Primitive Nonmotorized (SPNM) from 478,400 acres to 572,000 acres. In conjunction with this there have been approximately 105 miles of roads closed to public use.

The component of old trees as represented by a shift to more acres in the older age classes has been occurring. Refer to the forest's age class distribution at Table 8 and Table 9.

Increased acres of older hardwood stands, sustained hard mast production, and enhanced soft mast production through forest management activities—such as prescribed burning and timber harvest—have contributed to improved black bear habitat on the Forest. However, reduction in forest management (early successional habitat) may result in reduced soft mast availability in the future. This could, in turn, reduce habitat quality for black bears, especially in years of low acorn abundance.

The black bear is a game animal that is harvested throughout Virginia and West Virginia; therefore, viability is not a concern. Overall, viability is well sustained for black bear on the GWJNF. Based on the results of our monitoring and evaluation, this species has the abundance and distribution across the Forests that will provide for its persistence into the foreseeable future.

g. Recommendation: No change in Plan direction is recommended for bear. Continue monitoring.

3. Wild Turkey

a. Reason For Selection: Wild Turkey was selected because it is a species commonly hunted and its population is therefore of direct interest. It is a species whose habitats may be influenced by management activities (GWNF FEIS Appendix page J-12, JNF FEIS, Appendix page D-3). Wild Turkeys prefer mature forests with open understories and well-dispersed temporary and permanent clearings. Freedom from disturbance during nesting and brood rearing seasons is also important. Brood habitat is the most limiting factor to eastern turkey populations in the central Appalachians (J. Pack, West Virginia DNR, Pers. Comm.). Hens with broods use a variety of habitats: pastures, hay fields, wildlife clearings, powerline rights-of-way, natural glades, and savannas. Structure of vegetation is as important as ground vegetation types (Healy 1981). Ground cover should consist of sparse herbaceous vegetation that does not impede poult movements and produces maximum insect production. In addition, canopied savannahs that are open and park like with moderate herbaceous understory provide brood habitat. Well-distributed water sources, especially in brood habitat are important to turkeys. Water should be available approximately every one-fourth mile. Hard mast is the most important winter food of the eastern turkey in the central Appalachians.

For purposes of this analysis, the fundamental relationship between wild turkey and its habitat is that it prefers mature forests with open understories and temporary or permanent open areas vegetated with grasses, forbs, and low woody fruit-producing plants. The amount and distribution of 1) temporary and permanent clearings, 2) canopied savannahs that are open and park like, and 3) habitat that provides hard mast is most likely to be influenced by management activities associated with timber sales, creating wildlife clearings, and prescribed burning.

b. Plan Habitat Objectives Related to MIS: For the GWNF, to maintain habitat for turkey, a minimum of 10% should be hard mast bearing stands (in hardwood stands within age range from 40 to 120 years old) (GWNF FEIS, Appendix J, page J-5). For the JNF, a minimum of 69,000 acres (also 10 %) should be able to produce hard mast (JNF FEIS, Appendix B, page B-32). There is no objective for grass/forb habitat associated with temporary and permanent clearings given in the JNF Forest Plan (JNF FEIS, Appendix B, page B-32).

For the GWNF, the Plan identifies a minimum population level of 2 birds per square mile, or 3,300 birds Forest-wide (GWNF FEIS, Appendix J, page J-13). The JNF should provide a minimum population of 3,320 (JNF FEIS, Appendix B, page B-32).

c. Description of Monitoring Method: Hunter harvest information is reported by the VDGIF and the WVDNR, and includes sex, age, and total harvest data for turkey harvested on NFS land.

d. Habitat Trend for MIS: The discussion of maturing forests (under the deer section) contributing to the decline in deer populations on forested lands also pertains to wild turkeys, except in reverse. The maturing forests are of benefit to turkey habitat. Wild turkeys have an even greater dependence on hard mast than do deer, so the more mature forest is of more benefit to them. Also of great importance to turkeys is an interspersion of savanna-like areas with a herbaceous/shrubby understory, an open midstory, and a partially open overstory. Other favored areas include small open patches or strips vegetated with grasses or other herbaceous species. These are used heavily, especially in spring, as "bugging" areas. With an increase in prescribed burning as noted in Table 7, the trend in wild turkey habitat is now increasing.

e. Population Trend for MIS: Table 16 through Table 18 show indexes on wild turkey populations taken from the 1997-98 Virginia Wild Turkey Status Report (VDGIF 1998). As with deer, the population trend was derived from a population index. The population index was based on the percent change in spring gobbler harvest between 1989 and 1998. The population index has not been re-calculated by VDGIF to include the 1999/2000 data. A similar population index for West Virginia counties is not available at this time.

Table 16. Wild Turkey Population Index Trend Across the GWNF, 1997 to 2003

County	Ranger Districts Included	% Annual Change 1997-1998	% Annual Change 2001-2003
Allegheny	James River, Warm Springs	+9.3	+24.3
Amherst	Pedlar	+5.6	+20.7
Augusta	Deerfield, Dry River, Pedlar	+14.0	-7.4
Bath	Deerfield, Warm Springs	+6.1	-36.4
Frederick	Lee	+3.6	+3.4
Highland	Deerfield, Dry River, Warm Springs	+3.0	-28.1
Nelson	Pedlar	+9.6	+3.6
Page	Lee	+6.3	-11.4
Rockbridge	Deerfield, James River, Pedlar	+9.9	+4.2
Rockingham	Dry River, Lee, Warm Springs	+8.5	+9.1
Shenandoah	Lee	+9.8	0.0
Warren	Lee	+5.0	+42.2

Table 17. Wild Turkey Population Index Trend Across the JNF, 1997 to 2003

County	Ranger Districts Included	% Annual Change 1997-1998	% Annual Change 2001-2003
Bedford	Glenwood	+11.8	-4.2
Bland	Blacksburg, Wythe	+2.3	-4.3
Carroll	Mt. Rogers	-0.2	-14.6
Craig	Blacksburg, New Castle	+9.9	-11.3
Dickenson	Clinch	+9.7	-41.4
Giles	Blacksburg, New Castle, Wythe	+6.5	-11.1
Grayson	Mt. Rogers	+4.4	-32.3
Lee	Clinch	+4.6	+22.3
Montgomery	Blacksburg	+5.3	-11.1
Pulaski	Blacksburg, Wythe	+2.4	+14.8
Roanoke	New Castle	+9.7	0.0
Scott	Clinch	+6.2	13.6
Smyth	Mt. Rogers, Wythe	+1.8	-17.0
Tazewell	Wythe	+4.1	-11.1
Washington	Mt. Rogers	+1.5	-6.2
Wise	Clinch	-1.5	-12.0
Wythe	Mt. Rogers, Wythe	+3.3	+18.3

Table 18. Wild Turkey Population Index Trend Across the Forests' Shared Counties, 1997 to 2003

County	Ranger Districts Included	% Annual Change 1997-1998	% Annual Change 2001-2003
Botetourt	James River, New Castle	+10.6	+20.7

The average Annual Change for all of the GWNF counties is +7.8%. The average annual change for the JNF counties is +5.1%. Results of analysis suggest an overall increasing trend for wild turkey populations on the GWJNF. In 2000, VDGIF and WVDNR estimated turkey populations at 4,149 individuals on the GWNF and 8,278 individuals on the JNF, respectively. Based on the calculated population growth trend, turkey populations for 2003 are estimated to be at 4,473 individuals on the GWNF and 8,700 individuals on the JNF, respectively.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

As discussed above in Section d, Habitat Trend for MIS, more mature forests producing greater amounts of hard mast are of benefit to turkey. Martin et al. (1951) and Dickson (1992) point out that acorns (hard mast) are the most important food for turkeys, especially in the winter and early spring months. The more mature forests favor wild turkeys. As long as a high percentage of the forest remains in the optimum hard mast-producing age range (oaks 50-100 years old, generally), wild turkeys will be favored.

Wild turkeys use a wide range of habitats, with diversified habitats providing optimum conditions (Schroeder, 1985). This includes mature mast-producing stands during fall and winter, shrub-dominated stands for nesting, and herb-dominated communities, including agricultural clearings for brood rearing. Habitat conditions for wild turkey can be enhanced by management activities such as prescribed burning and thinning (Hurst, 1978; Pack, Igo, and Taylor, 1988), and the development of herbaceous openings (Nenno and Lindzey, 1979; Healy and Nenno, 1983).

Wildlife habitat improvement activities, such as waterhole developments, permanent grassy openings which are provided routinely during timber sale operations, prescribed burning, and road management that decreases disturbance, will favor an upward trend in the wild turkey population. On the Forest, both habitat and nonhabitat factors—such as protection and conservative harvests—have been responsible for increased turkey populations.

The eastern wild turkey is a game animal that is harvested throughout Virginia and West Virginia; therefore, viability is not a concern. Pack et al. (1999) has pointed out that hunting seasons, especially either-sex fall hunting, has the potential of significantly reducing wild turkey population growth. Both Virginia and West Virginia have reduced fall seasons in recent years and experienced increases in their wild turkey populations. Overall, viability is well sustained for wild turkey on the GWJNF. Based on the results of our monitoring and evaluation, this species has the abundance and distribution across the Forests that will provide for its persistence into the foreseeable future.

g. Recommendation: No change in Plan direction is recommended for turkey. Continue monitoring.

Ecological Indicators

The state wildlife agencies do not monitor populations of most ecological indicators. For songbirds, the population trend data available to the U.S. Forest Service is from the Breeding Bird Survey (BBS) Program, administered by the U.S. Geological Survey (USGS) Biological Resources Division, and from the Off-Road Point Count Program (ORPC) managed by the GWJNF in partnership with the Conservation and Research Center of the Smithsonian Institution. Analysis of the BBS data has been conducted for the years 1966 through 1999. Off-Road Point Count Program data has been collected

since 1994 on the GWNF and since 1997 on the JNF. In 1994, the GWNF monitored songbirds at 252 points. In 1995, that number was increased to 330 points. In 1996, the number increased to 396 points, and in 1997 to 799 points with the implementation of the JNF's songbird monitoring program (388 points) and the addition of 15 more points on the GWNF. For the year 2000 season, the total points increased to 814.

In the early phases of development of the GWJNF's bird monitoring program, Dr. Bill McShea of the Conservation and Research Center of the Smithsonian Institution was contracted to conduct data entry and analysis and to assist the Forests in the development of a scientifically sound bird sampling protocol. In 1997, Dr. McShea conducted a Power Analysis of the data we had collected to that time (McShea and Vega, 1998). Power Analysis is a statistical technique that is used to evaluate the ability of detecting population trends from data generated using a pre-established sampling protocol. The objectives of the analysis were:

1. To examine the feasibility of the GWJNF's sampling protocol to successfully ($\geq$ 80% probability) detect annual bird population changes of 10% or less, over periods of 5, 10, and 10+ years
2. To determine a subset of indicator species (i.e. species that were more abundant or show less annual variation).
3. To identify problems with the sampling protocol, such as the location of points, numbers of points per District or Forest, etc.

The Power Analysis of the existing data resulted in the following information:

1. Detection of a decreasing (or increasing) population trend of 5% over a 5-year period would be possible for only a single MIS; the ovenbird.
2. Detection of a decreasing (or increasing) population trend of 10% over a 5-year period would be possible for one additional MIS; the worm-eating warbler.
3. Detection of a decreasing population trend of 10% or an increasing population trend of 5% over a 10-year period would be possible for 2 additional MIS: the brown-headed cowbird and the pileated woodpecker.
4. For the remaining 2 non-game bird MIS: the barred owl and the common flicker, the number of observations was too small to conduct Power Analysis.

These results tell us that with the number of years of data that we currently have (1994-2003 = 9 years), we can detect population trends for 2 MIS: the ovenbird and the worm-eating warbler, with reasonable ($\geq$ 80%) accuracy.

When reviewing and comparing the BBS data and the ORP data, keep in mind that BBS data is presented as **the average number of birds seen or heard per route**, while the ORP data is presented as **average number of birds' seen/heard per point per year**. Even though a particular species may be an MIS for only one Forest, ORP counts reflect birds seen or heard on both Forests.

4. Barred Owl

a. Reason For Selection: The Barred Owl is an MIS only on the JNF. The Barred Owl was selected because it was a species whose habitats may be influenced by management activities, and a species whose population changes are believed to indicate the effects of management activities on riparian forests (JNF FEIS, page D-6). It was also selected because of interest expressed by a citizen's forest planning advisory committee in having a predator represented. The Barred Owl is highly associated with riparian areas (DeGraaf et al 1981). The riparian component is typically the most important component in a landscape to wildlife (Bull 1978), supports the greatest number of bird species (Evand and Kirkman 1981), and riparian acres are used more intensively than other acres by wildlife (JNF FEIS, page D-6).

For purposes of this analysis, the fundamental relationship between the barred owl and its habitat is that it nests in forested riparian areas**,** while feeding both there and in adjacent upland forests (Hamel, 1992). The amount and distribution of riparian area forests are most likely to be influenced by management activities associated with timber harvesting.

b. Plan Habitat Objectives Related to MIS: For the JNF, a minimum of 25,000 acres of riparian area habitat should be able to provide large, natural cavities (JNF FEIS, Appendix B, page B-32). The minimum population level is estimated at 500 birds Forest-wide (JNF FEIS, Appendix B, page B-32).

c. Description of Monitoring Method: The USGS breeding bird surveys will be used. Off-road point counts will be used in addition to BBS. The standardized protocol (monitoring standards) for conducting Off-Road Breeding Bird Surveys is in *The Southern National Forest's Migratory and Resident Landbird Conservation Strategy*. The monitoring standards for conducting Breeding Bird Surveys is in the USGS's *The Breeding Bird Survey: Its First Fifteen Years, 1965-1979*

d. Habitat Trend for MIS: Table 19 displays the amount and age of young forests within 100 feet of each side of perennial streams (see 36 CFR 219. 27(e)) on the National Forests. The total forested acreage within 100 feet of perennial streams on the JNF is 19,681 acres and on the GWNF 21,698 acres (combined 41,379 acres). The total acreage of 2 - 25 year old forests given in Table 19 below represents 2.9% of the total acreage within 100 feet of perennial streams. The amount of young forests within this 100-foot corridor indicates that management activities (predominately timber sales) have occurred near riparian areas, yet not necessarily in riparian areas.

Table 19. Age and Amount of Young Forests within 100 Feet of Perennial Streams

Age of Forest in 1999	George Washington Nat. Forest (Acres)	Jefferson Nat. Forest (Acres)	Total Acres Across Both Forests
2	29	4	33
3	57	5	62
4	8	11	19
5	16	9	25
6	14	18	32
7	36	23	59
8	15	23	38
9	27	17	44
10	5	33	38
11	27	42	69
12	16	38	54
13	24	16	40
14	10	38	48
15	41	23	64
16	41	40	81
17	17	30	47
18	58	20	78
19	1	46	47
20	8	23	31
21	1	25	26
22	9	14	23
23	25	14	39
24	30	28	58
25	125	38	163
TOTAL	640	578	1,218

e. Population Trend for MIS: Both the BBS and ORPC monitoring programs are designed primarily to examine population trends of diurnal (active during the daytime) birds. Since owls are most active at night, all records of barred owl sightings are incidental. Even so, these data for Virginia show a steadily increasing trend in sightings of barred owls (see Figure 1 below).

(Statewide Virginia Breeding Bird Survey Data)

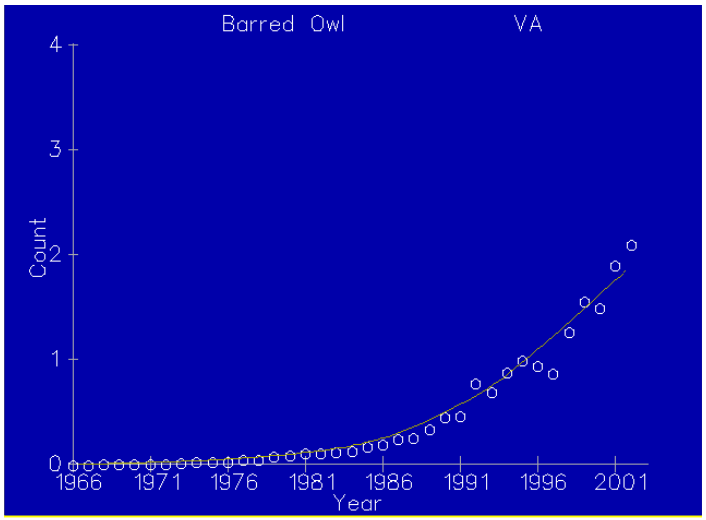

Figure 1. Trend in Barred Owls Seen or Heard Across Virginia, 1967 to 2002

Review of the Forest's ORPC bird monitoring data in Table 20shows the following trend for barred owls.

Table 20. Trend in Barred Owls Seen or Heard Across Forest, 1994 to 2002

(Forest's Off-Road Point Count Data)

Year	Average Birds/Point
1994	0.004
1995	0.009
1996	0
1997	0.001
1998	0.004
1999	0.010
2000	0.009
2001	0.012
2002	0.027

Results of analysis suggest an overall increasing trend for barred owl populations on the JNF, but data points are too few to be definitive.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

The acres of riparian habitat would be expected to remain constant over time. Riparian habitat quality is maintained on the Forest on all projects through the implementation of streamside standards and guidelines. These specific guidelines meet or exceed State Best Management Practices (BMPs).

National Forest management activities have had no effect on barred owl nesting habitat, since management is typically excluded from streamside zones, riparian areas and other wet areas. While

Table 19 shows younger forests within 100 feet of stream, timber sales have avoided all riparian areas as noted in their site-specific project analysis. Exceptions to this are that roads are constructed or reconstructed across streams, yet they are done so using strict mitigation measures to protect riparian area values. Some management of forested uplands is of benefit to barred owls, since opening of the forest canopy increases understory vegetation, which in turn leads to increases in rodent populations. Rodents are the primary food item in a barred owl's diet.

The current population trend estimates of barred owls were calculated based on sightings during the annual breeding bird censuses (BBS and ORPC). As pointed out earlier in the discussion, because of the barred owl's nocturnal habits, they are under-sampled in these diurnal based counts. However, based on the results of our monitoring and evaluation and general knowledge of species status and distribution, this species is common and is not deemed at risk of losing viability. It has the abundance and distribution of habitat across the Forests that will provide for its persistence into the foreseeable future.

g. Recommendation: No change in Plan direction is recommended.

5. Cave Dwelling Bats

Reason For Selection: Cave dwelling bats are designated as an MIS in the GWNF Revised Plan of 1993. Cave dwelling bats were selected because they are dependent on relatively undisturbed caves, a habitat element important for maintaining the wide array of animal diversity on the Forest. Populations of cave dwelling bats are believed to reflect effectiveness of measures to protect these habitats (i.e. caves) from disturbance (primarily human-induced). The Indiana bat was individually selected because it is a federally listed endangered species and there is direct interest in its population levels.

Bats use the relatively constant temperature and humidity of caves to meet specific seasonal habitat requirements. Depending on the bat species, caves may be used as hibernacula, roosts, and/or maternity sites. All bats monitored use caves for hibernating, although some also may be found in man-made structures such as mines, culverts, barns, outbuildings and house attics.

Bat species known to occur in caves on the GWNF include: big brown bat, northern myotis (formerly Keen's myotis), eastern small-footed bat, little brown bat, eastern pipistrelle, and Indiana bat. Some species such as pipistrelles use caves year round. Others, such as the big brown bat and Indiana bat use caves only from late fall to early spring (while in hibernation), and then spend summer days under the bark of trees or in buildings, foraging at night.

Bats are especially sensitive to disturbance during winter hibernation. For this reason, protection of caves and the area surrounding cave entrances is extremely important. Less is known about bat life history outside caves during the spring, summer, and fall months. Future research and study findings on feeding and migration habits of bats will likely further refine management techniques and procedures. Until then, protection of caves and the immediate above-ground area around cave entrances is essential.

For purposes of this analysis, the fundamental relationship between bats and their winter habitat is that the cave environment must remain stable and free from human disturbance. The cave's environment is most likely to be influenced by management activities associated with allowing public use (spelunking) of caves during winter and by surface disturbances near the cave that could change the relatively constant environmental conditions within the cave. Such surface disturbances include activities that may drastically alter vegetative cover and water flow such as road construction, mining, or timber harvesting.

For spring, summer, and fall, another key relationship between bats and their habitat is the need for an available food source (GWNF FEIS, page J-10). Available food sources (insects, consisting primarily of beetles and moths) during the spring, summer, and fall are most likely to be negatively influenced by management activities associated with aerial pesticide applications to treat gypsy moth defoliations.

b. Plan Habitat Objectives Related to MIS: It is estimated the minimum population for this guild (as a group) is 40% of the 1982 - 1990 forest average (as determined from sampling the two most populated bat caves in Bath and Augusta Counties, Va.) (GWNF FEIS, page J-14). Thus, the Plan identifies a minimum population of 390 bats (GWNF FEIS, page J-14). Specific to the Indiana bat, habitat objectives are presented in a Forest Plan amendment dated March 12, 1998. While these objectives were adopted for conservation and recovery of the Indiana bat on the Forest as a result of formal consultation with the U.S. Fish and Wildlife Service (USFWS), they benefit all other cave dwelling bats as well. The objectives are presented as standards in the Plan Amendment and they provide for: cave gating to prevent human disturbance, cave and buffer area land acquisition (on a willing seller basis), eliminating or limiting types of disturbances near caves/roost sites/maternity sites, timber activities to leave all shagbark hickories and a minimum of six snag or cavity trees per acre >9" dbh, at least 60% of all forest types to be maintained over 70 years of age and a minimum of 40% acreage of CISC Forest Types #53 (white oak-red oak-hickory) and #56 (yellow poplar-white oak-red oak) to be maintained at an age >80 years old, encouraging prescribed burning to provide for open understory foraging corridors, and creating drinking water sources for bats in areas greater than 0.6 miles from open water (Indiana bat EA, page 1-83 and DN page 1-6).

c. Description of Monitoring Method: For all cave dwelling bats, population counts by species are conducted in hibernacula during January &/or February every other year (odd # years in VA, some even # years in WV). These surveys are conducted by and in cooperation with the USFWS, VDGIF, and West Virginia Department of Natural Resources. Based on the Biological Opinion received from the USFWS as a result of formal consultation in 1997 and subsequently included in the 1998 Forest Plan Amendment, three monitoring items are required for the Indiana bat: 1) the total number of acres of potential bat habitat removed or disturbed as the result of management activities (excluding prescribed burn acreage) (Acres disturbed cannot exceed 4,500 annually or 22,500 over a five year period), 2) the amount of forest type acreage over certain age classes across the Forest (minimum of 60% all forest types over 70 years of age and a minimum of 40% forest type #53 and # 56 greater than 80 years old), and 3) the number of Indiana bats "taken" (i.e. killed) shall not be more than 10 annually.

d. Habitat Trend for MIS: The number of caves on the GWNF is finite. In Virginia there are over 3,200 caves with more than 97% on private land according to the Cave & Karst Program of VDCR-DNH. Currently there are 39 caves known to occur on the JNF and 42 on the GWNF (81 total). Not all caves on NFS land are suitable for bats and fewer still are suitable for certain bat species. The Forest Service is looking for opportunities to acquire or assist with management of caves adjacent to NFS land. Work is still underway to acquire an important bat hibernacula cave entrance and surrounding acreage in Wise County, Virginia. In 1999 this cave was gated with the assistance of the USFWS, VDGIF, The Nature Conservancy, and Bat Conservation International. In 2000 Mountain Grove Saltpetre Cave in Bath County was gated. Therefore, while the trend in cave numbers on the Forest is stable, that number may increase through acquisition of known caves and discovery of new caves. The trend for habitat conditions surrounding cave entrances is that of an aging ("maturing") late successional forest. This trend is due to the fact that forested acreage surrounding cave entrances is protected from forest management disturbance. At the same time food sources (i.e. insects) are experiencing population fluctuations and shifts in species diversity associated with an aging forest and limited management activities. These trends in forest age and management activities are displayed Table 5 through Table 9.

e. Population Trend for MIS: Table 21 through Table 25 display trends in cave dwelling bats on the GWNF by bat species and year monitored. These numbers are the result of winter surveys conducted in four caves that occur on (Mountain Grove Saltpetre Cave and Starr Chapel Cave) or near (Clark's Cave and Hupman's Saltpetre Cave) the GWNF. Personnel of the Non-game Section of the VDGIF, in cooperation with the Forest Service, conduct these surveys. These surveys are not conducted every year in order to minimize disturbance to the bats. Most caves were surveyed in 2001 and 2003 with the next

survey scheduled for January or February 2005.

Table 21. Bat Population Trend in Clark's Cave

Bat Species	1990	1992	1994	1995	1999	2001	2003
Big Brown	3	10	1	0	4	12	1
Little Brown	202	742	255	200	309	463	541
Northern Myotis	0	1	0	0	0	0	0
Indiana Bat	22	0	20	0	1	47	47
Eastern Pipistrelle	27	210	18	4	36	216	98
TOTAL	254	963	294	204	350	738	687

Table 22. Bat Population Trend in Hupman's Saltpetre Cave

Bat Species	1990	1991	1992	1994	1996	2001	2003
Big Brown Bat	128	174	58	34	29	18	10
Eastern Small Footed Myotis	56	55	64	27	22	44	37
Little Brown	1360	3082	3342	4571	2750	2611	3564
Northern Myotis	2	1	0	0	0	0	2
Indiana Bat	26	0	220	300	225	5	4
Eastern Pipistrelle	149	319	272	172	217	240	128
TOTAL	1721	3631	3956	5104	3243	2918	3745

The drop in Indiana bats at Humpman's Cave could be because the bats were hibernating in a different section of the cave from where they had seen them in the past *(2003 Personal Communication between Steve Croy and Rick Reynolds)*. The cave is complex with many levels and passages, not all of which are accessible. The bats may have moved due to some disturbance earlier in the winter or a difference in internal cave temperatures due to a colder/warmer fall/winter. While caves are generally the most static of environments, airflow and temperatures can change as a result of surface openings or internal passages forming or closing. This would result in temperature/humidity changes that would force bats to seek optimal hibernating conditions elsewhere in the cave. VDGIF was not concerned about large drop from previous counts, especially with other bat species in the cave showing similar trends to previous years. If the next count is equally low then as a start, additional sections of the cave would need to be explored to see where the bats are at or whether they may have moved to a different cave.

Table 23. Bat Population Trend in Mountain Grove Saltpetre Cave

Bat Species	1990	1992	1994	1998	2001	2003
Big Brown Bat	9	27	22	29	24	*
Eastern Small Footed Myotis	1	5	5	2	8	*
Little Brown	10	3	19	36	0	*
Indiana Bat	5	23	1	2	2	*
Eastern Pipistrelle	27	34	81	51	52	*
TOTAL	52	92	128	120	86	*

* = not surveyed due to snow cover and inaccessability

Table 24. Bat Population Trend in Starr Chapel Cave

Bat Species	1990	1992	1994	1995	1997	1999	2001	2003
Big Brown Bat	4	18	16	15	9	10	13	9
Eastern Small Footed Myotis	3	11	7	8	12	21	22	13
Little Brown	718	1292	1407	1393	1552	1689	1872	1727
Northern Myotis	0	1	3	4	3	13	28	13
Indiana Bat	37	38	42	60	54	55	47	67
Eastern Pipistrelle	34	326	146	95	73	128	264	111
TOTAL	796	1686	1621	1575	1703	1916	2246	1940

Based on individual bat counts in caves, in year 2003, bat populations are estimated at 6,372 individuals in three caves, including 120 Indiana bats (660 Indiana bats when Jefferson NF caves are included). Results of these surveys suggest a continuing overall stable to increasing trend for cave dwelling bat populations on the GWNF. Fluctuations can be seen in year-to-year numbers for a given species and for the total cave count. These are due to one or several factors such as differences in fall and winter weather from year-to-year causing bats to move to new cave locations or change their positions within a cave to a location on the cave wall or ceiling where they can't be easily counted or even missed entirely. Other causes for differences between years include normal population fluctuations, observer bias, differences in cave survey techniques, and cave inaccessibility due to deep snow or ice during the survey period.

The endangered Indiana bat has received much attention over the past several years. The Forest completed formal consultation with the USFWS and was issued a Biological Opinion for the Indiana bat in September 1997. The GWNF and JNF Forest Plans were amended in March 1998 to include new standards and guidelines as conservation measures specifically for the Indiana bat. Table 25 displays the results of surveys for the Indiana bat. The trend for the Indiana bat from 1959 to 1998 in 9 caves shows a decline from the 1960's through the 1980's and a stable to slow increase during the 1990's to present for western Virginia.

Table 25. Indiana Bat Populations Within Hibernacula On or Near the GWJNF

(Caves within Primary and Secondary Cave Protection Areas as noted in USFWS BO)
(Number of Bats Counted)

Winter Survey Year	Starr Chapel Cave	Mt. Grove Cave	Clarks Cave	Hupman's Saltpetre Cave	Shires Cave	Kelly Cave	Rocky Hollow Cave	Newberry-Bane Cave	Patton Cave (WV)
1960	600								
1962	600								
1970							1,200		
1972	35								
1974	30								
1978	2						750		
1979	1								
1980	0								
1981		0							3
1982	16	0							
1983	29								
1984							647		
1985	30						270		
1986		0	21			1		90	
1987	5		52						
1988			31	0	13				0
1989	36				13				
1990	37	5	22	26	3			120	
1991	23			0			202		
1992	38	23	0	220				100	
1993	31	0			20	18	241	107	
1994	42	1	20	300					
1995	60							110	
1996			0	225	27				
1997	54					10*			
1998		2							17
1999	55		1		23	10		120	
2000								235	8
2001		2			36	3	166		
2002									10
2003	67		47	4	19	9	325	189	

Blank cells = no survey done that winter. *Incomplete survey of Kelly Cave was done in 1997.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Populations of cave dwelling bats reflect more than management of caves and NFS land since they forage widely and some species migrate. For cave dwelling bats the trend in population numbers (stable to slowly increasing) reflect habitat conditions (an aging forest and cave stability) subject to management activities designed to maintain and/or enhance bat habitat (cave gating and foraging habitat enhancement through prescribed burning and modified timber harvest techniques). In order to prevent human disturbance during the hibernation period those caves on NFS land that have bat populations

have been gated and locked from September 1 to May 31 (at a minimum). Management activities are designed to enhance habitat for bats near hibernacula. Rocky Hollow Cave was gated in 1999 and Mountain Grove Saltpetre in 2000 to prevent unauthorized winter use. All caves on NFS land used by endangered bat species have now been gated to prevent human disturbance, however there continues to be problems with cave gate vandalism and unauthorized entrance. Gates have been repaired and law enforcement efforts are increasing in order to try and eliminate this population threat. From 2001 - 2003 no aerial pesticide applications occurred near any cave to treat gypsy moth defoliations, so there was no effect on food sources (i.e. insects) for the bat.

For the Indiana bat, since the Biological Opinion of 1997 and the Plan Amendment of 1998, the amount of acreage removed or disturbed has not exceeded 4,500 in any year nor have the percent of forest types by age been below the required level. In all cases the totals and percents are far below the allowed amounts. Table 26 displays the trend in disturbance to vegetation and Table 26 displays the trend for the past three years.

Table 26. Trend in Disturbance to Vegetation in Indiana Bat Habitat, By Forest Management Activity

(Acres)

Year (fiscal)	Timber GWNF	Timber JNF	*Total Timber Harvested	*Road Const.	*Rx Burn Line Const.**	*Recreation Develop.	*Wildlife Opening Develop.	*Special Use Develop.	*Grand Totals
1998	1,449	1,293	2,742	3.15	15.8	40	7.5	5.8	2,814.25
1999	1,284	942	2,226	3.2	10.2	23	9.0	15.5	2,286.9
2000	1,254	1,115	2,369	0.1	12.7	11	14.4	12.3	2,419.5
2001	1,162	795	1,957	2.8	13.8	15	12.5	7.1	2,008.2
2002	881	332	1,213	0.3	15.1	10.5	8.0	4.2	1,251.1
2003	789	226	1,015	0.2	12.3	6.2	10.1	8.3	1,052.1

* = acres for both GW & JNF

** = Correction to BO by USFWS letter of February 11, 1999, prescribed burning is a conservation recommendation in BO to improve bat habitat, only tree cutting for control-line construction is considered to be an negative disturbance factor.

Table 27. Trend in Indiana Bat Habitat Meeting Conditions Required by USFWS Biological Opinion

Year of CISC/GIS Data	CISC/GIS Total Forest Acres	> 60% of All Forest Types > 70 Years Old (Acres/Percent)	Total 53/56 Forest Acres	>40% of 53/56 Forest Types > 80 Years Old (Acres/Percent)
3/12/98*	**1,707,112**	**1,300,681 / 76.2**	**701,925**	**352,250 / 50.2**
4/1/99	**1,743,546**	**1,358,995 / 77.9**	**720,382**	**388,094 / 53.9**
3/16/00	**1,742,489**	**1,369,028 / 78.6**	**720,777**	**397,646 / 55.2**
3/29/04	**1,721,795****	**1,440,357 / 83.6**	**716,235**	**459,077 / 64.1**

*** Indiana Bat EA dated 3/12/98, page 32.**

**** 22,769 acres not included in GIS age class report**

The number of Indiana bats "taken" (i.e. killed) has been 0 each year from 1998 to 2003 since no dead or injured bats have been seen during or following any management activity.

Bat populations reflect more than cave management, or even NFS land management, as some species

migrate widely. Cave protection measures appear adequate to protect this portion of the species life history and therefore National Forest management is contributing, to the extent possible, to maintain species viability. While there is uncertainty about some bat population levels range-wide in North America, the bat populations on the Forest are expected to remain relatively stable or increase in the near future.

The GWNF is within the east-central portion of the range of the Indiana bat in eastern North America. While its winter distribution is limited to a few select caves, the summer distribution is widespread and potentially covers the entire Forest. This species is inherently rare and not well distributed across the Forest at some times of the year, yet potentially Forest-wide at others. Current management provides for ecological habitat conditions capable to maintain bat populations, when concentrated at wintering caves, as well as when dispersed during summer months. Overall, ecological conditions on the Forest are sufficient to contribute to species viability (persistence over time). Rangewide viability of the Indiana bat as a species is not completely ensured, but the agency is contributing to its viability and following the recovery plan from the USFWS.

g. Recommendation: No change in current Plan direction for bats is recommended at this time. Continue monitoring and maintain cave gates along with seasonal closures and increased law enforcement.

6. Brown-headed Cowbird

a. Reason For Selection: Brown-headed cowbird was selected to represent effects of fragmentation in terms of intrusion of this species into forested areas (GWNF FEIS, page J-10). This bird is common in agricultural lands on the Forest's edge. The brown-headed cowbird is a nest parasite of songbirds and serves as an indicator of edge habitat effects (GWNF FEIS, page 3-172). It builds no nest, but lays its eggs in the nests of over 100 species of birds. Many forest interior birds have lower reproductive success near forest edges, in part due to increased brood parasitism by the cowbird (Thompson, 1992).

Numbers of cowbirds and rates of parasitism vary with distance from edges. In an extensively forested area of Wisconsin, for example, percent of parasitized nests declined from 65% within 99 meters of an edge to less than 18% at > 300 meters (Temple, 1988).

In forest landscapes away from agricultural lands, recent research suggests very little change in cowbird populations from increased edge (e.g. from timber harvesting). Work in the Missouri Ozark Forests (Thompson et al., 1992) compared areas managed with clearcutting to areas with no recent timber harvest or disturbance. Brown-headed cowbirds occurred in similar numbers in both of these areas.

For purposes of this analysis, the fundamental relationship between cowbirds and its habitat is that it prefers to parasitize nests in the edges of open areas such as pastures (where it feeds) that permanently fragment the forested landscape. The amount and distribution of open areas used by cowbirds is more likely to be influenced by management activities associated with creating permanent wildlife clearings and log landings than associated with the more transitory openings created by timber harvesting.

b. Plan Habitat Objectives Related to MIS: Since the species is a nest parasite, our objective is to minimize the number of cowbirds, while still maintaining a viable population. Throughout much of its range, this species has experienced significant population increases (result of increased fragmentation). Due to its increased abundance and detrimental effects on other bird species, it will be monitored not primarily to insure viability, but to gauge effects on other species.

c. Description of Monitoring Method: The USGS breeding bird surveys will be used. Off-road point counts will be used in addition to BBS.

d. Habitat Trend for MIS: Table 28 displays the trend in the amount and distribution of open areas potentially used by cowbirds.

Table 28. Trend in Open Areas Across both Forests

(Acres)

	George Washington N.F.			Jefferson N.F.		
Year*	**Nonforest Land**	**Total NFS Land**	**Percent Nonforest of Total NFS**	**Nonforest Land**	**Total NFS Land**	**Percent Nonforest of Total NFS**
1985	9,719* (6,847)**	1,055,525	0.9 (0.6)	7,151* (6,800)**	690,258	1.0 (1.0)
1999	9,734* (6,978)**	1,064,379	0.9 (0.7)	7,187* (6,778)**	716,960	1.0 (0.9)

* Includes Water, data from planning records from both National Forests
** Excludes Water

e. Population Trend for MIS: The BBS data reflects a steady downward trend in brown-headed cowbird numbers in Virginia and in the Blue Ridge Mountain and Northern Ridge and Valley Sections. That data is shown in Figure 2 below:

(Statewide Virginia Breeding Bird Survey Data)

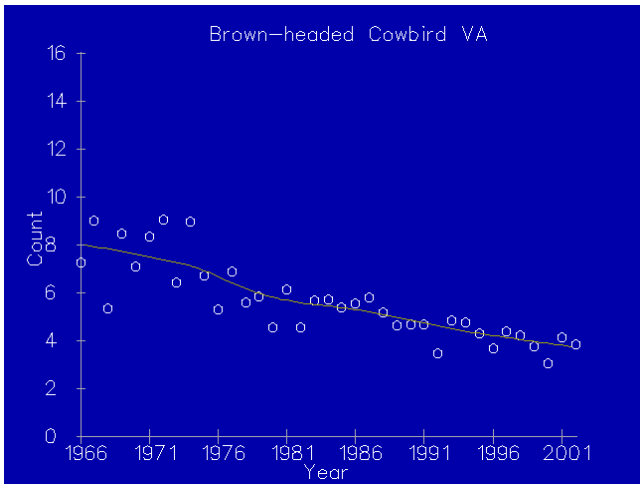

Figure 2. Trend in Brown-headed Cowbirds Seen/ Heard Across Virginia, 1966 to 2002

Data from the ORPC for the brown-headed cowbird are presented in Table 29 below:

Table 29. Trend in Brown-headed Cowbirds Seen or Heard Across GWJNF, 1994 to 2002

(Forest's Off-Road Point Count Data)

Year	Average Number of Birds per Point
1994	0.075
1995	0.133
1996	0.088
1997	0.076
1998	0.036
1999	0.089
2000	0.048
2001	0.040
2002	0.038

The trend of this species bears careful watching since a downward trend is what the agency desires. Analysis results suggest an overall decreasing trend for cowbird populations on the GWNF.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Relatively low numbers documented by point counts and the downward trend suggests the minimal amount of forest fragmentation (both existing and that created by management activities) across the GWJNF is not sufficient to support significant populations of cowbirds. Additionally, the size of the patches of interior forest on the GWJNF is such that they are not readily penetrated by cowbirds searching for nests to parasitize. Thus, management activities are not creating habitat to support significant increases in cowbird populations.

The overall forest continues to age. Agency timber and wildlife management activities provide the edge habitat preferred by the cowbird, with some activities fragmenting the forest, such as the creation of permanent openings at the site of selected log landings to meet the desired future condition of the management area. Yet, these permanent openings are small, typically less than ½-acre in size. Agency timber management activities continue to decrease. There indeed may also not be any correlation between management activities that create permanent openings and increases or decreases in cowbird populations because the existing Northern Ridge and Valley and Blue Ridge Mountain Sections are heavily forested and relatively unfragmented.

Overall, viability of this species in the area surrounding the GWJNF is not in question. NFS land likely contributes marginally to area populations. Those birds found on NFS land are primarily composed of birds coming from surrounding agricultural land in search of nest parasitism opportunities. Cowbird occurrences are expected to continue to decrease in the near future as the timber program decreases, yet their continued presence is assured because of the influences of surrounding private lands.

g. Recommendation: No change in Plan direction for cowbirds is recommended. Continue monitoring.

7. Northern Flicker

a. Reason For Selection: At the time this species was placed on the MIS list for the JNF and for the GWNF Forest Plans, the Virginia subspecies was known as the common flicker. Another subspecies was called the yellow-shafted flicker, and is known as that in the BBS data. Yet another subspecies was known as the red-shafted flicker. In the last few years, however, the subspecies have been combined and the common name was changed to reflect this combination. The scientific name, *Colaptes auratus* remains the same, however.

The northern (common) flicker was selected to represent effects of management on cavity nesters (GWNF FEIS, Appendix page J-12). It is also a species whose habitats may be influenced by management activities, and it's a non-game of special interest. It requires large-sized (over 12" DBH) snags (standing dead trees) since it is a primary cavity nester. A primary cavity nester is a species capable of excavating it's own nest cavities. Secondary cavity nesters are those species that nest in cavities, but are not capable of excavating their own nest cavities. Secondary cavity nesters are dependent on the primary cavity nesters to create their nest cavities for them. The flicker prefers habitat that contains large dead trees (for cavities) and is associated with open woodlands/fields for foraging. It prefers to nest near the top of broken-off stubs of dead trees in open country. It also nests in and around openings in extensive forested areas. It excavates nests in dead or live trees of many species including oak and pine and primarily forages on the ground. The northern flicker is most abundant in woodland margins (edge areas). They are seldom found in deep, extensive mature forests (Hamel, page 189). Edges between mature forests and early successional forest, with abundant dead trees along the edge, will provide flicker habitat.

The fundamental relationship between the flicker and its habitat is that it prefers edges between mature forests and early successional forests, with abundant dead trees in order to nest. The amount and distribution of early successional habitat and large-sized snags is most likely to be influenced by management activities associated with timber sales.

b. Plan Habitat Objectives Related to MIS: For the GWNF to maintain habitat for the flicker, a minimum of one percent of the forest should be in early successional stages of ages 1 through 12 (GWNF FEIS, Appendix J, page J-5). For the JNF, a minimum of 3,900 acres should be in an early successional stage (JNF FEIS, Appendix B, page B-32). Likewise two standing dead snags per acre within harvest units need to be provided when possible (JNF FEIS, Appendix B, page B-32, as amended by FEIS on Vegetation Management in the Appalachian Mountains).

Minimum flicker populations are defined as one bird per square mile (GWNF FEIS, Appendix J, page J-14) or about 1,650 birds forestwide. The JNF should provide a minimum population of 500 birds (JNF FEIS, Appendix B, page B-32).

c. Description of Monitoring Method: The USGS breeding bird surveys will be used. Off-road point counts will be used in addition to BBS.

d. Habitat Trend for MIS: See age-class distribution Table 8 and Table 9 displayed earlier in this report.

Age class data for the two Forests at Table 8 shows a low proportion of the area in young age classes. Conversely, the table also shows a high proportion in older age classes. Older age classes mean maximum numbers of large trees, and as the forest gets older, the number of snags increases. While the amount of edges between mature forests and early successional forests decreases as harvesting decreases, snag numbers should be in good supply as the overall forest ages to provide northern flicker habitat as well as habitat for other cavity nesting species.

e. Population Trend for MIS: The data sources for this species are the same as for other nongame birds. The population trend for flickers (northern/common/yellow-shafted/red-shafted) in Virginia and in the Blue Ridge Mountain and Northern Ridge and Valley Sections, as determined from the BBS data, is shown in Figure 3 below:

(Statewide Virginia Breeding Bird Survey Data)

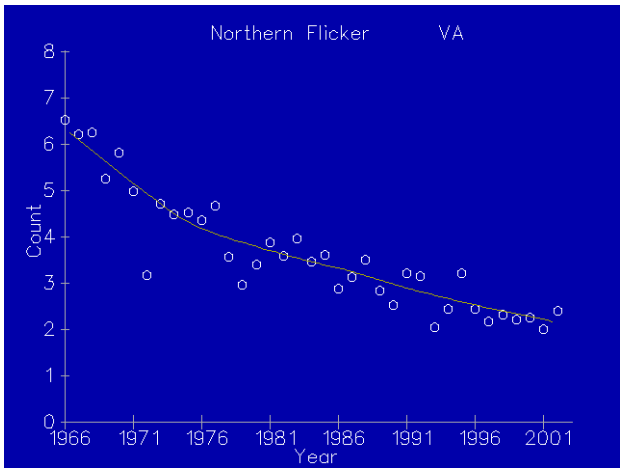

Figure 3. Trend in Northern Flickers Seen or Heard Across Virginia, 1966 to 2002

ORPC data for the Northern Flicker is displayed in Table 30.

Table 30. Trend in Northern Flickers Seen or Heard Across GWJNF, 1994 to 2002

(Forest's Off-Road Point Count Data)

Year	Average Number of Birds per Point
1994	0.008
1995	0.033
1996	0.070
1997	0.020
1998	0.016
1999	0.063
2000	0.061
2001	0.023
2002	0.001

The BBS data, which cover the entire state of Virginia, including the National Forest, indicate a steady downward trend for the species. According to the BBS, the same downward trend holds for the Blue Ridge Mountain and Northern Ridge and Valley Sections. The ORPC data, which are collected only on the National Forest, indicate a more positive trend for the species, yet one needs to keep in mind that the species still only occurs at an average of 6 out of every 100 monitoring points. Nevertheless, the ORPC data suggests that flickers are relatively uncommon on the Forest.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Northern flickers prefer edges between mature forests and early successional forests, with abundant dead trees in order to nest. Forest management activities are no longer providing as much of this kind of habitat (see trend in timber harvesting at Table 5 through Table 7). The analysis suggests that as edge habitat decreases, there is a corresponding decrease in flicker populations.

The overall forest continues to age. With an aging forest and the occurrence of the gypsy moth, snags will remain abundant. Agency timber management activities can provide the edge habitat preferred by the flicker, while multiple prescribed burning of the same area cleans out understory vegetation to provide park-like settings, another habitat utilized by the flicker. Agency timber management activities continue to decrease, while the acres of prescribed burning have increased in recent years. It remains to be seen whether an increased prescribed burning program would offset the decrease in acres harvested, and increase the flicker's populations. Based on results of our monitoring and evaluation and general knowledge of this species status and distribution, viability of flickers in the general area is not at risk. However, their abundance and distribution on the Forest is likely to remain low without increases in timber harvesting and prescribed burning to increase early successional habitat.

g. Recommendation: No change in current Plan direction for flickers is recommended. The Forest should increase efforts to implment existing Plan direction by increasing timber harvesting to create edges where common flicker can prosper. Otherwise, continue monitoring.

8. Pileated Woodpecker

a. Reason For Selection: The pileated woodpecker was selected because it is a species whose habitats may be influenced by management activities and is a non-game species of special interest (GWNF FEIS, Appendix page J-12), and because it is associated with mature forest habitats and requires large snags for cavity excavation (JNF FEIS, Appendix page D-3). It generally prefers mature older forests with closed canopies near water. This species is also a primary cavity nester/excavator, and like the northern flicker, may excavate several cavities every nesting season, even though it only nests in one. It therefore provides nesting habitat for many secondary cavity nesters. Requiring large snags for nesting cavities

and large dead trees for feeding, the pileated woodpecker requires a minimum of 405 hectares of continuous forest habitat and is an area sensitive forest interior species (Hamel, page G-1). The pileated woodpecker usually excavates nest holes in dead tree trunks or dead limbs of living trees. Generally, this species requires trees greater than 15 inches DBH for cavities, but prefers trees greater than 20 inches DBH. (Hamel, page E-1). Snags are used for nesting, roosting, and foraging by pileated woodpeckers. Nests may occur in a variety of trees including oak, hickory, maple, hemlock, and pine. The maintenance of older age forests, in relatively unfragmented blocks, will provide optimum pileated woodpecker habitat.

For purposes of this analysis, the fundamental relationship between the woodpecker and its habitat is that it prefers older age forests in relatively unfragmented blocks. These forests would also contain large snags. The amount and distribution of older age forests in relatively unfragmented blocks and large-sized snags is most likely to be influenced by management activities associated with timber sales.

b. Plan Habitat Objectives Related to MIS: For the GWNF, to maintain old growth habitat for pileated woodpecker, a minimum of 2.5% of the forest should be in old growth (in hardwood stands older than 200 years old) (GWNF FEIS, Appendix J, page J-5). For the JNF, a minimum of 25,000 acres (3.5% of forest) should be old growth greater than 100 years old (JNF FEIS, Appendix B, page B-32).

For the GWNF, the minimum population objective is estimated at one bird per square mile, or 1,625 birds Forest-wide (GWNF FEIS, Appendix J, J-14). The JNF should provide a minimum population of 500 birds (JNF FEIS, Appendix B, page B-32).

c. Description of Monitoring Method: The USGS breeding bird surveys are used. Off-road point counts are used in addition to BBS.

d. Habitat Trend for MIS: See trend in old growth at Table 47. Table 31 shows the trend in remote habitat.

Table 31. Inventoried Remote Habitat (Unfragmented Blocks) Trend by National Forest

(Thousand Acres)

	George Washington N.F.		Jefferson N.F.		
Year*	Semi-Primitive Motorized	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Semi-Primitive Nonmotorized	Total Acres
1985	156.3	144.5	71.7	105.9	478.4
1993/1996	203.0	167.0	76.0	126.0	572.0

*1985: JNF Final EIS, GWNF FEIS
1993: GWNF FEIS
1996: JNF, Draft Analysis of the Management Situation

e. Population Trend for MIS: Populations of pileated woodpeckers statewide are increasing according to the BBS. The increase is less pronounced, but still evident in the Blue Ridge Mountain and Northern Ridge and Valley Sections. The BBS data are presented in Figure 4 below:

(Statewide Virginia Breeding Bird Survey Data)

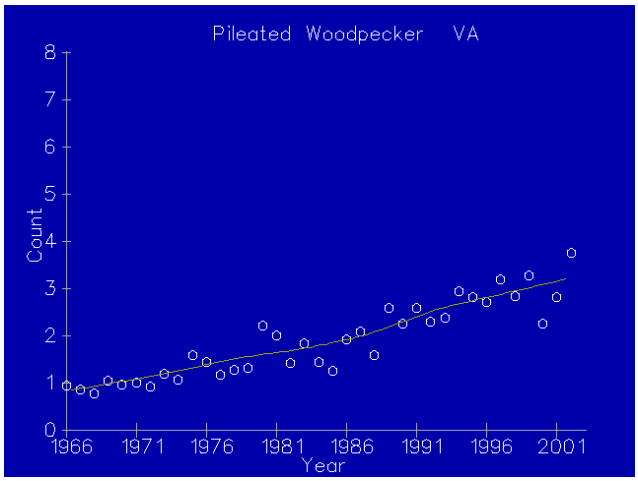

Figure 4. Trend in Pileated Woodpeckers Seen or Heard Across Virginia, 1966 to 2002

Data from the ORPC for the pileated woodpecker are presented in Table 32 below:

Table 32. Trend in Pileated Woodpeckers Seen or Heard Across GWJNF, 1994 to 2002

(Forest's Off-Road Point Count Data)

Year	Average Number of Birds/point
1994	0.349
1995	0.545
1996	0.323
1997	0.083
1998	0.050
1999	0.365
2000	0.335
2001	0.360
2002	0.356

Analysis results suggest an overall stable trend for pileated woodpecker populations on the GWNF.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

The Forest uses the pileated woodpecker as an indicator of the presence of extensive mature forests with dead or dying trees at least 20" in diameter, in which the birds excavate their nest cavities. Because of the pileated's association with extensive mature forests, it also follows that pileated woodpeckers have less (or no) affinity for edge habitats than do northern flickers. As discussed above in the northern flicker section and as presented in the forest age class discussion in Table 8 and Table 9, the aging forests should provide adequate snag numbers for all cavity-nesting species. All other evidence points to the adequacy of this habitat, so the data suggests an overall stable woodpecker population on the GWJNF. The amount of older aged forest, along with its large snag component, continues to increase across the Forest and so should continue to provide habitat for this woodpecker.

Based on the results of our monitoring and evaluation, this species is relatively common and has the abundance and distribution across the Forests that will provide for its persistence into the foreseeable future.

g. Recommendation: No change in Plan direction for the pileated woodpecker is recommended. Continue monitoring.

9. Ovenbird and 10. Worm eating Warbler

a. Reason For Selection: Both species are MIS only on the GWNF. These species were selected because they represent area-sensitive, forest interior species (GWNF FEIS, page J-12). They are particularly vulnerable to forest fragmentation for two reasons: (1) they require relatively large undisturbed tracts for optimal habitat; and (2) as ground nesters, they are especially vulnerable to predators. Openings, and the resultant edge are attractive habitat for cowbirds (nest parasite), and mammalian and avian predators. Both of these species are neotropical migrants, arriving in spring and departing the Forest in the fall. Trends in populations may be caused by events happening on the wintering areas or during migration, not events on the Forest.

As ground nesters, ovenbirds are especially vulnerable to predators such as raccoons, foxes, blue jays, etc. (GWNF FEIS, Appendix J, page J-11). Ovenbird breeding habitat is deciduous or mixed forest (rarely pure pine woods) with moderate understory, preferably in uplands (Hamel, page 281).

Worm-eating warblers prefer second growth woodlands with a dense understory (GWNF FEIS, page 3-169). They prefer to nest on steep slopes in brushy understory, near running water (Forest Service Agriculture Handbook 688).

For purposes of this analysis, the fundamental relationship between the ovenbird and warbler and their habitat is that they prefer relatively unfragmented blocks of forests. The amount and distribution of unfragmented blocks of forest are most likely to be influenced by management activities that create permanent openings, typically associated with creating wildlife clearings and creating log landings associated with timber harvesting.

b. Plan Habitat Objectives Related to MIS: The minimum population objective is one pair of breeding birds per square mile (GWNF FEIS, Appendix J, J-14) or about 1,625 birds forestwide.

c. Description of Monitoring Method: The USGS breeding bird surveys will be used. Off-road point counts will be used in addition to BBS.

d. Habitat Trend for MIS: Table 33 shows the trend in remote habitat that was presented earlier.

Table 33. Inventoried Remote Habitat (Unfragmented Blocks) Trend by National Forest

(Thousand Acres)

	George Washington N.F.		Jefferson N.F.		
Year*	Semi-Primitive Motorized	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Semi-Primitive Nonmotorized	Total Acres
1985	156.3	144.5	71.7	105.9	478.4
1993/1996	203.0	167.0	76.0	126.0	572.0

*1985: JNF Final EIS, GWNF FEIS
1993: GWNF FEIS
1996: JNF, Draft Analysis of the Management Situation

e. Population Trend for MIS: Again, we have two data sources available to us to examine the population trend of this species. The BBS ovenbird data for Virginia are shown in Figure 5.

(Statewide Virginia Breeding Bird Survey Data)

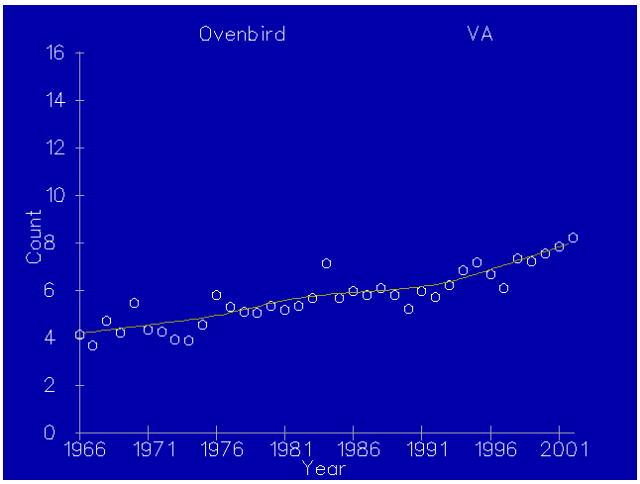

Figure 5. Trend in Ovenbirds Seen or Heard Across Virginia, 1966 to 2002

Data from the ORPC for the ovenbird are presented in the Table 34 below. Analysis results suggest a stable to increasing trend for ovenbird populations on the GWNF.

Table 34. Trend in Ovenbirds Seen or Heard Across GWJNF, 1994 to 2002

(Forest's Off-Road Point Count Data)

Year	Average Number of Birds/Point
1994	0.778
1995	0.870
1996	0.833
1997	0.646
1998	0.685
1999	1.027
2000	0.850
2001	0.820
2002	0.777

The worm-eating warbler is also a MIS only on the GWNF. The BBS warbler data for Virginia, the Blue Ridge Mountain Section, and the Northern Ridge and Valley Section are shown in Figure 6 below:

(Statewide Virginia Breeding Bird Survey Data)

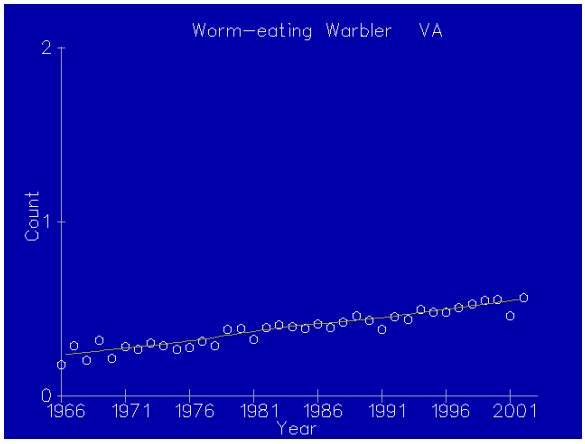

Figure 6. Trend in Worm-eating Warblers Seen or Heard Across Virginia, 1966 to 2002

Data from the ORPC for the worm-eating warbler are presented in Table 35 below:

Table 35. Trend in Worm-eating Warblers Seen or Heard Across GWJNF, 1994 to 2002

(Forest's Off-Road Point Count Data)

Year	Average Number of Birds/Point
1994	0.190
1995	0.252
1996	0.258
1997	0.180
1998	0.227
1999	0.309
2000	0.338
2001	0.290
2002	0.271

The statewide BBS, the Northern Ridge and Valley BBS and the ORPC data show a steadily increasing population trend for the worm-eating warbler. The Blue Ridge Mountain BBS shows a decreasing population trend, which has stabilized over the last ten years. Analysis results suggest an overall increasing trend for warbler populations on the GWNF.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Ovenbirds live in upland deciduous or mixed deciduous/pine forests with a moderately dense understory. They nest on the ground and build a covered nest from leaf litter. They are moderately area sensitive; they do best when they have unfragmented tracts of habitat of at least 450 ha. (1,125 acres) (Robbins, et al. 1989). As shown in the earlier management activity tables, since such a small fraction of the National Forests are harvested annually, overall, ovenbird populations are not likely to be negatively impacted by agency activities.

Worm-eating warblers also prefer deciduous or deciduous/pine forests, but they require a denser, evergreen understory that separates them from the ovenbird. They also nest on the ground in the leaf litter. They are more area sensitive than are ovenbirds, and do best in unfragmented blocks of 3,000 hectares (7,500 acres) or more. The discussion concerning the minimal amount of timber harvest compared to the total acreage of the GWJNFs also holds for the worm-eating warbler. For both species, the ovenbird and the worm-eating warbler, the amount of remote habitat provides some measure of the quantity of area available to them. Thus, Forest Service management activities are providing sufficient blocks of unfragmented habitat to support ovenbird and worm-eating warbler populations.

Based on the results of our monitoring and evaluation, these two species have the abundance and distribution across the Forests that will provide for their persistence into the foreseeable future.

g. Recommendation: No change in Plan direction for either the ovenbird or warbler is recommended. Continue monitoring.

11. Cow Knob Salamander

a. Reason For Selection: The Cow Knob salamander was selected because of viability concerns stemming from its naturally limited distribution. It is a Forest Service sensitive species and is only known to occur on Shenandoah Mountain along the Virginia - West Virginia state line. Nearly all of the global range of this salamander is located on land administered by the U.S. Forest Service. Members of

the genus *Plethodon* are terrestrial, breathe through their skin, and do not require water to breed. They prefer late successional forest habitat with a loose rocky substrate. This species is a slow recolonizer of disturbed ground and is confined to older age class (late successional) forests (Terwilliger, 1991).

For purposes of this evaluation, the fundamental relationship between the Cow Knob salamander and its habitat is that it prefers late successional habitat on Shenandoah Mountain, such as that associated with old growth forests. The amount and distribution of old growth/late successional forests on Shenandoah Mountain are most likely to be influenced by management activities associated with timber harvesting techniques conducted to regenerate stands. The amount and distribution is not affected by prescribed burning since this management activity is carried out under specific parameters and techniques that burn only the understory in hardwoods while occasionally burning the overstory in pine dominated stands.

b. Plan Habitat Objectives Related to MIS: The Revised Forest Plan for the GWNF recognized the significance of the Cow Knob salamander by establishing the Shenandoah Crest Special Interest Area - Biologic. This 43,000-acre area on the crest of Shenandoah Mountain above 3,000 ft. elevation encompasses most of the known range of the salamander. Special Biological Areas (Management Area 4) are managed to "protect and/or enhance their outstanding natural biological values" (GWNF Plan, page 3-6). Thus, the Plan provides for those ecological conditions to maintain the salamander considering their limited distribution and abundance. By providing this habitat, the minimum population objective is estimated at 10 core populations throughout its range consisting of a minimum of 1,000 individuals per population (GWNF FEIS, Appendix J, page J-14).

c. Description of Monitoring Method: The emphasis has been on locating new populations and better defining habitat needs (see below). Since 1988 the Forest has supported and participated in studies to better define the distribution, abundance, habitat needs, and effects of management activities on the Cow Knob salamander (Buhlman and Mitchell 1988, Buhlmann et al. 1998, Mitchell 1996, Tucker, Pauley, and Mitchell 1997). In 1992 a prelisting conservation plan was developed for this species with the cooperation of the USFWS, West Virginia Department of Natural Resources, Virginia Division of Natural Heritage, Virginia Department of Game and Inland Fisheries. Based on this conservation plan, a Conservation Agreement was signed by the USFWS and the U.S. Forest Service in 1994. Under the Conservation Agreement the Cow Knob salamander would not need to be listed as endangered or threatened under the Endangered Species Act provided the U.S. Forest Service follows certain management guidelines. The main guideline is allowing old growth conditions to develop and continue within the majority of the salamander's range on NFS land.

d. Habitat Trend for MIS: Since the Shenandoah Mountain Special Interest Area - Biologic is managed to minimize disturbance, the habitat trend is toward more suitable conditions (i.e. late successional, old-growth forest) for the Cow Knob salamander.

e. Population Trend for MIS: During 1995 and 1996 a total of 49 sites with habitat characteristics indicating a possibility of the presence of Cow Knob salamanders on Shenandoah Mountain were surveyed and Cow Knob salamanders were found at 22 of those sites (Tucker, Pauley, and Mitchell 1997). In addition to distribution and abundance information, this study also collected information such as leaf litter moisture, cover object preference, reproductive biology, and prey items. Due to concern about the effects of the loss of hemlock stands because of the hemlock wooly adelgid, 22 hemlock stands were surveyed in 1996. Cow Knob salamanders were found at 6 of the sites, all under rocks, at elevations ranging from 2,950 ft. to 3,620 ft. The results of this study indicate that the impact of the loss of hemlock on the salamander will probably be slight because Cow Knob salamanders occur in greater abundance in hardwood (oak dominated) sites. Table 36 shows the Cow Knob salamander's trends.

Table 36. Trend in Cow Knob Salamanders Captured and Recaptured On Shenandoah Mountain

Year	Location	Number Captured	Number Recaptured
1987 & 1988	North Mountain	0	0
1987 to 1988	Various	19 found on 3 of 7 sites	0
1988	Briery Branch Gap to High Knob to Hall Spring	Occurrence documented, but not enumerated	0
1988	Little Bald Knob	16	3 from 1987
1996	Various	9 found on 6 of 22 sites	0

There have been no new studies of this species since 1996. The majority of the Cow Knob salamander's habitat is in the Shenandoah Crest Special Interest Area-Biologic and is being managed to allow old-growth forest conditions to develop. Over time the habitat is improving for this species as the forest matures. Analysis results suggest an overall stable trend for Cow Knob salamander populations on the GWNF.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Management in the Shenandoah Mountain Special Interest Area - Biologic consists generally of dispersed recreation and prescribed burning. The habitat trend is one of an aging forest that benefits Cow Knob salamanders and should lead to a stable or increasing population. Because habitat conditions are stable to improving, the Cow Knob salamander will remain viable on the Forest; however, due to the naturally limited range of this species it will remain vulnerable to unexpected events possibly causing population decline.

Almost the entire range of the Cow Knob salamander is on the GWNF. It's inherently rare and thus not well distributed across the Forest. Current management provides for ecological conditions capable to maintain the salamander population considering its limited distribution and abundance. Overall, ecological conditions are sufficient on the Forest to provide for species viability (persistence over time).

g. Recommendation: No change in Plan direction for Cow Knob salamander is recommended. Continue monitoring.

12. Eastern Tiger Salamander

a. Reason For Selection: The tiger salamander (*Ambystoma tigrinum tigrinum*) was selected because it is a locally rare species, whose limited range on the Forest is cause for concern about local viability. The Maple Flats area, a sinkhole pond complex on the GWNF, is the only known location of the tiger salamander on the Forest. This population is naturally disjunct from its global range and contains a self-sustaining salamander population. The GWNF Plan designates the Maple Flats area as a Special Biological Area. The tiger salamander's habitat (seasonally dry, fishless natural ponds, and surrounding forest) may be influenced by management activities.

For purposes of this analysis, the fundamental relationship between the tiger salamander and its habitat is that it requires sinkhole ponds and associated uplands. The amount and distribution of sinkhole ponds in this Special Biological Area are most likely to be influenced by beaver activity, or off site management that would influence the hydrology of the area. Other factors that could affect the water quality, terrestrial habitat, or biotic interactions include acid deposition, illegal fish stocking, illegal ATV use, maintenance of wildlife openings, timber management, and control activities associated with insects and disease.

b. Plan Habitat Objectives Related to MIS: The habitat for the eastern tiger salamander is protected within the Maple Flats Special Biological Area. Special Biological Areas (Management Area 4) are

managed to "protect and/or enhance their outstanding natural biological values" (GWNF Plan, p. 3-6). This would include minimizing disturbance of the natural community and hydrologic regimes.

c. Description of Monitoring Method: The Forest Plan indicates the monitoring techniques for the tiger salamander are mark-recapture and plot surveys measured every two years. The Forest has been intensively studying the tiger salamander populations at Maple Flats in cooperation with researchers at the University of Virginia, Dr. Joe Mitchell, and others (Buhlmann 1987, 1997, Buhlmann and Mitchell 1998, Mitchell 1996, 1997, 1998, 2000). In 1996 we began using passive integrated transponder (PIT) tags as a technique to identify individual salamanders. PIT tags are tiny electronic devices that are inserted subcutaneously and contain a unique identifying number that is read using a scanner.

d. Habitat Trend for MIS: Monitoring trips in 1997 revealed that fish (bluegill and bass) had been introduced into one sinkhole pond raising the concern that these fish would eliminate tiger salamanders from that location. The water level had been high for several years enabling the fish to survive and grow. In late 1997 and early 1998 the water level dropped in that pond and all fish apparently died. Adult tiger salamanders and egg masses were observed in this pond in 1999. Monitoring in 2000 showed that, for the whole Maple Flats Sinkhole Complex, the habitat is stable; however, there is a continuing problem with illegal ATV use in the area. In addition, water quality trends for the mountains of Virginia show an increase in acidity related to atmospheric acid deposition. At low pH levels amphibians cannot reproduce.

e. Population Trend for MIS: Between 1996 and 1998 112 salamanders were tagged and released. In 1999, 69 were tagged. The increase in individuals tagged was due to increased time spent in the field and improved methods of capturing tiger salamanders. Ten salamanders captured in 1999 were recaptures from previous years. One salamander had been tagged in 1996 and recaptured in 1997 in the same pond. In 1999, this salamander was captured twice in a different pond. Data collected are beginning to provide information on how long tiger salamanders live and how mobile they are. In addition to adult tiger salamanders being tagged, they are measured for length and mass, and sex is determined. Egg masses are counted, and larval salamanders are captured for mass and length measurements. In 1999 drift fences were installed at three ponds as part of a University of Virginia cooperative study. During the winter of 1999-2000 very accurate counts of the tiger salamanders entering and leaving the three ponds were possible. Water chemistry of potential tiger salamander ponds has been sampled to develop a baseline from which to determine whether the ponds are undergoing acidification (Downey, Douglas, and Wirtz 1996). In 2001 the Virginia Herpetological Society conducted its spring survey in the Love's Run Pond Complex 5 miles west of Maple Flats. At one pond five larval tiger salamanders were dipnetted and released. This was the first time tiger salamanders were proven to occur outside the Maple Flats Sinkhole Pond Complex in the Big Levels area. In 2003 the pond was revisited, but it was dry.

Table 37 shows the trends in numbers of salamanders. Data from the above surveys for 2000 are still being analyzed, and initial figures show that 1458 tiger salamanders were caught at the three ponds with drift fences. From 2001 to 2003 the numbers of salamanders caught at the drift-fenced ponds varied: 405 in 2001, 138 in 2002, and 1079 in 2003. This variation is most likely the result of the severe drought in 2001 and 2002 (Church 2003). In addition, field surveys in the winter of 1999-2000 discovered tiger salamander egg masses and larvae at two previously unknown sites in the Maple Flats area (Church and Huber, unpublished data 2000). The more intensive survey methodology has increased the number of animals observed, and the number of known locations. Analysis results suggest a stable to increasing trend for tiger salamander populations on the GWNF.

Table 37. Trend in Tiger Salamanders Captured and Recaptured at Big Levels

Year	Number Captured	Number Recaptured
1996	45	0
1997	53	3
1998	14	0
1999	69	10
2000	1458 (336 adult, 1122 metamorph)	Data Not Analyzed
2001	405 (194 adult, 211 metamorph)	Data Not Analyzed
2002	138 (138 adult, 0 metamorph)	Data Not Analyzed
2003	1079 (166 adult, 913 metamorph)	Data Not Analyzed

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Delineation of the Maple Flats Special Biological Area containing the eastern tiger salamander appears to have encompassed much, if not all, habitat used by this species on the GWNF. Observations made since this species was discovered on the Forest indicate that this species is still present at all locations where previously found. Population size and trend studies are on going, as are inventories of potential habitat. As new information on population trends and habitat use surface, management activities will be adjusted to protect the eastern tiger salamander where they occur on the Forest. Forest Service management activities are having no effect on the eastern tiger salamander since all sinkhole ponds in the Maple Flats area are avoided and buffered from management activities. Illegal ATV use is a continuing problem at Maple Flats. Illegal ATV use has the potential to directly impact this species along with federally listed plant species and their habitat. The 1999-2002 Monitoring and Evaluation Report suggested increased law enforcement efforts. Forest Service law enforcement has apprehended several illegal ATV users in the Maple Flats area and they were successfully prosecuted in court. In 2001, the district placed boulders to restrict illegal ATV activity. As a result of increased law enforcement and making access more difficult, illegal ATV activity seems to have greatly decreased in the area.

Salamander populations are expected to remain relatively stable or increase in the near future. The GWNF encompasses a single population of the tiger salamander that is disjunct from its almost contiguous Atlantic coastal and Midwest distribution. This species is therefore inherently rare and not well distributed across the Forest. Current management provides for ecological conditions capable to maintain the salamander population considering its limited distribution and abundance. Overall, ecological conditions are sufficient on the Forest to provide for viability (persistence over time) of this disjunct population.

g. Recommendation: No change in Plan direction for tiger salamanders is recommended. Continue law enforcement efforts to decrease illegal ATV use at Maple Flats to protect tiger salamanders. Continue monitoring.

Wild brook trout from Shoe Creek, Amherst County, VA

13. Brook Trout and Wild Trout

a. Reason For Selection: Trout were selected as MIS because they are commonly fished and are therefore in demand, and because they are associated with streams with high water quality (JNF FEIS, Appendix page D-3).

Brook trout was selected for the GWNF because it is the only trout species indigenous to the Forest and southern region (R8). Wild trout (brook, rainbow, and brown) were chosen for the JNF because many of the trout streams on the JNF support wild rainbow or brown trout populations in addition to the indigenous brook trout. Trout are indicative of cold-water streams, good water quality and sedimentation rates that are in equilibrium with the watershed. MIS population trends and changes are analyzed for resident fish rather than hatchery reared fish, since many stocked streams are not suitable for year-round survival or recruitment of a self-sustaining trout population.

The fundamental relationship between trout and their habitat is that they need cold water and the water must be of good quality. The amount and distribution of cold water habitat and water quality are most likely to be influenced by management activities that have the potential to raise stream temperature, affect water chemistry, and increase sediment transport to streams. Such Forest Service activities are those associated with timber sales.

b. Plan Habitat Objectives Related to MIS: The water temperature objective in the GWNF Plan (Plan, page 3-95) is for a maximum summer water temperature of 69º F. Additional objectives for cold-water habitat described in the GWNF Plan (Page 3-93) include 125 to 300 pieces of large woody debris (LWD) per mile, and between 35% and 65% pool habitat. The minimum population is considered to be five pounds of trout per acre (or 5.6 kilograms per hectare) in flowing waters (GWNF FEIS, Appendix J, page J-7, JNF FEIS, Appendix B, page B-32). Plan objectives are to maintain sedimentation rates that are in equilibrium with the watershed and do not alter biological communities as measured using EPA's Rapid Bioassessment, Protocol II (EPA 1989).

c. Description of Monitoring Method: Electrofishing using the 3-pass depletion method, and measuring biomass in kilograms per hectare is the monitoring method, because this is the method used by the VDGIF to determine biomass of trout within running waters. VDGIF started monitoring Virginia's trout streams in the mid-1970's. Since that time they have developed a monitoring program that involves electrofishing specific reaches every 2 years on streams selected to represent the diverse range of geologic conditions found in the mountains of Virginia.

d. Habitat Trend for MIS: There is an estimated 1,601 miles of cold-water streams on the GWJNF, although, wild trout are not found in all of those cold-water miles. Trout habitat is a combination of the physical and chemical components of the stream ecosystem. Trout and all stream habitats are maintained and improved through deliberate protection and management of the riparian areas on the GWJNF.

Over 850 miles of streams have been surveyed for large woody debris and pool/riffle ratios (ecologically important physical stream characteristics as described in the desired future condition for GWNF Forest Plan) on the GWJNF since 1995. One hundred eighty-eight miles were surveyed in the years of 2001-2003 (See Table 38). Approximately 30% of the streams surveyed did not meet the desired future conditions of 78 to 186 pieces of large woody debris per kilometer. Approximately 69% of the streams surveyed did not meet the desired future condition of pool habitat between 35% and 65%. Limiting factors for meeting the physical desired future conditions were predominately historic land use practices of the last 150 years. Historically, until the last 20 to 30 years, riparian areas have been logged to the stream banks. It takes over 100 years for riparian trees to grow to large size, die and fall into streams as large woody debris. Managing riparian areas for riparian dependant resources aids the slow progress towards meeting the large woody debris desired condition of riparian areas.

Table 38. Miles Of Stream Habitat Surveyed In 2001-2003 On Th Forest

Year Surveyed	# Of Stream Miles Surveyed	% Of Streams Below Minimum Pool Area Dfc	% Of Streams Below Minimum Lwd Dfc
2001	75.4	75	35
2002	57.3	62	33
2003	55.2	70	19
Totals:	188.0	69	30

Water quality has been systematically monitored on Forest streams since 1987. Approximately 200 streams were monitored for water quality each year in 2001, 2002 and 2003. As expected, the general water quality of any given stream is strongly tied to the underlying geology coupled with prevailing air quality. The collected data has been used to determine trends and changes in stream water composition, and to develop a model for projecting the future status of native trout streams. A 1998 report (Bulger et al. 1998) found that of the study streams in non-limestone geology, 50 percent are "non-acidic." An estimated 20 percent are extremely sensitive to further acidification. Another 24 percent experience regular episodic acidification at levels harmful to brook trout and other aquatic species. The remaining 6 percent of streams are "chronically acidic" and cannot host populations of brook trout or any other fish species. Similar findings were reported by the Southern Appalachian Mountain Initiative in their 2002 publication on acid deposition. Consequently, as a result of anthropogenic atmospheric deposition, trout habitat is declining in the Forest as streams become acidified.

e. Population Trend for MIS: There are 11 trout streams (10 on National Forest and one near National Forest) that have been monitored extensively between 1976 and 2003 by the VDGIF and GWJNF. These streams are used to elucidate trends in native brook trout and naturalized (wild) rainbow and brown trout populations across the Forest. All of these streams are scheduled for sampling again in 2004. Other trout streams are electrofished at permanent stations every 5 years. Some of these data have also been used to determine the trends seen in Table 39.

Table 39. Wild Trout Biomass from Selected Streams in kilograms/hectare

(To convert to lbs/acre, multiply by .8923)

Year	Cove Branch (bt)*	Gum Run (lower) (bt)*	Little Wilson (bt/rt)*	Roar'g Fork (bt)*	Helton (bt/rt)*	Little Stony (bt)*	St. Marys © (bt)*	Ramsys Draft (lower) (bt)*	Rock Castle (site 3) (bt/rt)*	Georges (bt)*	Otter (bt)*
1974				bt							
1975						bt					
1976		bt					bt/rt/bw	bt		bt	
1977	bt				bt/rt						
1978			0/20.1							bt	
1983			0/0								
1984				bt				bt			bt
1985			bt								bt
1986							7.5		16/14		
1987										18	
1988					bt/rt	12.1	9.5		29/16		
1989	30.5					6.9			24/20	51	15.5
1990	66.9		14/15		80/17	17.6	25	75	24/30	73	12.25
1991	50.9			bt		32.6					
1992	22.6		11.4/8		52/12	14.6	10	65		81	12.25
1993	20.2					15.4					
1994	16.5	19.9	19/8.7	0	60/37	13.3	14	47	48/25	65	10
1995	15.8	8.9				9.8					
1996	25.2	15	26/11	0	39/59	6.5	3	81	36/32	30	5
1998	20.5	19.2				27.4	20.1	46	18/30	121	
2000	7	8.8		21	14/2	39.5	23	70.7	22/12	92.3	0
2001							35.6				
2002	10.6	41.7	19.2/5.2	7.3	36/30	29	28.2	70.5	10/15	122.7	0
2003							21.3				

*: "bt" denotes brook trout, "rt" denotes rainbow trout, and "bn" denotes brown trout. Where these initials are found in a tabular cell, only presence was noted; biomass was not calculated.

Trout population trends can be broken into several categories that are strongly related to water quality:

1.) Good water quality, circum-neutral pH (non-acidic).

Where native brook trout are the only trout species in the stream, their populations generally fluctuate. Brook trout numbers from year to year are naturally variable and tend to respond to climatic extremes such as droughts or floods (i.e. Georges Creek, Otter Creek (See Figure 7). As an example, the lack of brook trout found in Otter Creek in 2000 and 2002 reflects the extreme drought that occurred during 1999-2002, and the subsequent drying up of the stream during the summer months. Approximately 70 wild brook trout of various sizes were stocked in Otter Creek in 2003, a non-drought year. It is hoped that these fish will survive and re-populate the stream.

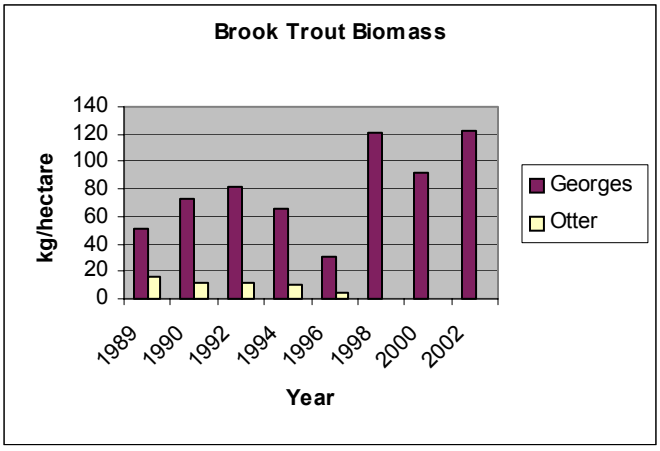

Figure 7. Brook Trout Biomass in Georges Creek and Otter Creek, 1989 to 2002

(Data from S. Smith, VDGIF 2004).

Where brook trout and wild rainbow trout are found in the same stream with good water quality, there is competition between rainbow trout and brook trout, resulting in rainbow trout occupying lower reaches of the stream and brook trout occupying upper reaches of the stream. In some of the streams sampled that fit this category, there are middle reaches where both species are found (See Figure 8). Rainbow trout adults are found in moderate numbers, while brook trout numbers fluctuate from moderately high, to low with a large percentage of young fish in the sample.

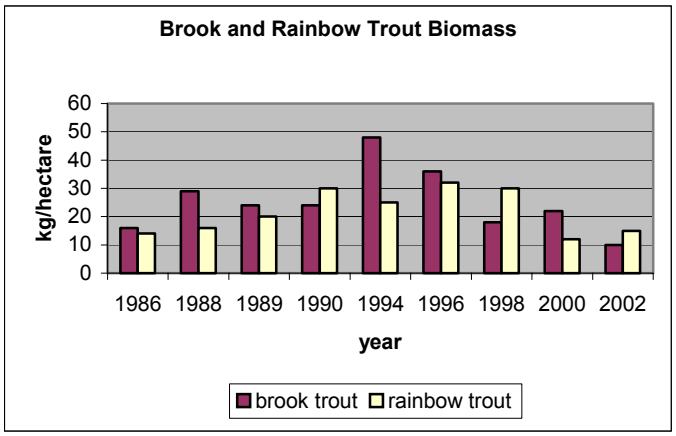

Figure 8. Brook Trout and Rainbow Trout Biomass for Rock Castle Creek, 1986 to 2002

(Data from S. Smith, VDGIF 2004).

A small number of streams on the Forest have stream conditions suitable to support reproducing brown trout. These populations fluctuate in response to natural events.

2.) Water quality with low acid neutralizing capacity (ANC) and variable pH (acid sensitive).

Because brook trout are fairly acid-tolerant, native brook trout populations in these streams are similar to the populations found in non-acidic streams, except the fish have an additional extreme to contend with in the form of acid pulses, or periods of flow with low pH, generally associated with storm events in the winter or spring.

Where rainbow trout are present, their populations are declining, and brook trout populations are expanding. This category of stream seems to be reverting from wild rainbow back to brook trout (e.g., Little Wilson Creek, See Figure 9).

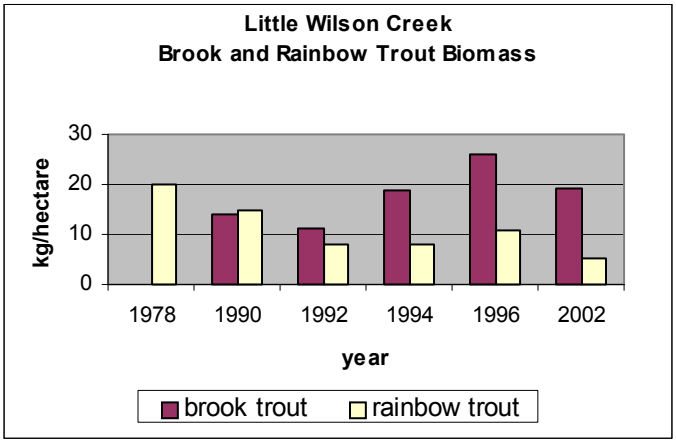

Figure 9. Brook and Rainbow Trout Biomass of Little Wilson Creek, 1978 to 2002

(Data from G. Palmer, VDGIF 2004).

3.) Water quality with no ANC and low pH (acidified).

If streams in this category once harbored rainbow trout, they are now gone. Brook trout numbers are low. The population is chiefly made of older fish, and there is generally low recruitment. Some of these streams have had all fish extirpated. An example would be Roaring Fork prior to 1999. Several years of no spring floods carrying acidic pulses gave brook trout a chance to re-colonize the upper reaches of Roaring Fork. Although brook trout are among the most acid-tolerant fish, we do not expect this to be a long-lived upward trend. The 2002 survey already shows a decrease in brook trout biomass. See Figure 10.

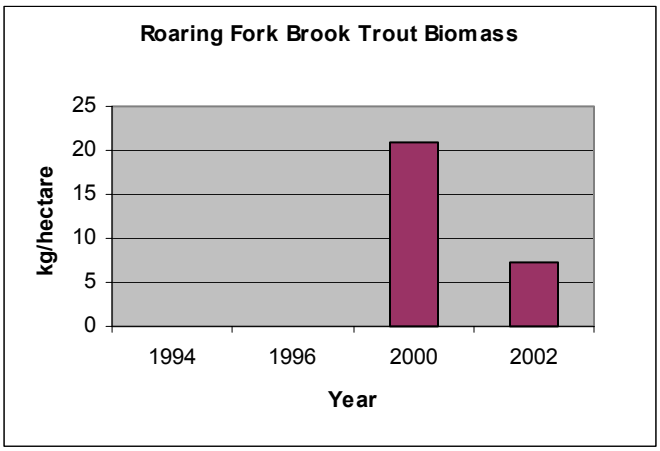

Figure 10. Brook Trout Biomass of Roaring Fork, 1994 to 2002

(Data from G. Palmer, VDGIF 2004)

In summary, using the trout streams mentioned in Table 2 as representative of trout streams on the GWJNF, the 2002 biomass is an average of 18.05 kg/ha (16.1 lbs/ac) on the JNF, and 48.68 kg/ha (43.4 lbs/ac) on the GWNF. Both of these are above the minimum objectives of 5 lbs/ac. Analysis results suggest an overall stable trend for wild trout populations on the GWJNF, although trends vary by stream.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Brook trout populations in chronically acidic streams that have been treated with high-grade limestone sand have increased dramatically following treatment. If population trends continue upward for several years, relatively stable populations can be maintained through periodic liming. If the stream is not re-limed, brook trout numbers will return to their pre-liming condition within 5 to 8 years. Thus, Forest Service management activities such as liming (e.g., Little Stony Creek (See Figure 11, Fridley Gap (Hudy et al, 1999), and St. Marys) and watershed restoration (e.g. after the 1996 flood on Dry River Ranger District) are increasing brook trout populations within selected watersheds. Since brook trout are among the most acid-tolerant of native fish, they are the last species to disappear from acidic waters, and an overall declining trend will be seen when streams gradually move from episodically acidic to chronically acidic.

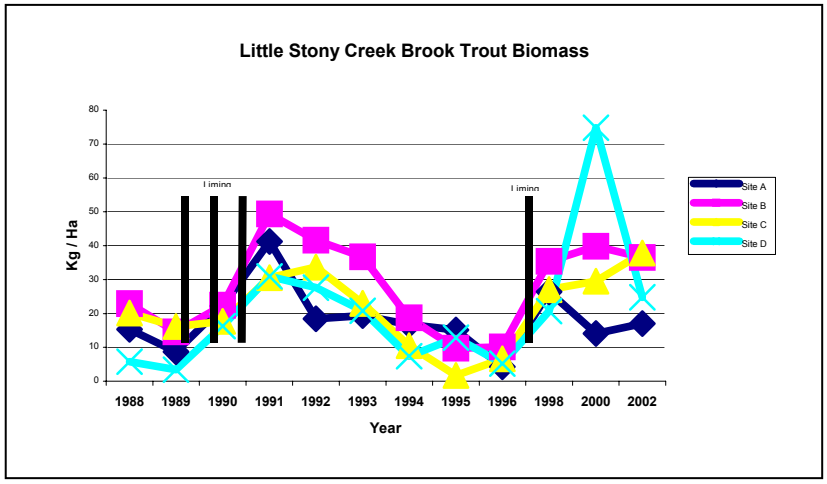

Figure 11. Little Stony Creek Brook Trout Biomass Before and After Liming Treatment, 1975 to 2000

(Figure from S. Reeser, VDGIF 2002).

As shown in Table 39, populations of wild trout tend to fluctuate greatly over time. These findings do not necessarily suggest negative impacts to those streams from management activities, but rather that trout numbers are often highly variable due to natural occurrences (drought, floods, high temperatures, etc). Hakala (2000) showed that low flows related to drought conditions, overpowered other mechanisms that could potentially influence juvenile trout abundance (i.e. fine sediment), and that adult trout abundance was principally a function of stream discharge. He also showed that the critical fine sediment size for brook trout in his study is between 0.063 mm and 1.0 mm, and that fine sediment (<0.063mm) should not exceed 0.6-1.0% of spawning substrate, or negative population effects may be incurred. Documented sediment shifts from extreme events that result in altered Rosgen channel types have involved median particle sizes (D50) much larger (i.e. D50 shift from 78 mm to 52 mm) than those that have been scientifically linked to biological effects (FY 97/98 Monitoring and Evaluation Report, GWJNF). Therefore, although extreme channel-altering events may be significant enough to change the stream morphology and hydrology, they may not necessarily affect stream biota in the short term.

Vegetation management activities, such as timber harvesting or prescribed burning, are not affecting water temperatures. Timber harvesting does not occur in riparian areas as documented in site-specific project-level analyses. Prescribed burning does not affect over-story vegetation and thus does not increase the amount sunlight reaching the stream. Timber harvesting introduces short-term (4-7 years or less) sediment increases, but properly implemented Best Management Practices have been shown to

mitigate effects on water quality and biota that may result from timber harvest (Austin, 1998). These activities are being monitored Forest-wide using aquatic macroinvertebrates as an indicator of effects to the aquatic biological community.

Aquatic macroinvertebrate communities integrate the physical, chemical, and biological components of the riparian ecosystem and have been successfully used as bioindicators to monitor change and impacts (EPA 1989). An analysis of over 536 streams on the GWJNF has established the current range of conditions for aquatic macroinvertebrate communities found on the GWJNF. A Macroinvertebrate Aggregated Index for Streams (MAIS) (range of scores 0 to 18) incorporates nine ecological aspects (metrics) of the aquatic macroinvertebrate community to evaluate the current condition of a stream relative to others within that ecological section (Smith and Voshell 1997). A Rapid Bioassessment report provides raw data on the taxa collected in addition to the metric scores and the overall MAIS score. Adjectives of "very good" (MAIS = 17-18), "good" (MAIS = 13-16), poor/fair (MAIS - 7-12), and "very poor" (MAIS = 0-6) are added to the report to make it user friendly to non-technical managers and decision makers. The GWJNF uses the MAIS score as "coarse filter" screening tool on some projects to establish current "stream health" and to establish a baseline to evaluate effectiveness of standards, guidelines and mitigation measures in preventing changes and impacts to the aquatic community. When the MAIS score is low or has changed from previous monitoring, biologists examine the individual metric scores and/or raw data to identify limiting factors. The individual metrics often point to a limiting factor or trigger a more rigorous and quantitative monitoring effort.

Sample sites were selected downstream of management activity areas to monitor the impacts on stream health of projects including but not limited to timber sales and prescribed burns. Other samples were collected to create a baseline of stream conditions within the forest. Only samples collected from March through the first week in June were compared to minimize seasonal variability in structure of macroinvertebrate communities. Across the Forest, 728 samples were collected, analyzed and assigned an overall MAIS score (0-18). Of these samples, 84% were in the "good" and "very good" categories.

A paired t-test was used to compare the MAIS scores of 18 streams before and after timber harvests that occurred at various locations across the Forest. There was no significant difference between the pre and post timber harvest MAIS scores; both the pre and post mean scores were in the "Good" category (See Table 40).

Table 40. Paired Samples T-Test On Pre And Post MAIS Scores From 18 Different Timber Sales

Mean MAIS Score Pre-Harvest	16
Mean MAIS Score Post-Harvest	15
95% Confidence Interval	-0.365 to 2.365
P value	0.140

A paired t-test was used to compare the MAIS scores of 7 streams before and after prescribed burn that occurred at various locations across the Forest. There was no significant difference between the pre and post prescribed burn MAIS scores; both the pre and post mean scores were in the "Good" category (See Table 41).

Table 41. Paired Samples T-Test On Pre And Post MAIS Scores From 7 Different Prescribed Burns

Mean MAIS Score Pre-Burn	16
Mean MAIS Score Post-Burnt	16
95% Confidence Interval	1.098 to 1.669
P value	0.631

Based on the above monitoring analysis, timber harvesting and other management activities are not significantly decreasing habitat or populations of wild trout or brook trout.

The trout is a game fish that is harvested throughout Virginia and West Virginia, and therefore, viability is not a concern. Overall, viability is sustained for trout on the GWJNF. Trout populations are expected to remain relatively stable in the near future. Based on the results of our monitoring and evaluation, this species has the abundance and distribution across the Forests that will provide for its persistence into the foreseeable future.

g. Recommendation: No change in Plan direction for trout is recommended. Continue monitoring.

14. Sunfish Family

a. Reason For Selection: The Sunfish family was selected because it includes species whose habitats may be influenced by management activities and members of this family include popular game fish. Largemouth and smallmouth bass were selected as representatives of this group because they are highly desired by the public for angling recreation, and VDGIF monitors their populations. The members of the sunfish family are used as indicators of recreational fishing opportunities associated with warm water streams, small impoundments, and large impoundments (such as Lake Moomaw).

The fundamental relationship between sunfish and their habitat is that the water must be of good quality and there should be adequate structural habitat for spawning and cover. The amount and distribution of warm water quality is most likely to be influenced by management activities associated with timber sales, dumping sewage (after treatment) into lakes from nearby developed recreation sites, dredging operations to remove sediment buildup, and repairing or reconstructing spillways.

b. Plan Habitat Objectives Related to MIS: The water temperature objective in the GWNF Revised Forest Plan (Page 3-93) for cool to warm water habitat requires maintaining a water temperature regime within 2 degrees Fahrenheit of ambient water temperature, dissolved oxygen values greater than 7.0 parts per million, and sedimentation rates that are in equilibrium with the watershed. For the GWNF, the minimum population for sunfish is considered to be 15 pounds per acre (16.81 kg/ha) in cool/warm water streams, lakes, and ponds (GWNF FEIS, Appendix J, page J-7). For the JNF, a minimum of 50 pounds per acre (56.03 kg/ha) is to be provided (JNF FEIS, Appendix page B-32).

c. Description of Monitoring Method: Fish shocking of population as measured in catch per unit effort (#/hour), which is then used to estimate biomass, will be the monitoring method, because calculation of catch per unit effort is the method used by the VDGIF in monitoring fish within large rivers and reservoirs.

d. Habitat Trend for MIS: The GWJNF has approximately 981 miles of warm-water stream habitat and approximately 3,000 acres of warm-water lake habitat. Much of the warm water stream habitat on the Forest is within a mosaic of private ownership. Off-Forest non-point source pollutants from agriculture and urban runoff continue to be a problem. Acid deposition is not an immediate problem for

most warm-water streams on NFS lands because they are often found in the valley bottoms where the geology is rich in limestone or other carbonate-bearing rock. As small impoundments within the Forest age, underwater structural habitat diversity (generally, trees and shrubs) that may have been present at time of lake or pond development is decaying and needs to be replaced in order to maintain a healthy, self-sustaining warm water fish population. Several existing small impoundments are being developed into new warm water fisheries, thereby increasing this type of habitat on the Forest. However, there are no new impoundments planned in the near future.

The habitat trend for a large impoundment on the Forest, such as Lake Moomaw, is centered on the continued addition and maintenance of structural habitat as older structures decays. Water quality remains good, yet is dependent on the water quality that feeds the lake.

e. Population Trend for MIS: Recruitment (ability of the fish to successfully reproduce) is good, but growth is slow due to the relatively infertile nature of most of the Forest's warmwater habitat. Data for this analysis was taken from VDGIF electroshocking surveys of warmwater habitat on the Forest. A representative of each of the warmwater types was used to determine biomass and trends.

1.) Warmwater Streams

Members of the sunfish family dominating these streams include smallmouth bass, redbreast sunfish, and rock bass. Again, recruitment is good, but growth is relatively slow. The smallmouth bass populations are dominated by fish less than 12 inches. Regulations are proposed to restructure the populations through length limits (to get more, larger fish). Natural events (i.e. floods) greatly affect fish age class structure and numbers, which in turn affects fishing for several years. Table 42 and Figure 12 show trends for smallmouth bass.

Table 42. Smallmouth Bass Trend from the South Fork Shenandoah River

(Data from S.Reeser, VDGIF 2004)

Year	Catch per unit effort (#/hour)	Estimated biomass (kg/ha)
1997	85.8	142.67
2000	84.5	140.51
2001	73.8	122.72
2003	74	123.05

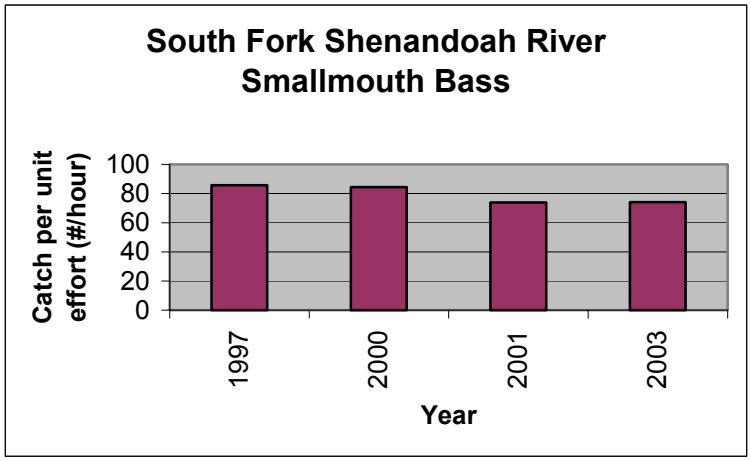

Figure 12. Catch per Unit Effort for Smallmouth Bass for the South Fork Shenandoah River, 1997 to 2003

(Data from S. Reeser, VDGIF 2004)

2.) Small Impoundments

Largemouth bass and bluegill are the dominant members of the sunfish family found in small impoundments. Largemouth bass spawning and reproduction is good, but better recruitment to an optimal size (greater than 12 inches) is needed. Harvest pressure is light on bluegill. When trout are stocked in the same impoundment, angling effort is directed toward trout more than bass or "sunfish". Table 43 and Figure 13show trends for largemouth bass.

Table 43. Largemouth Bass Trend from Bark Camp Lake

(Data from T. Hampton, VDGIF 2004).

Year	Catch per unit effort (#/hour)	Estimated biomass (kg/ha)
1992	27	125.17
1995	29	134.44
1996	18	83.44
1997	40	185.43
1998	52	241.06
1999	55	296.55
2000	43	166.83
2001	47	217.88
2002	47.7	221.17

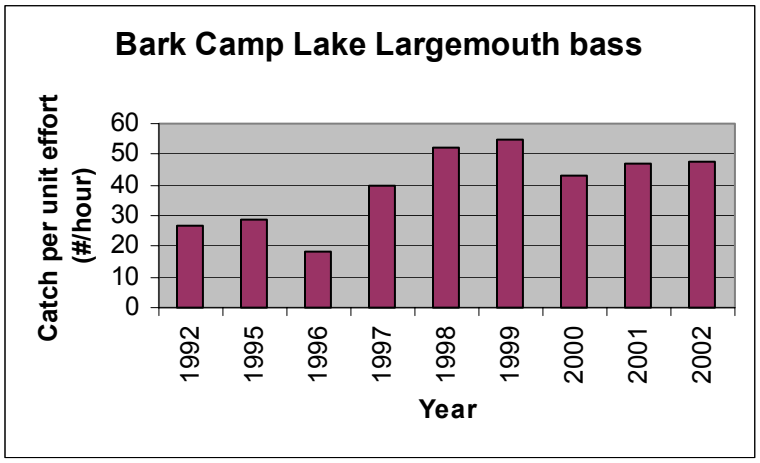

Figure 13. Catch per Unit Effort for Largemouth Bass for Bark Camp Lake, 1992 to 2002

(Data from T. Hampton, VDGIF 2004)

3.) Lake Moomaw

Lake Moomaw is a 2,500-acre reservoir that is 22 years old. It is managed as a 2-story fishery, supporting trophy trout as well as trophy bass. Members of the sunfish family were originally stocked 20 years ago, and have not needed supplemental stockings to thrive. The primary representatives of this family are smallmouth bass, largemouth bass, black crappie, bluegill, and redear sunfish. The smallmouth population is increasing, growth rates are excellent, and habitat is excellent in the reservoir for this fish. The largemouth bass population is continuing to expand in the lake; spawning and recruitment are good, and growth is good for a mountain reservoir. Black crappie populations are very good, and very stable at a quality size. The lake produces an occasional trophy size crappie of 2 ½

pounds. Bluegill and redear sunfish population trends are up, and there are high numbers of these fish of at a size suitable for angler enjoyment. Table 44 and Figure 14 display this trend.

Table 44. Black Bass (Largemouth and Smallmouth) Trend from Lake Moomaw

(Data from P. Bugas, VDGIF 2004)

Year	Catch per unit effort (#/hour)	Estimated biomass (kg/ha)
1985	40	66.51
1986	39	64.85
1987	28	46.56
1988	56	93.12
1989	57	94.78
1990	59	98.11
1991	81	134.69
1992	64	106.42
1993	64	106.42
1994	53	88.13
1995	90	149.66
1996	84	139.68
1997	57	94.78
2000	90	149.66
2001	103	170.77
2002	61	101.10
2003	73	121.55

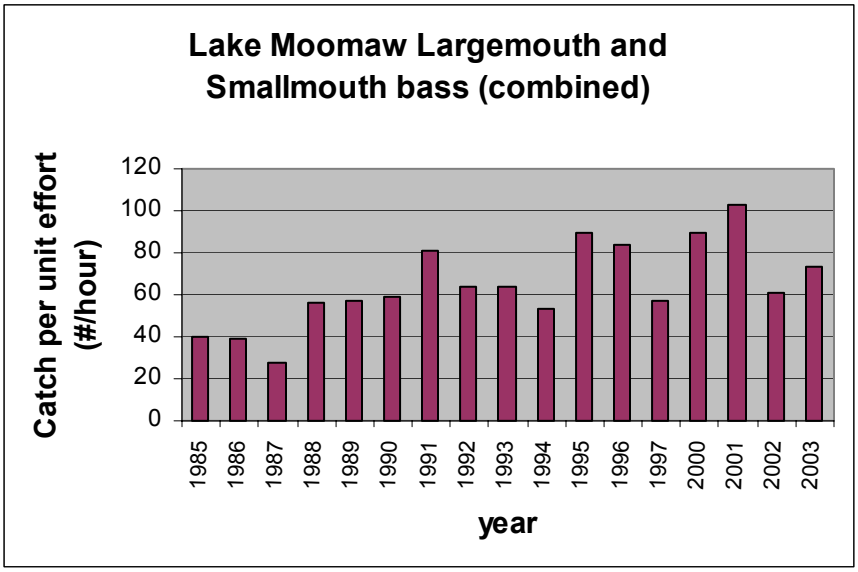

Figure 14. Catch per Unit Effort for Largemouth and Smallmouth Bass at Lake Moomaw, 1985 to 2003

(Data from P. Bugas, VDGIF 2004)

Across the Forest, average biomass for black bass (representatives of the sunfish family) within the different habitat types for the most recent years are:

- Warm water stream: 123.1 kg/ha (109.8 lb/ac)
- Small Impoundment: 221.2 kg/ha (197.4 lb/ac)
- Large Impoundment: 121.6 kg/ha (108.5 lb/ac)

The average of these three is 138.6 lb/acre across both Forests. They are all above minimum objectives of 15 and 50 lbs/ac for the GWNF and JNF (respectively). Analysis results suggest an overall stable trend for sunfish populations on the GWJNF.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Although the addition and maintenance of underwater structures in Forest reservoirs is necessary for healthy self-sustaining warm water fish populations, these populations are heavily manipulated through fishing regulations and harvest pressure. Forest Service activities, such as the creation of structures in reservoirs, are beneficial to members of the sunfish family.

Sunfish are game fish that are harvested throughout Virginia and West Virginia; and, therefore, viability of these populations is not a concern. Overall, numbers and distribution of sunfish species on the GWJNF is sufficient to support viable populations and sustained recreational use. Sunfish populations are expected to remain relatively stable or increase in the near future. Based on the results of our monitoring and evaluation, this species has the abundance and distribution across the Forests that will provide for its persistence into the foreseeable future.

g. Recommendation: No change in Plan direction for the sunfish family is recommended. Continue monitoring; suggest developing a MVP based on catch per unit effort (CPUE) rather than biomass, since biomass is rarely monitored within reservoirs on the Forest. To get a true fish biomass estimate of these habitats would take a rotenone or other lethal sampling method.

15. Yellow Pine Community

a. Reason For Selection: The Yellow Pine Forest Community (combined forest types dominated by yellow pine tree species) was selected in the GWNF Plan because it is an important element of plant and animal diversity and is a fire-dependent habitat type (GWNF FEIS, page J-12) that may be influenced by management activities. This forest community type consists of pitch, table mountain, Virginia, and shortleaf pine forests. This community is dependent on recurrent fire for maintenance and regeneration.

The yellow pine community is an aggregate of forest types that are dominated by "hard" pine (often called yellow pine) species that occur in the mid-Appalachians. This community is made up of four pine dominated forest types (pitch pine, table mountain pine, shortleaf pine, and Virginia pine) and four pine-oak forest types where pine species dominate the overstory (pitch pine - oak, table mountain pine - oak, shortleaf pine - oak, and Virginia pine - oak).

The yellow pine community is typically found on south to southwest facing ridges and slopes. These areas are well drained and receive maximum solar radiation, and are exposed to prevailing winds making them more prone to desiccation and are hence drier. While pines dominate the overstory, shrubs such as mountain laurel, blueberry, huckleberry, teaberry, azaleas, wintergreen, fetterbush, mulberry, minniebush, and trailing arbutus dominate the understory. These shrubs have waxy leaves and most are evergreen. This combination of dry, windy site conditions, and the volatile chemical nature of resinous pines and waxy/oily shrubs, which retain their foliage year-round, make them conducive to burn. In fact, most occurrences of this community are maintained by fire and must be disturbed periodically in this way to regenerate and maintain a structure of an open midstory with a shrub/grass understory and patchy overstory. Without fire this community will become dominated by hardwoods (oaks) or white pine (which is a "soft" pine) and the openness of typical yellow pine stands will be lost as it closes in with thick understory and midstory vegetation. Many plant species that occur in this community are

also adapted to fire for seed release and flowering. The cones of table mountain pines open and release their seeds when exposed to high heat. Blueberries and huckleberries are stimulated to rapid growth from underground stems (rhizomes) and subsequent flowering once top killed by fire. Therefore the species composition and vertical structure relies on the periodic disturbance of fire.

For purposes of this analysis, the amount and distribution of the yellow pine community is most likely to be influenced by those management activities associated with prescribed burning. Events that affect this community but are not management activities include episodes of bark beetle infestations and wildfire occurrences.

b. Plan Habitat Objectives Related to the Yellow Pine Community: The GWNF Plan objective is that "Maintaining biological diversity on the Forest is a major goal….". Habitat objectives are "…to conserve specific elements of biodiversity and restore others where needed" (GWNF Revised Forest Plan, page 2-1). Thus maintaining and restoring the spatial and structural attributes of the yellow pine community is a Plan habitat objective. Likewise, a prescribed burning program objective is to improve fire-dependent ecosystems (GWNF Plan, page 2-32).

c. Description of Monitoring Method: Monitoring of the yellow pine community looks at the Forestwide database titled "Continuous Inventory of Stand Condition" (CISC), forest health reports from the Southeast Forest Experiment Station, number of acres prescribed burned annually, and data collected from vegetation plots established in yellow pine community occurrences.

d. Habitat Trend for the Yellow Pine Community: To track the yellow pine community we used the GWNF CISC database and Forest Inventory data on forest types and acres. Table 45 shows the trend in acres by forest type for yellow pines on the GWNF since 1993 utilizing CISC. Table 46 shows the trend in acres by pine forest types from the forest survey data done by the Southeastern Forest Experiment Station.

Table 45. Yellow Pine Community Trend by CISC Forest Type Across the GWNF

(CISC/GIS Acres)

Forest Type (CISC #)	1993	1997	1999	2000	2004
Shortleaf Pine (32)	1,590	1,550	1,484	1,547	1,553
Virginia Pine (33)	14,408	14,600	14,195	14,167	14,313
Pitch Pine (38)	28,084	27,430	27,864	27,832	27,366
Table Mountain Pine (39)	13,650	13,510	13,663	13,688	13,419
Shortleaf Pine - Oak (12)	1,050	1,190	1,065	1,065	1,175
Pitch Pine - Oak (15)	31,871	32,270	31,758	31,681	31,288
Virginia Pine - Oak (16)	18,706	17,930	18,449	18,448	17,839
Table Mtn. Pine - Oak (20)	15,129	14,810	15,288	15,297	14,885
TOTAL ACRES	124,488	123,290	123,766	123,725	121,838

Table 46. Yellow Pine Community Trend From Forest Survey Data Across GWJNF in Virginia

(Acres)

Forest Type	Virginia Mountain Region*	1977	1986	1992	2001
Virginia Pine	Northern Mt.	17,857	12,649	8,966	3,521
	Southern Mt.	N/A	4,227	4,204	4,763
Pitch Pine	Northern Mt.	39,188	30,496	26,818	28,673
	Southern Mt.	4,738	3,772	3,773	5,631
Table Mt. Pine	Northern Mt.	16,718	25,555	29,627	22,894
	Southern Mt.	5,494	12,767	7,924	4,575
Subtotal Pines	All Regions	66,138	91,452	83,304	72,058

* Separate Reports: Table 10 of Forest Statistics for National Forest land only for the Northern and Southern Regions of Virginia, 1977, 1986, and 1992 (2002 data not yet available from FS Southern Research Station)

Based on CISC information the number of acres of yellow pine forest types across the GWNF has decreased over the past 11 years with the reduction being 2.1%. The changes may be greater than indicated due to the inventory technique used in CISC coupled with recent ongoing natural changes in those eight forest types that are not reflected in these acreage figures. For at least the past decade CISC has only been updated on those lands considered suitable for timber production as allocated in the Forest Plan. Yellow pine dominated forest types are considered unsuitable for timber production for the most part and are therefore not consistently inventoried. Additionally, the past eight years have seen pine bark beetles (a native insect) infesting many yellow pine stands to epidemic proportions and have caused extensive pine mortality in the overstory. More than 85% of the yellow pine stands on the GWNF are over 80 years old. As these stands age they become more susceptible to bark beetle infestations. This combined with the lack of fire occurrences in these stands (both wildfire and prescribed fire), where no more than 2% has burned over the past 15 years, has lead to increased stress from competition with non-yellow pine tree species in the understory and has lead to a rapidly increasing pine overstory mortality and ever-increasing fuel loads. These pine dominated stands require periodic fire for regeneration since the effects of burning result in opening the canopy to increased sunlight on the forest floor, killing thin-barked fire intolerant / shade tolerant trees that compete with pine seedlings, and in the case with table-mountain pine heat from a fire opens serotinous cones allowing for seed release and dissemination. The lack of fire coupled with the ever-increasing beetle activity accounts for what is likely a downward trend in the number of acres (quantity) and in stand condition (quality) of this management indicator.

1992 Forest survey data reveals decreasing trends for Virginia Pine and Pitch Pine, yet, unexplainably, table mountain pine acreage increases when compared to 1977 acreage figures.

e. Population Trend for the Yellow Pine Community: See previous paragraph on habitat trend as a function of total acreage.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Agency management activities are limited to prescribed burning and managing fire within these forest types. Control or suppression of pine bark beetles, by means other than timber salvage harvesting, has not been done due to prohibitive costs and negative impacts to other associated animal species. While the acres of prescribed burning have increased in recent years (see trend in management activities presented earlier at the beginning of this report), the number of acres burned that have been targeted at

restoring the yellow pine community have not kept up with the downward decline in total number of acres and regeneration of yellow pine trees. Thus while current Forest Service management activities are attempting to increase the Yellow Pine Community in some areas, not enough prescribed burning is occurring Forestwide and the overall decreasing trend in habitat quality and total acreage is likely to continue.

Overall, viability of species dependent on the Yellow Pine Community is a concern on the GWNF. Amount of yellow pine acreage is expected to continue to decrease in the near future.

g. Recommendation: Implement prescribed fire and fire managed for resource benefits in those areas with a yellow pine component. Continue revision the existing Fire Management Plan (expected late 2004 or early 2005) and include Fire Use as an option so fire can be used as a more effective management tool in maintaining and restoring the yellow pine ecosystem. Implement inventory methods that more accurately depict yellow pine acreage and conditions on the Forest.

16. Old Growth Forest Types

a. Reason For Selection: Old growth forests were selected a management indicator in the GWNF Revised Plan because they are important elements of plant and animal diversity and a social issue. These late successional (i.e. "mature") forest conditions may be influenced by management activities and are biological communities (GWNF FEIS, page J-12). There are 10 old growth forest type groups on the GWNF. They consist of: 1) northern hardwood forests, 2) conifer (hemlock, white pine, red spruce) and northern hardwood forests, 3) mixed mesophytic forests, 4) hardwood wetland forests, 5) dry-mesic oak forests, 6) dry and xeric oak woodlands and savannas, 7) xeric pine and pine-oak forests and woodlands, 8) dry and dry-mesic oak-pine forests, 9) eastern riverfront forests, and 10) rocky, thin-soiled excessively drained cedar woodlands. These groups represent aggregations of similar forest types in conditions that are necessary for species requiring mature forests.

For purposes of this analysis, the amount and distribution of old growth forest types is most likely to be influenced by management activities associated with timber harvesting. Natural disturbances, such as strong winds, large accumulations of ice, native insects/disease, fire (including prescribed fire), and landslides, also affect old growth forest conditions, but they are regarded as being with the natural range of variability for forest successional dynamics. Old growth is a management indicator only for the GWNF. (NOTE: No plant or animal species in the Appalachians are known to require old growth forest conditions exclusively i.e. are "old growth obligates" for their survival or continued existence.) Mature forests are considered to be those forests that are in the later stages of succession and are generally synonymous with old growth. Old growth forests are distinguished by old-age trees and related structural attributes within the forest stand. The stand age at which old growth develops varies according to forest type (determined by dominant tree species) and reflects climate, site conditions (bedrock geology, soil type, aspect, moisture regime, elevation), and disturbance regime. A discussion on old growth as it relates to the GWNF is found in FEIS Appendix H and GWNF Revised Plan pages 2-3 to 2-6. Additional information is contained in the document, "Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region, Forestry Report R8-FR 62" and "Information About Old Growth for Selected Forest Type Groups in the Eastern United States, General Technical Report NC-197."

b. Plan Habitat Objectives Related to Old Growth Forests: For the GWNF, to maintain old growth forest type conditions, a minimum of 2.5% of the forest should be in old growth (defined as hardwood stands older than 200 years old) (GWNF FEIS, Appendix J, page J-5). This would amount to approximately 25,879 acres on the GWNF (1,035,155 total forested acres). Additional discussion and objectives for all forest types are outlined on pages 2-3 to 2-6 of the Final Revised Forest Plan and Appendix H of the GWNF FEIS.

c. Description of Monitoring Method: The Continuous Inventory of Stand Conditions (CISC) data set maintained by the Forest will be used to measure acres of each old growth forest type.

d. Habitat Trend for Old Growth Forests: Table 47 displays trends for this management indicator as acres by year and Old Growth Forest Type (OGFT). Acreage figures for 1993 differ from those presented in the GWNF Forest Plan and EIS. The CISC data set from which those numbers were derived in 1993 no longer exists due to computer system conversions implemented since 1993. The number of acres presented here are from the current 2004 CISC/GIS data set. The only management that has occurred in any old growth forest acres since 1993 that would alter stand age and structure (i.e. timber harvest) has occurred in OGFT 21. All other OGFT acres identified in 1993 still exist. The number of acres reaching the minimum age to be considered old growth is increasing annually as the forest ages. Forestwide the forest is aging and the number of acres in earlier successional stages is decreasing. Based on these acreage figures the amount of old growth is steadily increasing on the Forest.

Table 47. Old Growth Trend Across the GWNF

(Acres)

Old Growth Forest Type Groups*	1993	1994	1995	1996	1997	1998	1999	2000	2004
01 - Northern Hardwood Forests	0	0	0	0	0	0	0	369	369
02 - Conifer & North. Hardwood Forests									
2a-Hemlock-North. Hardwd Subgroup	1,364	1,364	1,364	1,364	1,364	1,364	1,364	1,515	1,515
2b-Wh. Pine-North. Hardwd Subgroup	19	19	19	19	19	19	19	847	847
2c-Spruce-North. Hardwood Subgroup	71	71	71	71	71	71	71	71	71
05 - Mixed Mesophytic Forests	680	708	727	727	727	727	727	1,395	1,542
10 - Hardwood Wetland Forests	0	0	0	0	0	0	0	78	78
21 - Dry-mesic Oak Forests	70,416	72,460	75,986	77,406	79,060	81,904	85,432	108,193	120,364
22 - Dry and Xeric Oak Woodlands	0	0	0	0	0	0	0	80	80
24 - Xeric pine & Pine-oak Forests	78,239	82,316	86,009	88,820	91,295	94,991	97,384	100,019	106,076
25 - Dry & Dry-mesic Oak-pine Forests	3,814	4,268	4343	4,581	4,666	5,100	5,133	6,702	7,375
28 - Eastern Riverfront Forests	5	5	5	5	5	5	5	25	25
37 – Rocky, Thin-soil Conifer Wood.	0	0	0	0	0	0	0	0	0
TOTAL ACRES	154,609	161,212	168,526	172,994	177,208	184,182	190,135	219,294	238,342

* Names and associated identification numbers are from Forestry Report R8-FR 62. Three OGFT groups were added in the 2000 CISC inventory as meeting the minimum age necessary to be considered old growth. These stands were not reflected in earlier years due to their stand ages in CISC. These OGFT groups are: 1) Northern Hardwood Forests, 2) Hardwood Wetland Forests, and 3) Dry & Xeric oak Woodlands & Savannas. One OGFT group still has no acreage that meets the minimum age criteria. That type is the rocky, thin-soiled, excessively drained conifer woodland that is found over limestone bedrock and dominated by eastern red cedar. Very few acres of that type exist on the GWNF and no management activity is occurring in those acres that would affect stand age.

e. Population Trend for Old Growth Forests: Measurement by "population" is not applicable as old growth is a forest successional stage and habitat condition measured in acres, not individual species. The trend in old growth as measured in acres is one of steady increase. From 2000 to 2004 total acreage increased 19,048 acres (8%). From 1993 to 2004 total acreage increased by 83,733 acres (35%).

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

As specified in the GWNF Forest Plan with regards to management activities in old age stands, timber harvesting can only occur within the Dry Mesic Oak Type (OGFT #21), as all other stands meeting the

minimum age in other groups were classified during the Forest Plan revision process as unsuitable for timber production. Timber harvesting on unsuitable timberland has not been done on the GWNF. Timber harvesting of any old growth Dry Mesic Oak stands is disclosed in site-specific environmental analyses. While some individual old age stands of the Dry Mesic Oak type have been lost due to timber harvest during the past 11 years (<1,000 acres), the total acreage of stands meeting the minimum age within the that group continues to increase. From 2000 to 2004 there was an increase of 12,171 acres (10%) and from 1993 to 2004 an increase of 49,948 acres (41.5%). Thus, timber harvesting is not significantly limiting the old growth forest conditions on the GWNF, and in particular OGFT #21.

Very few acres have reached 200 years old since most of the Forest was cutover prior to entering federal ownership in the 1910s to 1930s. It will take another 60 to 80 years before a significant amount of 200 year-old stands are found on the Forest. According to data from CISC/GIS there exists approximately 80,670 acres (7.9%) of hardwood dominated forest types greater than 141 years of age on the GWNF (1,015,545 total forested acres in Age Class Report of 3-29-04). For stands greater than 200 years old there exists 10,916 acres (1.07%). Therefore 69,754 acres is between 141 and 200 years of age. In less than 15 years there will be at least 25,878 acres (2.5%) greater than 200 years old. However, an important point is that the age at which old growth conditions develop varies by forest type and is not simply 200 years old for all forest types. The acreage by OGFT displayed in the table takes this into account where some types (mostly pine/conifer dominated) develop old growth conditions at 80 to 130 years of age. This is why the acreage figures for these types are greater. More information on old growth designation is presented in Appendix H of the GWNF Plan EIS.

Fire is a natural disturbance process common to most OGFTs (but is very limited or non-existent in northern hardwoods, spruce/fir, and riverfront forests). Thus, the increased use of prescribed fire is not affecting the overall amount of old growth across the Forest, but instead is restoring and maintaining that condition in a species composition and structure more typical of the fire regime these forests experienced prior to active fire suppression (~1930's).

Overall, acreage of old growth forest types on the GWNF is increasing as the forest continues to increase in age. Old growth acreages of each forest type are expected to continue to steadily increase over time.

g. Recommendation: No change in Plan direction for old growth is recommended. Continue monitoring.

Threatened and Endangered Species

17. Indiana Bat

See discussion under Section dealing with "Cave Dwelling Bats".

18. Virginia Northern Flying Squirrel

a. Reason For Selection: *Glaucomys sabrinus fuscus* - Virginia northern flying squirrel was listed as endangered in 1985 by the USFWS. This squirrel was selected because it is a federally endangered species and therefore there is direct interest in its population status. The species occurs in high-elevation forests in the southern Appalachians, being restricted to mature red spruce/northern hardwood areas (Laurel Fork) on the GWNF.

For purposes of this analysis, the fundamental relationship between the squirrel and its habitat is that it prefers mature red spruce and northern hardwoods, typically associated with the spruce-northern hardwood old growth forest type group. The spruce forest type is to be protected (GWNF FEIS, page J-19). See earlier discussion of old growth. The amount and distribution of mature red spruce and

northern hardwoods are most likely to be influenced by management activities associated with timber harvesting, or herbicide applications to deal with a pest that strikes red spruce.

b. Plan Habitat Objectives Related to MIS: A specific habitat objective related to mature red spruce and northern hardwoods to achieve minimum populations for the Virginia northern flying squirrel *(Glaucomys sabrinus fuscus)* is stated in the GWNF Revised Forest Plan. That objective states "…stands that contain a red spruce component are managed to increase the red spruce component. In such an instance, the activities must comply with the Recovery Plan for the Virginia northern flying squirrel" (GWNF Plan, Common Standard #244, page 3-150).

Furthermore, on the GWNF, the Revised Forest Plan recognized the significance of the Laurel Fork area by designating it as a Special Management Area (GWNF Revised Plan, page 3-109). This is 10,000 acre area encompasses most of the known range of the squirrel on the GWNF. In Laurel Fork, the Plan's objective is to maintain and, where appropriate, enhance habitat for this unique species west of Laurel Fork stream (Plan page 3-110).

c. Description of Monitoring Method: The Forest has been coordinating with VDGIF and Dr. John Pagels at Virginia Commonwealth University to monitor northern flying squirrels. From 1985 to 1996, 349 nest boxes were set up at 26 sites. Red spruce, northern hardwood, or hemlock-dominated forest characterized each site. Depending on the size of the available habitat, 6 to 20 nest boxes were installed at each site approximately 50 m apart. Nest boxes were checked three to four times a year at most sites, usually twice in the fall and twice in the spring. In some years, several sites were checked only once or twice annually because of time or weather constraints. Nest boxes were checked during daylight hours when the squirrels were inactive. If squirrels were present the following data were collected: age, mass, reproductive condition. They were marked with metal ear tags and released at the capture site. Tail length, a character used in separating the subspecies *G.s.coloratus* and *G.s.fuscus,* was recorded for squirrels captured in southwestern Virginia (Mt Rogers/Whitetop area). Monitoring continues to the present time on the NRA, but no monitoring has been conducted in Laurel Fork since 1996 due to budgets. Additional monitoring was conducted from 2000-2002 to determine nest site characteristics and home range and resource partitioning of northern flying squirrels in the Mt Rogers/Whitetop area (Hackett and Pagels, 2002a and Hackett and Pagels, 2002b).

d. Habitat Trend for MIS: The habitat is stable to increasing. See trend in spruce-northern hardwood old growth forest type group in Table 47.

e. Population Trend for MIS: Flying squirrels were trapped in the Laurel Fork area between 1986 and 1996 to obtain population trend data. The number of squirrels trapped ranged from 0 to six. No squirrels were trapped in six out of the ten years of trapping. Based on this information, the GWNF Plan estimated that there were fewer than 20 northern flying squirrels (NFS) on the Forest (all in the Laurel Fork area) at the time the Plan was written (1993). This area is immediately adjacent to a large area of NFS habitat on the Monongahela National Forest, and is a part of the Spruce Knob/Laurel Fork Geographic Recovery Area for *G. s. fuscus* (USFWS, 1990). Table 48 shows the trends by location for the northern flying squirrel.

Table 48. Northern Flying Squirrel Trend by Site Across the GWJNF

Number of Individuals captured/10 boxes checked and the total number of G.sabrinus captured (in parenthesis) in Virginia from 1986 to 1996 (From Reynolds, in press), and 2002 (Pagels, annual report)												
Sites 1 through 4 are located in Grayson and Smyth Counties, sites 5 and 6 are located in Highland County.												
Year		**86-87**	**87-88**	**88-89**	**89-90**	**90-91**	**91-92**	**92-93**	**93-94**	**94-95**	**95-96**	**2002**
Cabin Creek	Site #1	0.2(2)	1.6(13)	0.9(7)	1.5(12)	1.0(6)	1.6(9)	0.0(0)	1.4(5)	1.4(8)	0.6(2)	0.1(5)
Whitetop	Site #2	0.4(4)	0.8(6)	0.0(0)	0.6(5)	0.0(0)	0.0(0)	0.0(0)	0.5(2)	0.5(3)	1.3(2)	0.09(12)
Opossum Creek	Site #3*	0.0(0)	0.0(0)	0.0(0)	0.13(1)	0.0(0)						
Lower Whitetop	Site #4**							0.0(0)	7.0(7)	1.0(2)	0.0(0)	
Newman's Run	Site #5	0.17(1)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	0.0(0)	
Laurel Fork	Site #6	0.0(0)	1.6(3)	0.0(0)	0.0(0)	3.8(6)	1.5(3)	0.0(0)	0.0(0)	0.0(0)	1.7(3)	
Total Number Captured Per 10 Boxes		0.77	4.00	0.90	2.23	4.8	3.1	0.0	8.9	2.9	3.6	0.19

Analysis results suggest an overall stable trend for northern flying squirrel populations on both the GWNF and JNF.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

This species is inherently rare and not naturally well distributed across the Forest due to its dependence on spruce-fir/northern hardwood ecotone. The spruce forest and its ecotone with northern hardwood forests is the only habitat for this species in the Appalachian Mountains. This habitat type is fairly stable on the GWJNF, but is being impacted by balsam wooly adelgid affecting the Fraser fir in the Whitetop area (sites #1 thru #5 in above table) of the JNF. Air pollution may be having a generalized negative impact in some areas of the higher elevation habitats, but it is unclear whether the Fraser fir forest types are declining at Whitetop (even though trends show an overall stable habitat), and, if so, what the relationship is to air pollution. The Forest analyzed the continued use of cattle grazing to maintain the open areas in the High Country of the Mt. Rogers NRA and informally consulted with the USFWS. Both agencies concluded that continued grazing would have no effect on northern flying squirrels. Thus, as documented in a site-specific Biological Evaluation, Forest Service management activities are having no effect on the northern flying squirrel.

Squirrel populations are expected to remain relatively stable in the near future. The GWNF encompasses a single population of the Virginia northern flying squirrel that is disjunct from its almost contiguous boreal distribution across northern North America, the Rocky Mountains, and New England. It's therefore inherently rare and thus not well distributed across the Forest. Current management provides for ecological conditions capable to maintain the flying squirrel population considering its limited distribution and abundance. Overall, ecological conditions are sufficient on the Forest to provide for viability (persistence over time) of this disjunct population.

g. Recommendation: No change in Plan direction for northern flying squirrels is recommended. Continue monitoring on the NRA; reinstitute annual monitoring in Laurel Fork.

19. Peregrine Falcon

a. Reason For Selection: The peregrine falcon was selected because it was a federally threatened species, and there is therefore direct interest in its populations. It was, however, de-listed by the USFWS on August 8, 1999 (64 FR 46541 to 46558). It's a species whose habitat may be influenced by management activities, and it's a non-game species of interest. It requires a specialized nesting habitat (cliffs).

For purposes of this analysis, the fundamental relationship between the falcon and its habitat is that it requires isolated cliffs in order to nest. The amount and distribution of isolated cliffs on the Forest are most likely to be influenced by management activities associated with allowing recreational climbing in and around cliff areas that were used as hack sites in the early and late 1980's to release fledgling falcons.

b. Plan Habitat Objectives Related to MIS: The habitat objective for this species is to maintain all known historic nest sites (eyries), with the hope that falcons will eventually nest on the Forest.

From 1988 through 1991, a total of 59 young peregrines were "hacked" onto the GWNF (hacking is a process whereby young raptors are trained to feed and to fly). The purpose of the hacking was to restore a breeding population of peregrines to the GWNF, as the birds often return to breed in the area where they fledged. None of the hacked birds returned to the GWNF to nest, although banding records show that several of these birds have shown up both north and south of Virginia. For the past few years, a pair of peregrines has nested in a remote section of Shenandoah National Park, and in year 2000, we received a report that a nesting pair fledged 2 young in the vicinity of Lost River State Park, just over the state line in West Virginia.

c. Description of Monitoring Method: The Forest Service has participated in a comprehensive statewide survey for peregrines every year since 1990, and individual and pairs of birds have been seen, but no nests have been identified on either of the Forests.

d. Habitat Trend for MIS: Cliffs are habitat created naturally over millions of years. No man-made cliffs have been made on the Forest through such activities as large cut banks as a result of road construction or reconstruction projects on the GWNF.

e. Population Trend for MIS: The Forest hacked 59 falcons between 1988 and 1991 inclusive (GWNF FY 1992 M&E Report). None of these hacked falcons are known to have returned and nested on the Forest. Peregrine falcons are not tracked by the BBS, nor have we found them on any of our ORP routes. Juvenile peregrines have been hacked at various locations on both Forests over the last 10 years, but none have taken up residence since these hacked birds have been identified from banding records in other locations both north and south of Virginia. Birds have been nesting in Shenandoah National Park, however, and have probably been hunting on the adjacent National Forest. Nationwide, peregrine populations are doing very well, and the USFWS has delisted the species. As part of delisting, the species will continue to be monitored for 5 years. Monitoring results indicate there are no resident peregrine falcons on the Forest.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

No scientific relationship can be established between recreational rock climbers, cliff sites, and numbers of peregrine falcons. No scientific information exists on which to make an informed analysis, although intuitively, the few numbers of rock climbers on the Forest aren't going to affect the number of falcons, particularly since these rock climbers have lots of places to climb. If it were determined that falcons were nesting, or attempting to nest at either a historic or a new eyrie on either Forest, one of the first items of business would be to close the area to rock climbing and to other activities that could potentially disturb the birds. The odds of climbers actually picking a historical hack site to climb and

then actually having an effect on falcons are minuscule. Thus recreational rock climbing is having no effect on falcon populations.

Based on the results of our monitoring and evaluation, ecological conditions on the Forest are sufficient to contribute to species viability (persistence over time). Overall, factors outside the authority of this agency affect the viability of the falcon. Agency management activities can only contribute to the viability of the falcon.

g. Recommendation: No change in Plan direction for peregrine falcons is recommended at this time since, under delisting, the species is to be monitored for another 5 years. At the time of the next Plan revision, the falcon should no longer be considered a MIS on the GWNF since little evidence exists that the species nests on the Forest.

20. Bald Eagle

a. Reason For Selection: The bald eagle was selected because it is a federally endangered species, and there is therefore direct interest in its populations. The eagle is a species whose habitat may be influenced by management activities, and it's a non-game species of interest. It prefers large bodies of water adjacent to forested areas with minimal disturbance to its nesting sites.

For purposes of this analysis, the fundamental relationship between the eagle and its habitat is that it needs riparian areas associated with medium-to-large-sized rivers or lakes for nesting and foraging (GWNF FEIS, page J-19). The amount and distribution of riparian area forests and nesting sites are most likely to be influenced by management activities associated with timber harvesting and allowing people to recreate near known nesting sites.

b. Plan Habitat Objectives Related to MIS: The Plan's habitat objective is to protect known nest sites with a ½ mile "restricted management activity" buffer (See GWNF FEIS; pg. J-21 and Revised Plan Standard #246; pg. 3-15).

c. Description of Monitoring Method: The USGS breeding bird surveys are used, along with eagle nest surveys.

d. Habitat Trend for MIS: See riparian area discussion elsewhere in this report associated with barred owl. This data includes data around the edges of large-sized rivers, lakes, and ponds.

e. Population Trend for MIS: Several bald eagle occurrences are noted on the GWNF annually, however, these represent transient individuals. Currently, an active bald eagle nest is known on private land in the Lake Moomaw area and the area of the Virginia Power (VEPCO) reservoir (near the Warm Springs Ranger District), and on Forest Service land located on the Lee Ranger District.

We have never seen a bald eagle on any of our ORP routes, although forest personnel periodically see them during the course of other work. Bald eagles typically nest near a large body of water that they use for foraging. They seldom nest in extensive forested areas. Habitat for bald eagles on the National Forests is relatively insignificant when compared to the quantity and quality of habitat in the nearby Chesapeake Bay and the Virginia coastline. The BBS data for Virginia is presented in Figure 15. Data is currently unavailable from BBS route data for years 1997 to 2000. Analysis results suggest an overall increasing trend for bald eagle populations in the state, which likely results in increased use by transient birds and increase probability of future nesting on the GWNF.

(Statewide Virginia Breeding Bird Survey Data)

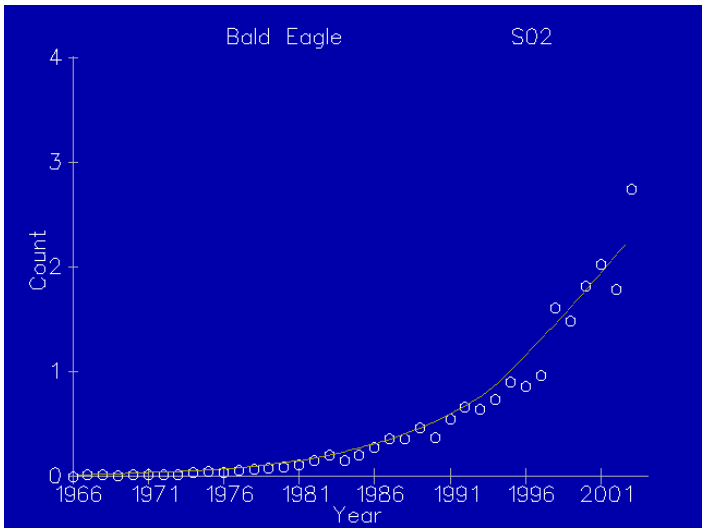

Figure 15. Average Number of Bald Eagles Seen or Heard Across Virginia, 1967 to 2002

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

The amount of nesting, roosting, and foraging habitat suitable for bald eagles on the GWNF and JNF is limited. Lakes such as Moomaw, Sherando, North Fork of the Pound, Cave Mountain, etc., or rivers such as the James, the Calfpasture, the Shenandoah, the Clinch, and Back Creek could provide habitat, and transient eagles may appear at these locations occasionally. Should a bird (or birds) appear to be making a nesting attempt at one of these, or any other location on the forest, we would provide the necessary protection of the area. Management activities are thus having no effect on bald eagle populations.

Based on the results of our monitoring and evaluation, ecological conditions on the Forest are sufficient to contribute to species viability (persistence over time). Overall, factors outside the authority of this agency affect the viability of the eagle. Agency management activities can only contribute to the viability of the eagle.

g. Recommendation: No change in Plan direction for bald eagle is recommended. The bald eagle has been downlisted from endangered to threatened by the USFWS. If range-wide population numbers continue to increase, it is likely the bald eagle will be delisted and removed from the Endangered Species List.

21. James Spinymussel

a. Reason For Selection: The James spinymussel (*Pleurobema collina*) was selected because it is a federally endangered aquatic species; therefore, its population status is of direct interest. Its habitat is directly affected by water quality with it being sensitive to siltation (GWNF FEIS, page J-19).

For purposes of this analysis, the fundamental relationship between the spinymussel and its habitat is water quality and the streambed substrate where it lives. Water quality, in streams with their watersheds on NFS land, is most likely to be negatively influenced by management activities that have the potential to introduce sediment into the streams. Water quality in streams draining private lands near the Forest is most likely to be influenced by agricultural activities and point-source discharges.

b. Plan Habitat Objectives Related to MIS: Plan objectives are to maintain sedimentation rates that are in equilibrium with the watershed and to not alter biological communities as measured using EPA's

Rapid Bioassessment, Protocol II (EPA 1989). The application of riparian area and soil and water Plan standards and guidelines will protect downstream aquatic habitat, where historic and current occurrences and suitable habitats for the spinymussel are found. Projects in riparian areas that occur within or near occupied or suitable habitat, are addressed with site-specific measures, such as Best Management Practices (GWNF FEIS, Appendix K, page K-5 and K-6).

c. Description of Monitoring Method: Chapter 5 of the GWNF FEIS lists two monitoring questions that apply to all federally listed threatened and endangered species:

1) Were requirements outlined in federal species recovery plans implemented?

For this species the recovery plan (USFWS, 1990) lists the following tasks relating to the Forest Service:

a. Conduct surveys.

b. Continue to utilize existing legislation and regulations to protect species.

c. Provide long-term protection of essential habitats through acquisition, registry, management agreements, etc.

d. Seek support from landowners, local governments, and agencies.

These tasks may be accomplished through the Forest's planning process, including inventory and monitoring, through project review and implementation, and through cooperative agreements and memoranda of understanding.

2) Is habitat for all existing threatened and endangered species being maintained or improved with no unwarranted habitat alterations/degradations happening?

This question is answered using qualitative and quantitative field surveys that are conducted by snorkeling along transects in potential or known habitat, in addition to biological monitoring using benthic macroinvertebrates.

d. Habitat Trend for MIS: The James spinymussel is a freshwater mussel endemic to the James River where it is found in runs with moderate currents and sand, gravel, or cobble substrate with water hardness values greater than 50 mg/l calcium carbonate (Hove, 1990). It historically was found in the James River above the Fall Line at Richmond, Virginia, but is now restricted to small, headwater tributaries typical of the habitat of its eight fish hosts, which include rosyside dace, bluehead chub, mountain redbelly dace, blacknose dace, central stoneroller, rosefin shiner, satinfin shiner, and swallowtail shiner (Hove and Neves, 1994).

Loss and fragmentation of spinymussel habitat on larger rivers has slowed since no major impoundments are currently proposed or being built. The fish hosts found on the Forest are not endangered, threatened, sensitive, or locally rare, therefore they are not thought to be a limiting factor. Water quality as related to acid deposition is reducing the calcium carbonate found in some streams that are not well buffered. Sediment loading seems to be the current major threat to populations of this species and is continuing to occur on private land.

e. Population Trend for MIS: Since this mussel is only an MIS for the GWNF, Table 49 is a summary of survey findings for streams on or near that National Forest. Survey data collected by M. O'Connell and R.J. Neves in 1991 and 1992, M. McGregor in 1999 through 2001, and B. Evans in 2002 and 2003 is compiled in this table. The O'Connell and Neves survey was designed to locate *P. collina* in upstream tributaries of the James River. The table shows the streams on the GWNF that were surveyed. Other than the larger rivers, the majority of the Forest Service streams do not have mussels in them. The discussion in the report explained, "tributaries of the Pedlar River and other streams surveyed in the Pedlar District have little or no mussel habitat" (O'Connell and Neves, 1992). Tributaries surveyed on

the GWNF "in Bath and Alleghany counties were also too small to have mussel habitat " (O'Connell and Neves, 1992).

Table 49. James spinymussel occurrence trend in streams on/near the George Washington National Forest

Date	Stream	County	# Found Live/ Dead	Location	Owned by FS (Y/N) Approx.Miles downstream
1990	Potts Creek	Allegheny	1/0	Cast Steel Confl	N ¼
1990, 1991, 1992	Pedlar River	Amherst	1/0	Jacks Branch	N 3
1990, 1991, 1992	Pedlar River	Amherst	0/2	Pedlar Mills	N 4
1991	Skulking Branch	Amherst	0		Y
1991	Browns Creek	Amherst	0		Y
1992	Brown Mtn Creek	Amherst	0		Y
1992	Swapping Camp Creek	Amherst	0		Y
1992	Enchanted Creek	Amherst	0		Y
1992	Jacks Branch	Amherst	0		N
1992	Dancing Creek	Amherst	0		Y
1992	Thomas Mill Creek	Amherst	0		Y
1992	Otter Creek	Amherst	0		Y
1992	Terrapin Creek	Amherst	0		Y
1992	Rocky Row Run	Amherst	0		Y
1992	Cashaw Creek	Amherst	0		Y
1992	Maury River	Rockbridge	0		N
1992	Wilson Creek	Bath	0		Y
1992	Smith Creek	Bath	0		Y
1992	Cast Steel Run	Allegheny	0		Y
1992	Mill Branch	Allegheny	0		Y
1992	Paxton Branch	Allegheny	0		N
1992	Nelsen Branch	Allegheny	0		N
1999	Potts Creek	Allegheny	0		N
1999	Blue Spring	Allegheny	0		N
1999	Piney River	Nelson	0		N
1999	Pedlar River	Amherst	0/1	So. of Dancing Cr	N 2.5
1999	Pedlar River	Amherst	2/0	No. of Cedar Cr	N 3.5
1999	Pedlar River	Amherst	0/3	130 crossing	N 5
1999	Buffalo River	Nelson	0		N
1999	NF Buffalo river	Nelson	0		Y
2000	Mill Creek	Augusta	8/0	39 crossing	N 3.5
2000	Thompson Creek	Bath	0		N
2000	Mill Creek	Bath	0	Dagger Springs	N
2000	Sinking Creek	Alleghany	0		N
2000	Cowpasture River	Bath	0	632 boat ramp	Y
2001	Cowpasture River	Augusta	0	Coursey Springs	N
2001	Calfpasture River	Rockbridge	0	Goshen	N
2001	Jackson River	Bath	0	Meadowlane	N
2001	Jackson River	Bath	0	North of Moomaw	N
2001	Cowpasture River	Augusta	0	@614/250	N
2001	Tye River	Nelson	0		N
2001	NF Tye River	Nelson	0		N
2002	Cowpasture River	Bath	1/0	Fort Lewis	N .5
2003	Cowpasture River	Bath	1/0	Fort Lewis	N .5

A preliminary report to the USFWS by Monte McGregor (VDGIF biologist) (1999) contains recent population data on the federally endangered James spinymussel (*Pleurobema collina*). This report describes a survey of the James spinymussel in Virginia with emphasis in the upper Rivanna River watershed and the upper James River tributaries begun in July 1998.

In the summer of 1998, VDGIF staff of the Nongame and Endangered Wildlife Program examined 61 sites on the Rivanna River in Albermarle, Green, Fluvanna, and Louisa counties, finding 11 species of bivalves. *Pleurobema collina* was identified from seven sites, with three new records. All sites with *P. collina* had low densities, with less than ten individuals of the James spinymussel. There was evidence for recruitment, as several *P. Collina* were less than 2-5 years in age. Densities of *P. collina*, however, were proportionally lower than densities of young and adults of other species.

In the late spring through the fall of 1999, VDGIF staff surveyed the Hardwater River, Rockfish River, Buffalo River, Pedlar River, Appomattox River, and Potts and Craig Creek tributaries for *P.collina*. The Buffalo River (including North Fork Buffalo), Blue Spring, Potts Creek, and the Pedlar River are the only streams that are on or near George Washington National Forest land. No spinymussels were found in the Buffalo, North Fork Buffalo, Blue Spring, or lower Potts Creek. One live and several fresh relicts were found in the Pedlar River in three new sites about a mile below the confluence with Dancing Creek. This is downstream from Forest Service property. *P. collina* were found in Johns Creek, Craig Creek, Dicks Creek, and Catawba Creek, within the Craig Creek watershed, near the Jefferson National Forest.

Of the 15 VDGIF survey locations in 2000, *P. collina* was only found in Mill Creek, Bath County. Dr. Neves from Virginia Polytechnic Institute and Sate University surveyed for the spinymussel on the South Fork of Potts Creek in Monroe County, WV in 2000. *P. collina* abundance has declined by 25% in 5 years in the survey sections in that stream. Throughout the Craig Creek drainage, *P. collina* numbers are declining (Pers. Com., Neves, 12/5/00).

VDGIF surveys in 2001 did not locate any *P. collina* in streams on or near the George Washington National Forest. *P. collina* were found in Potts Creek in West Virginia.

P. collina were found by Brian Evans of the US Fish and Wildlife Service in the Cowpasture River, downstream from National Forest in 2002 and 2003.

O'Connell and Neves conducted James spinymussel surveys in 1990 through 1992 to find the distribution of this mussel in streams of the GWJNF (O'Connell & Neves 1991, O'Connell and Neves 1992). As seen in the table above, most of the Forest Service streams surveyed did not contain spinymussels. This was attributed to lack of suitable habitat; the streams were too rocky, too cold, or too high of a gradient.

There are no current documented occurrences of *P. collina* in streams on the GWNF. Recent surveys have increased the number of occurrences downstream of the GWNF to 9. Analysis results suggest an overall increasing trend for spinymussel populations near the GWNF. The Forest is currently working with the US Fish and Wildlife Service and VDGIF to locate spinymussel populations on National Forest and habitat suitable for augmentation.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

This species is inherently rare and not naturally well distributed across the Forest due to its historic distribution (restricted to the James River drainage) and the limited amount of suitable habitat on the Forest. The current distribution of the James spinymussel includes the following areas: Potts Creek, Craig Creek, Johns Creek, Dicks Creek, Patterson Creek, Catawba Creek, Pedlar River, Mill Creek, and Cowpasture River (upper James), Meechums River, Moormans River, Wards and Ivy Creek (middle James and Rivanna River). It apparently is now extirpated from approximately 90 percent of its range

(Clarke, 1984). Recent surveys have determined the presence of the James spinymussel in tributaries of the upper Rivanna River near Charlottesville, Virginia (M. McGregor, Per. Com.). In addition, *P. collina* were found in the Dan River in 2000 by NC Department of Transportation biologists. Genetics work is being conducted on the Dan River spinymussel population to determine the relationship with the James River populations.

Since mussels are sedentary and unable to move long distances to more suitable areas in response to heavy siltation, sedimentation is a significant factor contributing to spinymussel habitat degradation and the consequent decline of the species. Juvenile mussels are especially susceptible to sedimentation because of their position in the substrate and their small size; this can decrease recruitment of young individuals into the population. The results of monitoring trout as shown in Section 13 are also germane to mussels. Table 3 in the wild trout section shows the monitoring results for several streams on the Forest before and after adjacent timber harvest. Table 4 in the wild trout section shows the monitoring results for several streams on the Forest before and after adjacent prescribed burns. There was not significant difference between the pre and post timber harvest or prescribed burn MAIS scores. They remained in the "Good" category.

Based on the above monitoring analysis, timber harvesting and other management activities are not significantly decreasing habitat or populations of spinymussels or their habitat.

The Forest is has developed a conservation strategy for all federally listed mussels and fish in conjunction with the USFWS, VDGIF, and universities to proactively contribute to providing ecological conditions that maintain or increase mussel populations.

The GWNF encompasses no populations of the James spinymussel on NFS land. The species does occur in watersheds that contain NFS land and occurs both upstream and downstream from the Forest. Current management provides for water quantity and quality from the Forest that contributes to population viability (persistence over time) of mussel populations within the watersheds where they occur.

Overall, viability remains a concern for the James spinymussel on the GWNF, yet management has little ability to affect its overall viability. Factors outside the authority of this agency affect the viability of the James spinymussel. Agency management activities can only contribute to the viability of the James spinymussel.

g. Recommendation: No change in Plan direction for the James spinymussel is recommended. Continue monitoring.

22. Shale Barren Rockcress

a. Reason For Selection: Shale barren rockcress (*Arabis serotina*) was selected because it is an endangered species. It was listed as endangered on August 14, 1989. This species is endemic to mid-Appalachian shale barrens in a small region of Virginia and West Virginia. The shale barren rockcress was selected because it is a federally endangered shale barren endemic species and therefore there is direct interest in its population status and trend (GWNF FEIS, page J-19).

For purposes of this analysis, the fundamental relationship between the shale barren rockcress and its habitat is the geologic structure and bedrock where it lives. The amount and distribution of this species is most likely to be influenced by management activities associated with authorizing the collection of common variety mineral materials by the private sector, road construction, the creation of shale pits for use in surfacing State or NFS roads, by herbicide applications associated with road maintenance or gypsy moth defoliation control, increased canopy closure (fire suppression?), herbivory (in particular deer browsing) or activities that could encourage the spread of invasive plant species.

b. Plan Habitat Objectives Related to MIS: The GWNF Plan allocated most of the habitat that supports shale barren rockcress on the Forest as Wilderness or Special Biological Areas. Wilderness Areas (Management Area 8) are managed to "maintain or achieve a naturally functioning ecosystem" (GWNF FEIS, p. 3-35). Special Biological Areas (Management Area 4) are managed to "protect and/or enhance their outstanding natural biological values" (GWNF FEIS, p. 3-6). In addition "No herbicide is aerially applied within 300 feet, nor ground-applied within 60 feet, of any known threatened, endangered, proposed, or sensitive plant. Buffers are clearly marked before treatment so applicators can easily see and avoid them" (GWNF FEIS, Appendix J, page J-18 to J-21) [GWNF Revised Plan Standard #118, page 3-136].

c. Description of Monitoring Method: Chapter 5 of the GWNF FEIS lists two monitoring questions that apply to all federally listed threatened and endangered species:

1) Were requirements outlined in federal species recovery plans implemented? For this species the recovery plan (USFWS, 1991) lists the following tasks relating to the Forest Service:

a. Preserve habitat on public lands.

b. Enforce regulatory authorities to protect populations/habitat.

c. Implement and evaluate the monitoring program.

These tasks may be accomplished through the Forest's planning process, including inventory and monitoring, and through project review and implementation.

2) Is habitat for all existing threatened and endangered species being maintained or improved with no unwarranted habitat alterations/degradations happening? This question is answered using qualitative field surveys.

d. Habitat Trend for MIS: Habitat where shale barren rockcress occurs is protected either by designation as a Special Biological Area or during the project-level Biological Evaluations prior to project decision and implementation. Habitat for this species on the Forest is stable. Habitat has not changed since the 2000 report except through natural processes.

e. Population Trend for MIS: In 1993 there were 17 known occurrences of shale barren rockcress on the Forest. The GWJNF's focus since this species was listed has been to attempt to locate additional populations and further define its range on the Forest. From 1994 to 1998 agency personnel worked cooperatively with the Virginia Division of Natural Heritage and the USFWS to inventory shale barrens on the Forest (Belden, Ludwig, and Van Alstine 1999). The Virginia Division of Natural Heritage identified 809 potential shale barrens from aerial photographs. Of these, 188 were examined for rare species. The inventory resulted in 27 new occurrences of shale barren rockcress, bringing the total known sites on the Forest (in Virginia) to 37. This number does not include two sites where shale barren rockcress was known to occur recently, but could not be found in 1994.

Subsequent fieldwork has brought the total occurrences on the Forest to 77 (West Virginia Natural Heritage Program 2000). This includes both Virginia and West Virginia information. Of the 77 occurrences, 17 were known in 1993 when the GWNF Plan took effect, so there has been an increase of 60 occurrences. The number of individual plants in shale barren rockcress populations are known to fluctuate greatly from year to year, so the inability to find plants in a given year is not necessarily indicative of loss of a population (Jarrett, et al. 1996). Overall, given that habitat is stable and protected and field studies have located new populations, shale barren rockcress populations appear stable on the GWNF. There has been no change in the number of occurrences since the 2000 report.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Habitat for this species is stable on the Forest. There are possible threats to shale barren communities from invasive native and exotic species. Populations appear stable, but since they naturally tend to fluctuate greatly from year to year this is uncertain. Potential habitat is being inventoried and continues to reveal new populations that will be protected. Management activities are having no effect on the habitat that contains the shale barren rockcress and thus are having no effect on the rockcress.

Overall, viability is being maintained through identification and protection of occurrences, however, viability is still of concern due to the naturally limited distribution of this species. Shale barren rockcress populations are expected to remain relatively stable in the near future.

The GWNF encompasses several populations of the endemic shale barren rockcress that are in the core of its limited distribution in the Northern Ridge and Valley Section of the mid-Appalachians. This species is inherently rare and not well distributed across the Forest. Current management provides for ecological conditions capable to maintain the shale barren rockcress populations considering its limited distribution and abundance. Overall, ecological conditions are sufficient on the Forest to maintain viability (persistence over time) of populations on national forest land.

g. Recommendation: No change in Plan direction for shale barren rockcress is recommended. Continue monitoring.

23. Swamp Pink

a. Reason For Selection: The swamp pink was selected because it is a federally threatened species and therefore its populations are of direct interest (GWNF FEIS, page J-19). It was listed as threatened on October 11, 1988. It occurs on the GWNF in Augusta County in the Maple Flats/Big Levels area south of Stuarts Draft, VA.

For purposes of this analysis, the fundamental relationship between the swamp pink and its habitat is that it needs wetland conditions to live. The amount and distribution of wetlands is most likely to be influenced by management activities associated with land exchanges involving isolated federal parcels that are better utilized for economic development in the private sector, by authorized recreational or other group public use where people could trample the plant, by pond construction that could flood wetlands or modify hydrology, by herbicide applications associated with road maintenance, or by gypsy moth defoliation.

b. Plan Habitat Objectives Related to MIS: The majority of the habitat that supports swamp pink on the Forest is located in Wilderness or Special Biological Areas. Wilderness Areas (Management Area 8) are managed to "maintain or achieve a naturally functioning ecosystem" (GW FEIS, p. 3-35). Special Biological Areas (Management Area 4) are managed to "protect and/or enhance their outstanding natural biological values" (GW FEIS, p. 3-6). The GWNF Plan also states that "No herbicide is aerially applied within 300 feet, nor ground-applied within 60 feet, of any known threatened, endangered, proposed, or sensitive plant. Buffers are clearly marked before treatment so applicators can easily see and avoid them" (GWNF FEIS, Appendix J, page J-18 to J-21) [GWNF Revised Plan Standard #118, page 3-136]. In 1993 there were 16 known occurrences of swamp pink on the Forest. The Forest's objective is to not lose any existing occurrences and to inventory to locate new populations that will be protected.

c. Description of Monitoring Method: Chapter 5 of the GWNF FEIS lists two monitoring questions that apply to all federally listed threatened and endangered species:

1) Were requirements outlined in federal species recovery plans implemented? For this species the recovery plan (USFWS, 1991b) lists the following tasks relating to the Forest Service:

a. Develop and maintain conservation plans.
b. Identify and implement management techniques.
c. Enforce protective regulations.
d. Investigate population dynamics.
e. Monitor threats to existing sites.

These tasks may be accomplished through the Forest's planning process, including inventory and monitoring, and through project review and implementation.

2) Is habitat for all existing threatened and endangered species being maintained or improved with no unwarranted habitat alterations/degradations happening? This question is answered using qualitative field surveys.

d. Habitat Trend for MIS: There has been annual qualitative monitoring of two sites. One site, a sinkhole pond, has had beavers raising the water level. Due to a concern that the raised water level would negatively impact the swamp pink in the vicinity of the pond, efforts have been made to eliminate the beaver and control the water level. In the fall of 1999 the water level in the sinkhole pond rose, perhaps due to heavy hurricane rains. The level did not fall after the rain subsided and it was found that the beavers had raised their dam, possibly in response to water flowing rapidly out of the pond. The USFWS were contacted for guidance. They did not feel action by the Forest Service was required. However, in 2002 the Forest Service installed a pipe through the beaver dam to lower the water to the level typically observed over the past few decades. This was in response to public concern for the swamp pink and for other rare plants. We will continue to monitor the beaver activities and the water level. A site in the St. Mary's Wilderness exists in a seep along a trail. This site has been monitored for several years, with no apparent negative impacts to the swamp pink, in spite of the fact that hikers have placed logs across the seep area. In fact, 1997 field surveys in the area located several hundred to a thousand additional plants. Because the majority of the Forest's swamp pink habitat is in Wilderness or Special Biological Areas it is being conserved and protected from potentially damaging activities. Basically, natural processes are operating in these areas. The habitat trend for this species is stable or increasing.

e. Population Trend for MIS: The population of swamp pink on the National Forest is large, dispersed over a ten-mile area, and well protected. At the time of the GWNF Plan in 1993 there were 16 known occurrences (according to Virginia Division of Natural Heritage information) with perhaps 15,000 plants. Since that time three more locations have been discovered, including one that contains up to one thousand plants. There has been no loss of population occurrences since the GWNF Revised Plan was adopted in 1993 or since the species was listed under the Endangered Species Act in 1988. The population trend is stable to increasing for swamp pink on the GWNF.

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

Habitat appears to be stable on the Forest and known occurrences and populations are protected. Occurrences appear to be stable with no loss of occurrences observed. Field surveys have revealed new occurrences, some quite large. Management activities do not appear to be having adverse effects on populations of swamp pink.

Overall, swamp pink occur in enough locations and in high enough numbers that their persistence on the Forest seems likely; however, viability remains a concern due to the limited nature of required habitats. Swamp pink populations are expected to remain stable or increase.

The GWNF encompasses a population of swamp pink that is part of a disjunct distribution in eastern North America from New Jersey south to North Carolina and Georgia. It's inherently rare and not well distributed across the Forest. Current management provides for ecological conditions capable to maintain swamp pink populations on the Forest considering its limited distribution and abundance.

Overall, ecological conditions are sufficient on the Forest to provide for distribution and abundance of the species that will provide for population viability (persistence over time).

g. Recommendation: No change in Plan direction for swamp pink is recommended. Continue monitoring.

24. Northeastern Bulrush

a. Reason For Selection: Northeastern bulrush was selected because it is a federally endangered species associated with wetlands, and therefore its populations are of direct interest (GWNF FEIS, page J-19). It was listed as endangered on June 6, 1991.

For purposes of this analysis, the fundamental relationship between the bulrush and its habitat is that it needs wetland conditions to live. The amount and distribution of wetlands is most likely to be influenced by management activities associated with land exchanges involving isolated federal parcels that are better utilized for economic development in the private sector, by authorized recreational or other group public use where people could trample the plant, by pond construction that could flood wetlands or modify hydrology, by herbicide applications associated with road maintenance, or by gypsy moth defoliation.

b. Plan Habitat Objectives Related to MIS: The GWNF Plan designates the Potts Mountain site and the Maple Springs site as Special Biological Areas. Special Biological Areas (Management Area 4) are managed to "protect and/or enhance their outstanding natural biological values" (GWNF FEIS, p. 3-6). Specific habitat objectives for the bulrush are clearly articulated in the GWNF Revised Forest Plan. "No herbicide is aerially applied within 300 feet, nor ground-applied within 60 feet, of any known threatened, endangered, proposed, or sensitive plant. Buffers are clearly marked before treatment so applicators can easily see and avoid them" (GWNF FEIS, Appendix J, page J-18 to J-21) [GWNF Revised Plan Standard #118, page 3-136]. In 1993 there were two occurrences of northeastern bulrush on the Forest, although subsequent information makes one of those occurrences suspect.

The 1993 Recovery Plan describes four extant populations in Virginia that are all on private land and are threatened by off-road vehicles and possible development. These populations occur in two types of ponds in the Northern Ridge and Valley section: 1) shallow, oligotrophic sinkhole ponds over sandstone which overlies limestone, or 2) sandstone depression ponds on mountain ridges that are not formed by the subsidence of underlying material. At the time of the 1993 GWNF Plan there were 2 possible occurrences on the Forest. One of the populations is on a 40-acre tract on Potts Mountain that was acquired by the U.S. Forest Service in 1995. This site is managed as a Special Biological Area. The other is in the Maple Springs Special Biological Area, however, the record of collection there has not been verified and it is doubtful northeastern bulrush occurs here. As of August 1996, inventories by Virginia Division of Natural Heritage (VDNH) discovered a new occurrence (Morning Knob). An additional site is in West Virginia at Pond Run Pond on the Forest.

c. Description of Monitoring Method: Chapter 5 of the GWNF FEIS lists two monitoring questions that apply to all federally listed threatened and endangered species:

1) Were requirements outlined in federal species recovery plans implemented? For this species the recovery plan (USFWS, 1992) lists the following tasks relating to the Forest Service:

a. Identify essential habitat.
b. Secure permanent protection for known populations.
c. Resurvey sites thought to have suitable habitat
d. Identify potentially suitable habitat for additional surveys
e. Survey potential sites for species presence.
f. Monitor 10 other representative populations for general population and habitat information.

g. Verify, monitor, and protect any additional populations.
h. Identify historical and potential habitat suitable for reintroductions.

These tasks may be accomplished through the Forest's planning process, including inventory and monitoring, and through project review and implementation.

2) Is habitat for all existing threatened and endangered species being maintained or improved with no unwarranted habitat alterations/degradations happening? This question is answered using qualitative field surveys. In 1999 photo monitoring was begun and will continue annually.

d. Habitat Trend for MIS:

i. Potts Mountain

The Potts Mountain population has been qualitatively monitored annually since 1990. A designated off-highway vehicle (OHV) trail/road runs near the pond. There has been concern that users of such vehicles might drive them through the pond as they have at other locations. The monitoring found that in June of 2001 at least one OHV had driven toward the pond. The tire tracks followed the drainage path from Potts Pond. The OHV did not enter the pond and there was no damage to the northeastern bulrush. In response to this activity large rocks were placed in the area where the OHV left the designated OHV road to prevent further incursions. In August of 2003 more damage in the same area was seen. Some of the rocks had been moved and, as in 2001, an OHV drove toward the pond following the pond drainage. In January of 2004 the OHV road was closed by the installation of a gate at the FDR 176 entrance. A sign was put up informing the public of the reason for the road closure. Before the road is opened for OHV use 90 large rocks have been put in place. In addition, the wilderness boundary has been remarked and there is a Forest Supervisor's order prohibiting vehicles from entering the Special Biological Community that supports the northeastern bulrush. This order includes signs placed along the road and around the Special Biological Community. The habitat is still intact and undisturbed and the bulrush is present in the pond. Area occupied by the bulrush has not changed since the Forest Service acquired the site.

ii. Morning Knob

No change in habitat except natural succession.

iii. Maple Springs

This pond is protected as part of the Shenandoah Mountain Crest Special Biological Area.

iv. Pond Run Pond

Pond Run Pond is monitored by the West Virginia Department of Natural Resources. Their 2002 report to the Forest indicated concern about increasing canopy closure over the pond that may negatively affect the Northeastern bulrush. They also noted the possible hydrologic connection between Pond Run Pond and a bog uphill. A trail runs between the pond and the bog and may be interfering with the normal movement of water between the two areas.

e. Population Trend for MIS: Table 50 shows the occurrences of bulrush. Since 1993, there has been no loss of occurrences on the Forest. An additional two occurrences were discovered as noted above. Analysis results suggest an overall stable trend for bulrush populations on the GWNF.

Table 50. Northeastern Bulrush Populations

Potts Mountain	Morning Knob	Maple Springs	Pond Run Pond
No quantitative population data available	In 1994, 1000+ culms	No population data available– this site may have been an error	1996, 30 culms 1997, 35 culms 1998, 30 culms 1999, pond dry, no plants observed
Habitat stable	Habitat stable	Habitat stable	2000, habitat possibly being impacted by horses 2001, 6 clumps and 12 stems 2002, 3 clumps and 14 stems

f. Evaluation of Relationship of Habitat Trend, Population Trend with Agency Activities

The Potts Mountain habitat is stable and the population appears stable. The Morning Knob and Maple Springs habitats are stable. The Morning Knob population has not been monitored since 1996. The Maple Springs site is protected within a Special Biological Area; however, the report of northeastern bulrush at this site has not been confirmed. The Pond Run Pond habitat may have been impacted by horse use. Management activities are having no effect on populations of bulrush.

The GWNF encompasses several populations of the northeastern bulrush as part of a disjunct distribution in eastern North America from New England south to Virginia. It's inherently rare and not well distributed across the Forest. Current management provides for ecological conditions capable to maintain bulrush populations considering its limited distribution and abundance. Overall, ecological conditions are sufficient on the Forest to maintain population viability (persistence over time).

g. Recommendation: No change in Plan direction for bulrush is recommended. Continue monitoring. Determine if horse damage has occurred at Pond Run Pond and, if so, take action to eliminate impacts to the northeastern bulrush.

E. Viability of Forests' MIS

The overall goal is to conserve species with viability concerns through conserving their habitat. The concept of viability is making the assumption that all the species needs can be met on the National Forests. But the Forests are not "islands" and cannot be called upon to meet all needs for all MIS, especially wide-ranging species such as neotropical migrants, bald eagles, or the Indiana bat. Each individual species status and trend narratives articulated the rationale for selection of that species. Most MIS were not selected because of concerns over viability. Most MIS species were selected for other reasons (1982 36 CFR §219.19(1)(a)).

See Table 51. Viability is not a concern for most identified MIS because, based on rankings of the Natural Heritage Program's, MIS species are either "very common and demonstrably secure" (G5, S5) or "common and apparently secure" (G4, S4) throughout their "global" and "state" ranges. This is the case for 11 out of 23 identified MIS/MIS groups on the GWNF and for 8 out of 8 identified MIS/MIS groups for the JNF.

Table 51. Global and State Rankings for GWJNFs' MIS and Identification of Viability Concerns

Assigned Number (GWJNF)	Management Indicator Species	Global Ranking*	Virginia Ranking*	West Virginia Ranking*	Species Viability Concerns (Yes or No)
1/1	Black bear	G5	S4	S5	No
2/2	Eastern Wild Turkey	G5	S5	S5	No
3/3	White-tailed Deer	G5	S5	S5	No
4/NA	Brown Headed Cowbird	G5	S5	S4B S5N	No
5/NA	Worm-eating Warbler	G5	S4	S5B	No
6/NA	Ovenbird	G5	S5	S5B	No
7/NA	Cow Knob Salamander	G3	S2	S1	Yes
8/NA	Tiger Salamander	G5	S1	N/A	Yes
9/4	Common Flicker	G5	S5	S5B S5N	No
10/5	Pileated Woodpecker	G5	S5	S5	No
11/NA	Native Brook Trout	G5	S4	S5	No
NA/6	Wild Trout (Brook, Rainbow and Brown)	G5	S4	S5	No
12/NA	Indiana Bat	G2	S1	S1	Yes
13/NA	Northern Flying Squirrel	G5	S1	S2	Yes
14/NA	Peregrine Falcon	G4	S1	S1B S2N	Yes*
15/NA	Bald Eagle	G4	S2	S1B S2N	Yes*
16/NA	James Spinymussel	G1	S1	S1	Yes
17/NA	Shale Barren Rockcress	G2	S2	S1	Yes
18/NA	Swamp Pink	G4	S1	N/A	Yes
19/NA	Northeastern Bulrush	G3	S2	S1	Yes
NA/7	Barred Owl	G5	S5	S5	No
20/NA	Cave Dwelling Bat Group				
	-Big Brown Bat	G5	S5	S5	No
	-Little Brown Bat	G5	S5	S5	No
	-North. (Keen's) Myotis	G4	S3	S3S4	Yes
	-Eastern Pipistrelle	G5	S5	S5	No
	-East. Small Footed Bat	G3	S1	S1	Yes
21/8	Sunfish Family Group				
	-Smallmouth Bass	G5	S5	S5	No
	-Largemouth Bass	G5	S5	S5	No
	-Redbreast Sunfish	G5	S5	S5	No
	-Rock Bass	G5	S5	S5	No
	-Black Crappie	G5	S5	S4	No
	-Bluegill	G5	S5	S5	No
	-Redear Sunfish	G5	SE	SE	No
22/NA	Yellow Pine Community	NA	NA	NA	Yes
23/NA	Old Growth Forest Types	NA	NA	NA	No

*Species being downlisted, so viability concerns on Forest are diminished.

Source: http://www.natureserve.org

*Heritage Ranking Codes Used in Preceding Table 51

Natural Heritage Program Rankings:
G = Global Ranking, And S = State Ranking

Code	Code Description
G1	Extremely Rare Throughout Entire Range Of Species (Occurrences 1-5)
S1	Extremely Rare Throughout The State (Occurrences 1-5)
G2	Very Rare Throughout Entire Range Of Species (Occurrences 6-20)
S2	Very Rare Throughout The State (Occurrences 6-20)
G3	Rare Or Uncommon Throughout The Entire Range Of Species (Occurrences 21-100)
S3	Rare Or Uncommon In The State (Occurrences 21-100)
G4	Common And Apparently Secure Throughout Range
S4	Common And Apparently Secure Throughout State
G5	Very Common And Demonstrably Secure Throughout Range
S5	Very Common And Demonstrably Secure Throughout State
GX	Believed Extinct With No Likelihood Of Rediscovery
SX	Believed Extirpated From State
SE	Exotic Species
GH	Historically Known Globally - Not Recently Verified (Within Past 15 Years)
SH	Historically Known From State - Not Recently Verified (Within Past 15 Years)
GU	Possibly Rare - Status Uncertain - More Data Needed
SU	Possibly Rare - Status Uncertain - More Data Needed
Q	Taxonomic Question
T	Signifies The Rank Of A Subspecies Or Variety
?	Rank Uncertain
N/A	Not Known To Occur In State
S*B S*N	B = Breeder, N = Nonbreeder
NA	Not Applicable

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