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Analysis of the Management Situation

Revision to the George Washington Revised Land Management Plan

George Washington and Jefferson National Forests
Roanoke, Virginia

Tiger Salamander: Photo: USFS

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CHAPTER 1. INTRODUCTION

Background and Purpose of Report

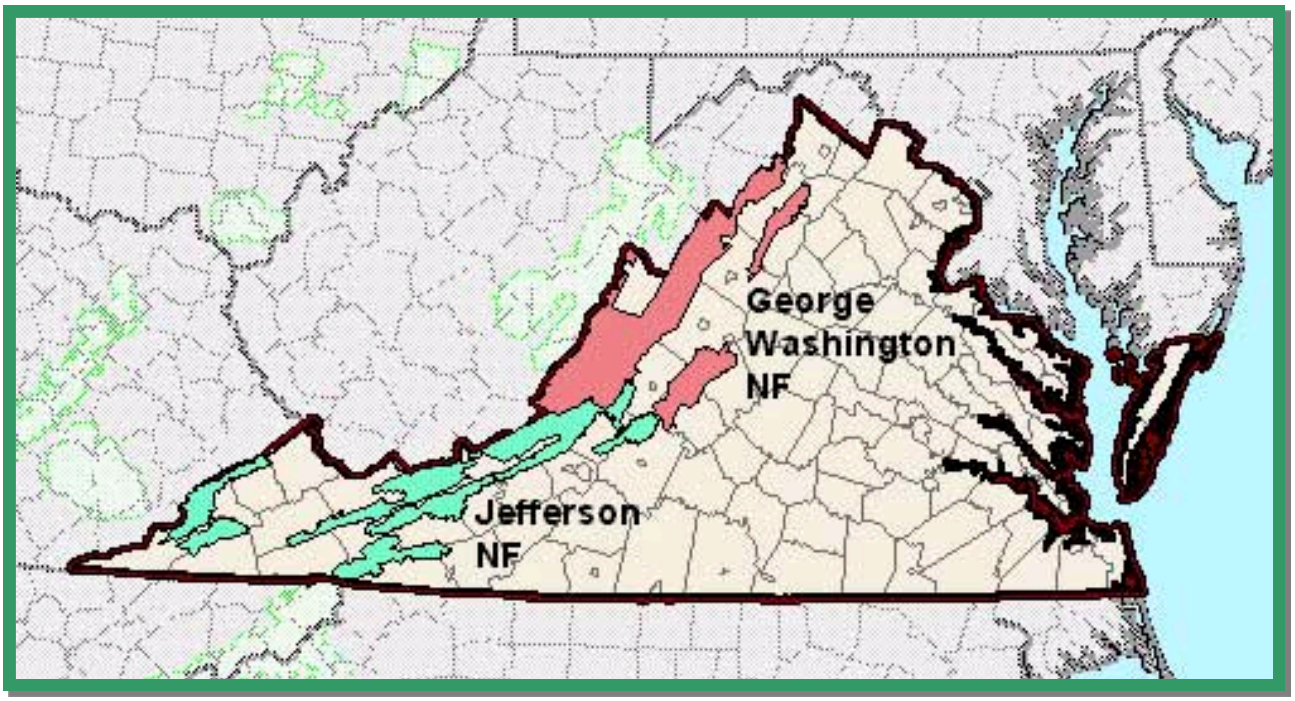
The George Washington National Forest began preparation of a Comprehensive Evaluation Report (CER) during the initial stages of the plan revision as required under the 2008 Forest Planning Regulations (2008 Planning Rule, 36 CFR 219, 2008 version). The CER identified the need to change certain aspects of direction in the 1993 Forest Plan, based on an evaluation of current conditions; past, present and reasonably foreseeable trends in conditions and demands; new information and priorities; best available science; and monitoring and evaluation results. In July 2009, the 2008 Planning Rule was enjoined and the GWNF proceeded with the plan revision under the 1982 Forest Planning regulations (1982 Planning Regulations, 36 CFR 219), which require an Analysis of the Management Situation (AMS) instead of a CER. Much of the information prepared for the CER was applicable to the AMS and has been carried forward.

The AMS is defined at 36 CFR 219.12(e) under the 1982 planning regulations as: "a determination of the ability of the planning area covered by the forest plan to supply goods and services in response to society's demands. The primary purpose of this analysis is to provide a basis for formulating a broad range of reasonable alternatives." An AMS is required to 1) include benchmark analyses, which help to define the range within which alternatives can be developed (36 CFR 219.12(e)(1)); 2) identify the current level of goods and services provided by the unit and the most likely amount of goods and services expected to be provided in the future if current management direction continues (219.12(e)(2)); 3) projections of demand using best available techniques, with both price and nonprice information (219.12(e)(3)); 4) a determination of the potential to resolve public issues and management concerns (219.12(e)(4)); and 5) a determination of the need to establish or change management direction (219.12(e)(5)).

The main body of this document is primarily the results of the CER that fulfill the AMS requirements of 36 CFR 219.12(e)(2), (e)(4) and (e)(5) by focusing on determining the need for change from 1993 Forest Plan direction. The appendices to this document fulfill the remaining requirements of the AMS. These appendices include the benchmark analyses, supply and demand analyses, and the results of the Social and Economic Sustainability Analysis that was initiated under the 2008 Planning Rule.

Analysis Area

The George Washington National Forest extends for 140 miles along the Appalachian Mountains of northwestern Virginia and adjacent West Virginia. The Forest includes approximately 960,000 acres of National Forest System lands in 13 Virginia counties and approximately 105,000 acres in four counties in West Virginia – a total of 1,065,000 acres. These counties include: Alleghany, Amherst, Augusta, Bath, Botetourt, Frederick, Highland, Nelson, Page, Rockbridge, Rockingham, Shenandoah and Warren Counties, Virginia and Hampshire, Hardy, Monroe and Pendleton Counties, West Virginia.



Vicinity Map

CHAPTER 2. MAJOR CHANGES SINCE THE 1993 REVISED FOREST PLAN

Introduction

This chapter describes new laws, regulations, policy or emerging issues and how they may affect direction in the 1993 Revised Forest Plan.

Forest Service Strategic Plan

Many decisions are made on the ground, at the district level, where site-specific conditions can best be considered. Yet, from the time of Gifford Pinchot, the Forest Service has also had an agency-wide common strategic direction. The agency captures that direction through its Strategic Plan and its periodic updates. The current USDA Forest Service Strategic Plan is for fiscal years 2007-2012. The Strategic Plan defines the Forest Service mission: "Sustain the health, diversity, and productivity of the Nation's forests and grasslands to meet the needs of present and future generations." The Strategic Plan also identifies four major threats to the Nation's forests and grasslands:

1) growing fire danger due to hazardous fuel buildups;

2) the spread of invasive species;

3) loss of open space; and

4) unmanaged recreation, particularly the unmanaged use of off highway vehicles.

The Strategic Plan identifies several management principles that are relevant to the revision of the Forest Plan, including:

1. Sustaining the Nation's natural resources by reducing the four major threats; restoring structural characteristics, native species and ecological processes often through active management; and adapting management strategies to help mitigate the effects of climate change.
2. Valuing ecosystem services, which are goods and services that we derive from the forest that are often not valued in the marketplace, such as air and water purification, flood and climate regulation, biodiversity, and scenic landscapes.
3. Working with partners to expand the knowledge and resources need to fulfill the mission of the Forest Service.

Yet, what ultimately counts is what happens on the ground. When the George Washington National Forest executes its existing budget, local managers plan their project-level work to maximize their contributions to the agency's strategic goals above. We use our local Forest Plan and our knowledge of the land to guide us in our endeavor to achieve or contribute to these agency-wide goals. Success in accomplishing our annual work program also depends partly on finding new ways of doing business, including community-based solutions, new ways to work in partnership with governmental and nongovernmental organizations, and procedural reforms.

This nationwide strategic plan shows the short-term priorities of the agency. However, the Revised Forest Plan not only provides some short-term priorities, but long-term desired conditions. Given the long-term Plan direction, the agency's Strategic Plan does not drive a forest plan revision. This nationwide plan helps trigger thought on how these nationwide goals are pertinent to the George Washington and the degree to which the Forest Plan can contribute to this nationwide strategy.

Region 8 Strategic Framework

The Region 8 Strategic Framework helps to focus on priority work in the Region. The framework is intended to guide each Forest's work to support the region's shared vision. The framework is a living document that will evolve over time to respond to a changing world and serve as an anchor during those times of change. There are three focus areas (Restore, Protect, and Respond) with objectives for each focus area.

Area of Focus 1: Restore

Goal: Ecological systems are returned to their natural resilience and sustained.

Objectives:

1. Condition of watersheds is improved.
2. Native vegetation identified in Forest or state plans is restored.
3. Rare species are restored.

Area of Focus 2: Protect

Goal: Human, natural, cultural, and physical resources are secure from degradation and harm.

Objectives:

1. People and resources are protected from catastrophic wildfires.
2. The basic structure, function, and resilience of ecosystems are protected.
3. People and resources are protected from unmanaged and/or unlawful activities.
4. Private inholdings and lands adjacent to forests and grasslands are not threatened by fragmentation.

Area of Focus 3: Respond

Goal: Social needs are met in an environmentally sensitive manner.

Objectives:

1. Biomass availability is emphasized to respond to anticipated needs and demands.
2. Administrative facilities and managed outdoor recreation opportunities are environmentally sustainable.
3. Special Uses are managed to minimize the environmental footprint through compliance with terms and conditions.

Forests Consolidation

In 1995 the George Washington and Jefferson National Forests were administratively combined. The two Forests continue to have separate Forest Plans.

The Jefferson Forest Plan was revised in 2004 and provides direction for 723,300 acres in Virginia, West Virginia and a small portion of Kentucky. That revision process was conducted in conjunction with the revision of Forest plans on four other Appalachian Forests and followed the Southern Appalachian Assessment. A strong effort was made to incorporate the best available science in these revisions. We would like to take advantage of this information in the revision of the George Washington Forest Plan. In addition, we would like to have the George Washington Forest Plan be more similar to the plan on the Jefferson to make management of the two Forests more compatible and easier to understand.

Southern Appalachians Assessment

The Southern Appalachian Assessment (SAA) was a broad scale assessment of conditions and trends completed in 1996 to facilitate the revisions of the Forest Plans for the Jefferson, Nantahala-Pisgah, Cherokee, Chattahoochee, and parts of the Sumter and Talladega National Forests. It also involves the National Park Service lands in the Great Smoky Mountains National Park, Shenandoah National Park, and Blue Ridge Parkway. The SAA facilitated an interagency ecological approach to assessing conditions in the Southern Appalachian area by collecting and analyzing broad-scale biological, physical, and socioeconomic data to facilitate better, more ecologically based, forest-level resource analysis and management decisions. The SAA culminated in a final summary report and four technical reports. The SAA is organized around four themes: (1) Terrestrial (including Forest Health and Plant and Animal Resources); (2) Aquatic Resources; (3) Atmospheric Resources; and (4) Social/Cultural/Economic Resources (which includes the Human Dimension, Roadless Areas and Wilderness, Recreation, and Timber Supply and Demand). The SAA supported the revision of the Forest Plans by describing how the

lands, resources, people, and management of the national forests interrelate within the larger context of the Southern Appalachian area.

The SAA also covered the lands of the George Washington National Forest and information in the SAA will help inform the development of plan components for the revised plan.

CHAPTER 3. ECOLOGICAL CONDITIONS AND TRENDS

Introduction

The 1993 Revision of the GW Plan focused on a number of significant issues. These issues were developed through an extensive public involvement effort. The issues were used to: 1) develop the environmental analysis; 2) evaluate the alternatives considered; and 3) help define the desired condition of the Forest. Due to the importance of the issues in defining the current George Washington Forest Plan, the issues were used as a starting point to evaluate how well the plan has been implemented and where changes may be needed. New issues, information from our public collaborative efforts and additional analysis of science were used to refine and expand the issues.

Issue Biodiversity

A major goal of the 1993 Revised Forest Plan was to maintain biological diversity on the Forest (Plan page 2-1). Within that the following factors were, at that time, important to the discussion. A discussion of these factors follows.

A. Fragmentation (Successional Habitat)

1. What was the Plan Striving For?

The Forest Plan strove to balance the need for unfragmented forests with the need to create early successional forests under the premise that "unfragmented" dealt with both permanent and temporary changes to the landscape. Science has evolved since 1993 (Franklin 2002) and one of the Chief's threats deals with loss of forests. Today, it is this concept that better defines "fragmentation" as associated with permanent loss of forests rather than temporary change within a forest as they are managed silviculturally.

Our approach to fragmentation took into account that all ecosystems on the Forest were and are dynamically affected by natural and man-made forces and that no natural community or habitat condition is considered never changing.

The Forest Plan (Pages 2-2 and 2-3) sought to:

1) Provide large, unfragmented blocks of forested land, mostly in later successional stages. These areas were allocated primarily to Management Areas 4, 5, 6, 8, 9, 18, 21 and portions of Management Areas 13, 14 and 15 that were unsuitable for timber production. These areas were located in a manner that provided opportunities for the movement of plants and animals.
2) Provide habitat for species benefiting from early successional vegetation. Early successional habitat was provided in Management Areas 12, 16, 17, 20, 22 and portions of Management Areas 7, 11, 13, 14 and 15 which were suitable for timber production. Basically, this early successional habitat was to be located in timber harvest

units (0-10 age class), wildlife clearings, utility rights-of-way, and in some prescribed burn areas.

2. Where is the Plan Now?

Forest Interior Habitat

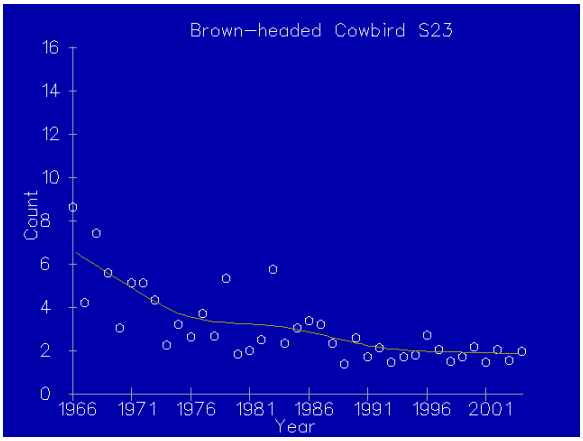
Before discussing the existing plan, we would like to also put the term "fragmentation" into context. Forest fragmentation is a function of patch size, isolation of patches, total reserve area, and linkages among patches. Patch size and age requirements vary by species. Many species tolerate or prefer a mixture of forest age classes, but some species are restricted to young (early successional) or mature (late successional) forest communities only.

The Management Areas designated to provide large blocks of relatively unfragmented forested areas have not changed. Three Management Indicator Species (MIS) were selected to monitor this facet of overall diversity: the brown-headed cowbird, the ovenbird, and the worm-eating warbler. Information on MIS is summarized in Appendix G of the *George Washington and Jefferson Detailed Monitoring and Evaluation Report for Fiscal Year 2004*.

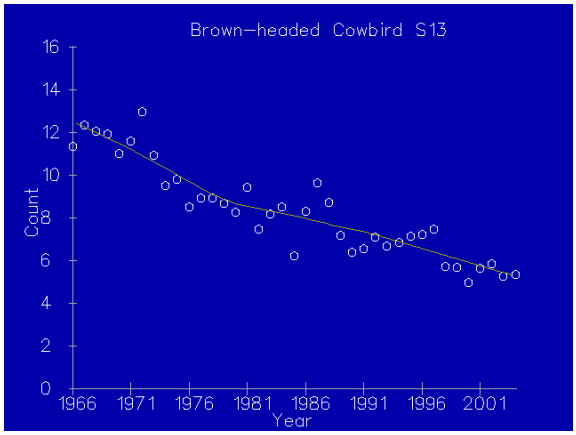
The brown-headed cowbird (*Molothrus ater*) was selected as a MIS to represent possible effects of fragmentation across the landscape (GWNF FEIS, page J-10). This species inhabits open agricultural lands, but will fly into nearby forested areas to lay their eggs in other bird's nests (nest parasite), and is considered an indicator of edge habitat effects (GWNF FEIS, page 3-172). Population trends for this MIS were documented in the Forest Service's past monitoring and evaluation reports.

Currently, the United States Geologic Service's (USGS) Breeding Bird Survey (BBS) data (Sauer, J. R., J. E. Hines, and J. Fallon. 2008. The North American Breeding Bird Survey, Results and Analysis 1966 – 2007) Version 5.15.2008. USGS Patuxent Wildlife Research Center, Laurel, MD indicates a steady downward trend in brown-headed cowbird numbers in Virginia and in the Blue Ridge Mountain and Northern Ridge and Valley Sections of Virginia.

Trend in BBS Data of Brown-Headed Cowbirds across the Blue Ridge and Ridge and Valley regions, 1966 To 2005. Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html



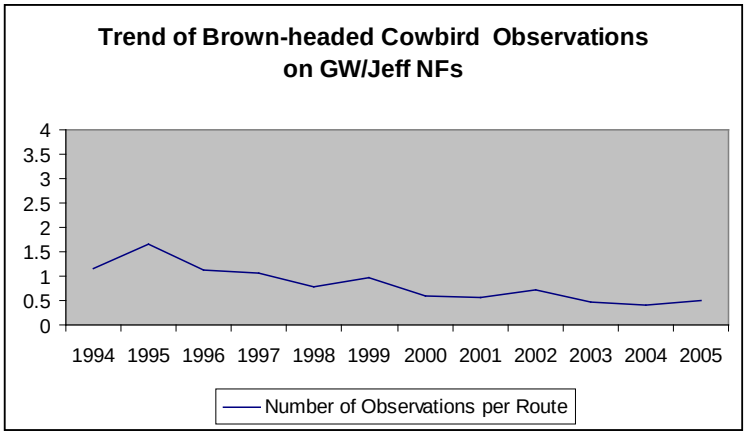
Blue Ridge Physiographic Region



Ridge and Valley Physiographic Region

Data from GWJNF's avian points for the brown-headed cowbird indicates an overall decreasing trend on the GWJNF's.

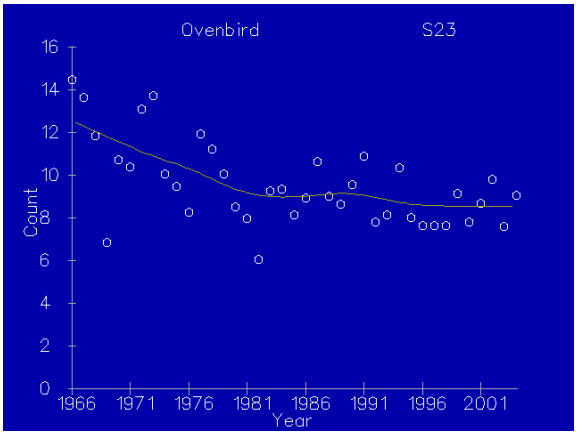
Trend in GWJNF Data of Brown-Headed Cowbirds across GWJNF, 1994 to 2005

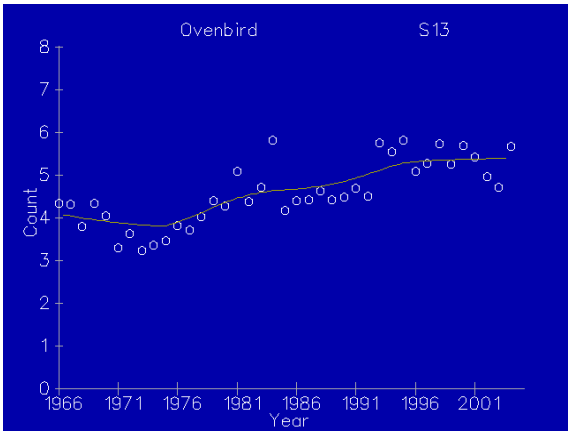


The relatively low numbers documented by point count data and steady downward trend by BBS data, suggests the minimal amount of forest fragmentation (both existing and that created by management activities) across the George Washington is not sufficient to support significant populations of cowbirds. Additionally, patch size of interior forest on the George Washington appears not be readily penetrated by cowbirds searching for nests to parasitize. 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 private agricultural land in search of nest parasitism opportunities. Cowbird occurrences are expected to continue to decrease in the near future as the landscape becomes more forested.

In addition, Ovenbird (*Seiurus aurocapillus*) and Worm-eating warbler (*Helmitheros vermivorus*) were selected because trends in presence and abundance of these species in mature deciduous forests will be used to help indicate the effectiveness of management in maintaining desired condition relative to forest interior habitats (GWNF FEIS, page J-12). USGS Breeding Bird Survey data indicates increasing trends in populations of ovenbirds and worm-eating warblers statewide, and stable to increasing trends in the Blue Ridge Mountain and Northern Ridge and Valley regions. Avian point count data from the GWJNF's for ovenbird and worm-eating warbler also indicates an overall stable to increasing population trend.

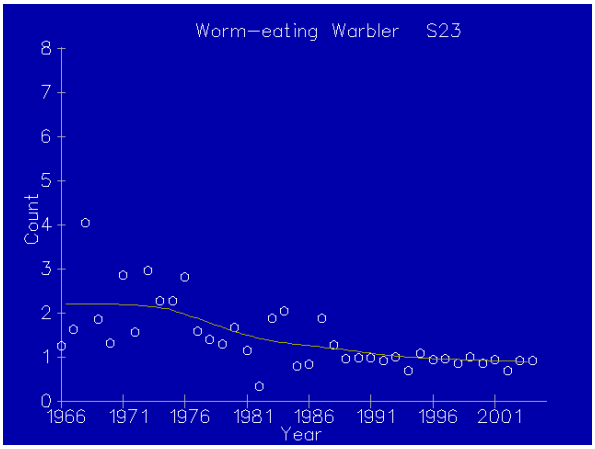
Trend in BBS Data of Ovenbirds across the Blue Ridge and Ridge and Valley regions, 1966 To 2005. Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

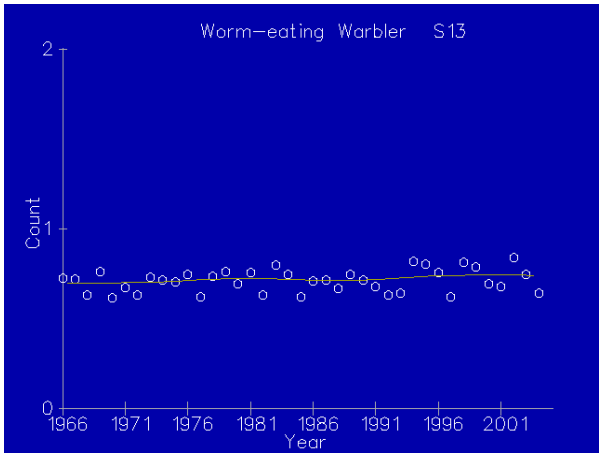




Blue Ridge Physiographic Region Ridge and Valley Physiographic Region

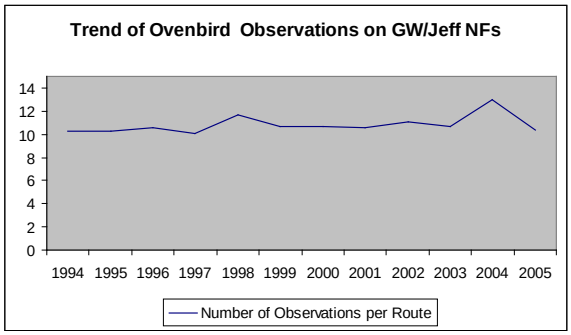
Trend in BBS Data of Worm-eating Warblers across the Blue Ridge and Ridge and Valley regions, 1966 To 2005. Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

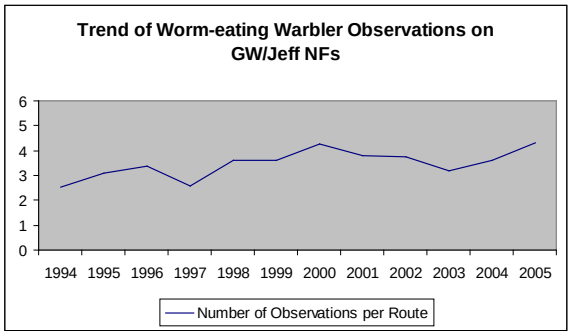




Blue Ridge Physiographic Region Ridge and Valley Physiographic Region

Trend in GWJNF Point Count Data of Ovenbirds and Worm-eating warblers across GWJNF, 1994 To 2005



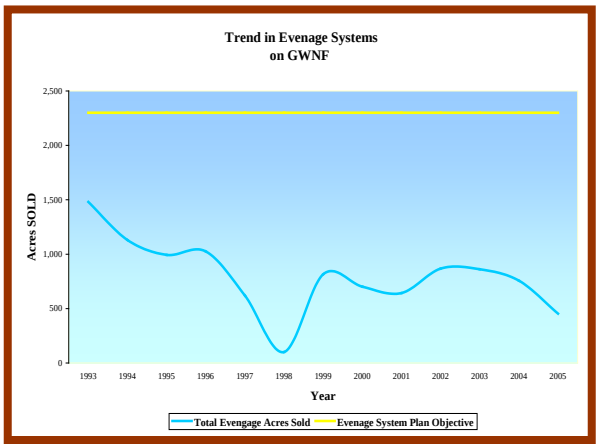


Ovenbirds breed in upland deciduous or mixed deciduous/pine forests with a moderately dense understory. They nest on the ground and build a covered nest from leaf litter. Worm-eating warblers also prefer deciduous or deciduous/pine forests to breed, but they require a denser, evergreen understory. They also nest on the ground in the leaf litter. Both require large patches of mature forest for nesting. While the need for large patches of mature forested habitat has been well documented for many migratory bird species, including ovenbirds and worm-eating warblers, evidence is mounting that early successional woody habitats are also important for these same species during the critical time period just after breeding and during migration (Bulluck and Buehler 2006). These areas provide 'safe havens' for adult and fledgling ovenbirds and worm-eating warblers for the following needs: molting, abundant food for the buildup of fat reserves for migration, and protection from predators. Studies strongly recommend conservation strategies that maintain large tracts of mature forest, within which there is a mosaic of different forest types and ages (early and mid-successional forest stands), to provide the habitat requirements needed by migratory birds such as ovenbirds and worm-eating warbler

during all of their life stages here in North America. Based on the current age-class structure of forested land in the GWNF's, 88% of all forest types are mature (71-150+ years). Timber management on the since 1993 has declined from about 3,000 acres per year to about 800. Conversely, prescribed fire has increased from about 1,000 acres per year to about 7,000. Timber management and some prescribed fire, in addition to natural disturbances and continued maturation of the forest, provide patches of early successional woody habitat, as well as restoring and maintaining open oak, oak/pine, and pine woodlands. Combined with the maintenance of over 80% of forested acres in mature forest condition, the George Washington should be able to provide the mosaic of forest types and ages recommended by research for migratory birds such as ovenbirds and worm-eating warblers during the life history stages (breeding, post-breeding, migration) that they utilize GW lands. Based on the results of monitoring data and habitat evaluation, these two species exhibit stable to increasing population trends on the GW, as well as state-wide and region-wide, and have the abundance and distribution across the Forest that will provide for their persistence into the foreseeable future.

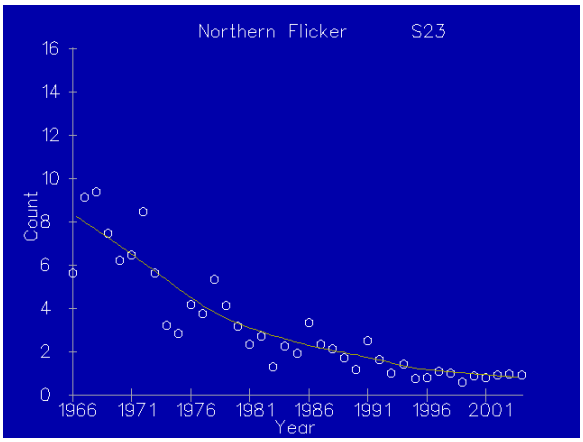
Early Successional Habitat

The Management Areas designated to provide patches of early successional habitat have not changed since the advent of the GW revised forest plan. Permanent early successional habitat in the form of open land, field, and old farm habitat has stayed relatively stable in Management Areas 10, 22, and developed recreation areas in Management Area 12. Utility corridors are also relatively stable grassy/shrubby habitat. Since 1993, prescribed fire has increased from about 1,000 acres to over 7,000 acres/year, creating, within a forested landscape, more open woodland habitat and some patches of early successional habitat (i.e. south and southwest facing slopes where hot fires helped open serotinous cones to regenerate such species as table mountain pine). Likewise, timber harvesting has also provided early successional habitat (See adjacent Even-aged Timber management graph), even though acreage treated has decreased from about 3,000 acres per year in 1993 to about 800 (see also section on Vegetation Management).

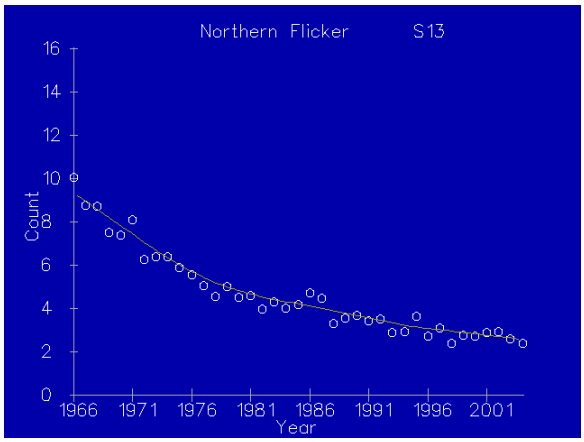


The northern (common) flicker (*Colaptes auratus*) was selected as a MIS to represent effects of management on cavity nesters for the GWNF (GWNF FEIS, Appendix page J-12), but is also an indicator of open woodland habitat (both deciduous and coniferous). USGS Breeding Bird Survey (BBS) data indicates a steady decline from 1966 to the mid 1990s, followed by a low but more stable trend for the last 10 years in some regions. Data from GWJNF's avian points has been collected since 1994 and generally mirrors the trend for the last 10 years of BBS data for northern flickers, indicating a low and variable, but overall stable trend on the GWJNF's.

Trend in BBS Data of Northern flickers across Blue Ridge and Ridge and Valley Physiographic Regions, 1966 To 2005. Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

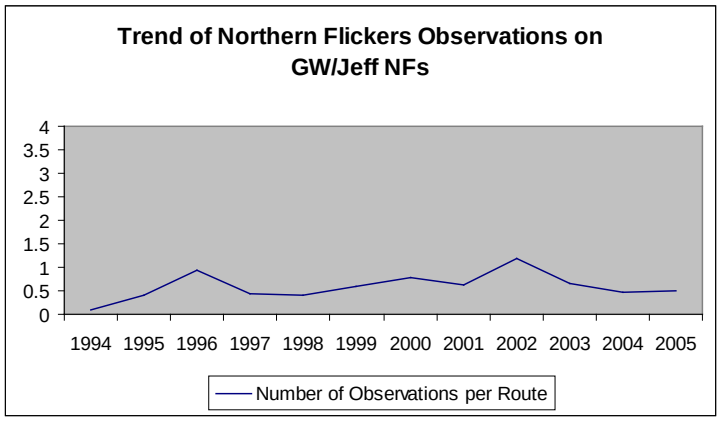


Blue Ridge Physiographic Region



Ridge and Valley Physiographic Region

Trend in GWJNF Data of Northern Flickers across GWJNF, 1994 to 2005



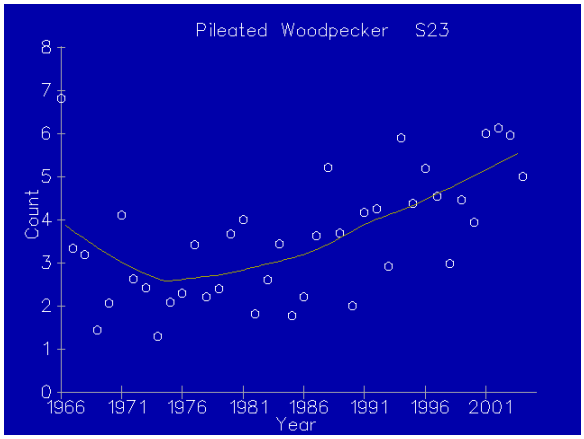
Northern flickers prefer open woodland habitat and ecotone habitat between forested and patches of early successional woody or grassy/shrubby habitat. It requires large-sized (over 12" DBH) snags and living trees for excavating nest cavities. Based on the current age-class structure of forested land in the GWNF's, 88% of all forest types are mature (71-150+ years). Timber management and some prescribed fire, in addition to natural disturbances and continued maturation of the forest, should provide the following habitat requirements for northern flickers: large-sized snags and living trees for nest cavities, patches of early successional woody habitat, and some restoration /maintenance of open oak, oak/pine, and pine woodlands. However, the steep declining trends shown by USGS BBS data in populations of northern flicker across the larger regions of the Blue Ridge Mountains and Ridge and Valley Regions, which are year-round residents, indicates a marked decrease in the type of habitat they rely upon, especially open woodland habitat and the ecotone habitat between forested and patches of early successional woody or grassy/shrubby habitat. An increase in management

activities such as prescribed fire and timber management is needed to restore open woodland habitat and create early successional habitat.

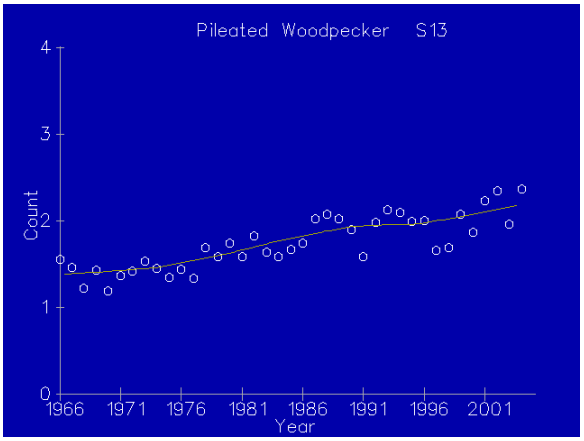
Snag Habitat

The pileated woodpecker (*Dryocopus pileatus*) was selected as a MIS because trends in presence and abundance of this species across the forest will help indicate the effectiveness of management in maintaining desired conditions relative to abundance of snags (GWNF FEIS, Appendix page J-12). USGS BBS data indicates an increasing population trend of pileated woodpeckers statewide, as well as in the Blue Ridge Mountain and Northern Ridge and Valley regions. Data from the GWJNF Point Counts indicated an overall stable population trend for pileated woodpeckers on the GWJNF.

Trend in BBS Data of Pileated Woodpeckers across the Blue Ridge and Ridge and Valley regions, 1966 To 2005. Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html

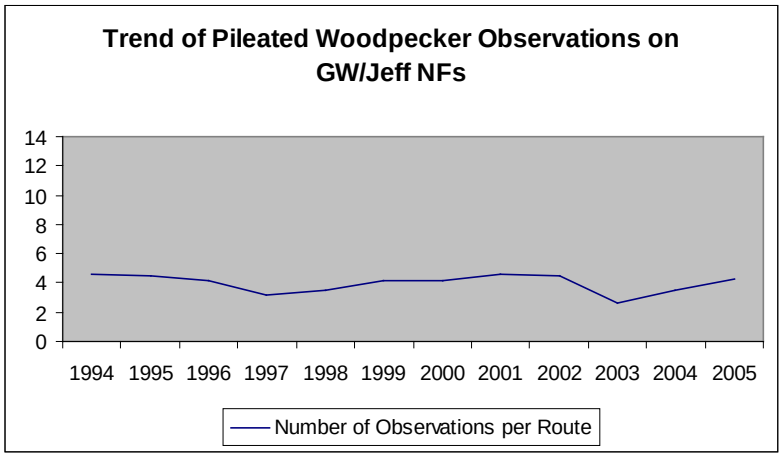


Blue Ridge Physiographic Region



Ridge and Valley Physiographic Region

Trend in GWJNF Data of Pileated Woodpeckers across GWJNF, 1994 to 2005



Pileated woodpeckers generally prefer mature forests near riparian areas. This species is a primary cavity nester/excavator, requiring large snags for nesting cavities and large dead trees for feeding. Generally, this species requires trees greater than 15 inches DBH for cavities, but prefers trees greater than 20 inches DBH. Based on the current age-class structure of forested land in the GWNF's, 88% of all forest types are mature (71-150+ years). Based on the results of monitoring data and habitat evaluation, this species is showing stable population trends on the GWJNF's and increasing trends both statewide

and across the Blue Ridge Mountain and Ridge and Valley Regions. Pileated woodpeckers have the abundance and distribution across the Forest that will provide for its persistence into the foreseeable future.

3. Did Management Activities Move the Forest towards the Desired Future condition?

For forest interior habitat, management activities did move the forest towards the desired future condition. For early successional habitat, management activities did move the forest towards the desired future condition, but did not meet certain objectives stated in management areas related to early successional habitat.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? Since the 1993 revised GW forest plan, scientific understanding of fragmentation in general and the effects of fragmentation on various wildlife species has changed (see Final Environmental Impact Statement for the 2004 Revised Jefferson National Forest Land and Resource Management Plan, pp. 3-121 through 3-123). In addition, as described in the sections on MIS such as northern flickers, yellow pine and white-tailed deer, open woodland habitat and early successional habitat have declined across the GWNF. Open woodland restoration has been identified as a need for change in other sections (see MIS, Endangered species, and fire sections). Open woodland habitat contains large patches of mature trees, and is classified as mature in the overall age-class structure tables, yet provides an understory of native grasses and shrubs that can be maintained as a stable component of this forest type. Historically created and maintained with disturbance regimes such as prescribed fire and timber treatments, open oak woodland restoration can provide habitat required by many species at some point in their yearly life cycle needs, including white-tailed deer, ruffed grouse, black bear, wild turkeys, Indiana bats, golden-winged warblers, and many 'forest interior' bird species during critical post-breeding, migratory, and wintering life cycles (Buehler 2007, Bulluck 2006, VDGIF 2005, WVDNR 2005, Natureserve 2009).

c. Tentative Options or Proposed Actions for Change

C-1. Add an objective for open woodland restoration.

5. What are the Consequences of Not Changing?

We would not be using best available science. Open woodlands were historically present across the GWNF and have declined dramatically since the turn of the century, mainly due to fire suppression. Characterized by an open mature tree canopy and a stable understory of native grasses, forbs and shrubs, larger patches of open woodlands are needed to provide habitat needs for an increasing number of species that are declining in population, or are already rare and/or endangered across the forest.

By not providing for open woodland restoration, the plan would not be able to provide an important habitat component for these species. Interior, unfragmented habitat would continue to be provided to support those species that need it. Open woodland habitat and early

successional habitat would continue to decrease and contribute to a continuing downward trend in the northern (common) flicker.

6. Recommendations for Plan Revision

Concern about maintaining early successional habitat and large blocks of mature forest with limited canopy breaks continue to be expressed. The SAA identified that it is expected that, over the next 15 years, suitable acreage in large tract sizes and associated forest interior habitats will continue to decrease, primarily on private lands.

The large blocks identified in the 1993 Plan should continue to have desired conditions emphasizing mature vegetation and late successional stages. However, this desired condition should be expanded to include the need for open canopy late successional stages developed through the reestablishment of a fire regime that results in patches of open woodland.

There is a need to maintain desired conditions for early successional habitat distributed throughout much of the Forest. The maintenance and reestablishment of early successional habitat is an area where the Forest has made little progress towards the desired condition. Both the Virginia Department of Game and Inland Fisheries and the West Virginia Division of Natural Resources have requested that the Forest increase the amount of early successional habitat on the Forest. While some people have suggested that private land can provide early successional habitat, the Forest has a responsibility to provide for diversity of plant and animal communities. This diversity includes those species that depend on, or use, early successional habitat. This includes species such as the golden-winged warbler that depends upon shrubland habitat and whose populations have been in decline. The American Bird Conservancy recently identified early successional habitat in deciduous forests as one of their top twenty most endangered habitats in the country.

To improve progress towards the desired condition for early successional habitat, objectives for prescribed fire should be identified in addition to timber harvest. Three types of early successional habitat need to be identified in objectives: grass/forb openings; old fields; and temporary openings that will grow back into forested communities. In addition, objectives should be established for open woodlands. Open woodlands provide aspects of both mature forests and forest openings.

B. Old Growth

1. What was the Plan Striving For?

Old growth and late successional forests were considered as a component of biodiversity in the Plan. To avoid foregoing opportunities for existing or developing old growth, the Plan prohibited scheduling silvicultural practices on lands classified as unsuitable for timber management in any of the ten old growth forest type groups that occur on the Forest (Plan page 2-4). Additionally, the Plan prohibited regeneration harvest practices on lands classified as suitable for timber production in 9 of the 10 old growth forest type groups (OGFTs) (all groups except the Dry-mesic Oak Forest Group #21) (Forest Plan page 2-6.) For the Dry-Mesic Oak Forest group,

stands proposed for silvicultural activities were to be inventoried, and the stands old growth characteristics, if any, were to be discussed in the site-specific analysis (Plan page 2-6.)

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.

2. Where is the Plan Now?

Fundamentally, little true old growth exists on the GWJNF. The main reason the GW and Jeff exist today is because these lands were ”The Lands Nobody Wanted” (Shands1992) They had been farmed, grazed, used to provide fuel for the iron industry, and to provide bark for tanneries during the 1800s. Thus, most of this land had been harvested at least one time. Almost all of the lands were acquired from private and business owners.

The amount and distribution of old growth forests on the GW is most influenced by management activities associated with timber harvesting. Natural disturbances, such as strong winds, large accumulations of ice, native insects (gypsy moths) and disease, fire (wildland and prescribed), and landslides, also affect old growth forest conditions, but they are regarded as being within the natural range of variability for forest successional dynamics. 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 (NatureServe, VDGIF 2005, WVDNR 2005, VDCR-NH). Mature or late seral 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 not only old-age trees but also related structural attributes within the forest stand. The age at which a stand develops old growth attributes 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 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*.”

Prior to scheduling any silvicultural practices on lands classified as suitable for timber production in Old Growth Forest Type Group (OGFT) 21 (dry-mesic oak forests), stands were inventoried by the criteria listed in Appendix H of the FEIS, and after 1997, were inventoried using the Southern Region's Guidance (Forestry Report R8-FR 62). Silvicultural practices could proceed after site-specific analysis and disclosure which included a discussion on the old growth characteristics found in the stand(s) of the project area, the effect of the action on these characteristics, and the effect the action would have on the contribution of the area to the Forest's "old growth" inventory (Forest Plan pages 2-3 to 2-6.)

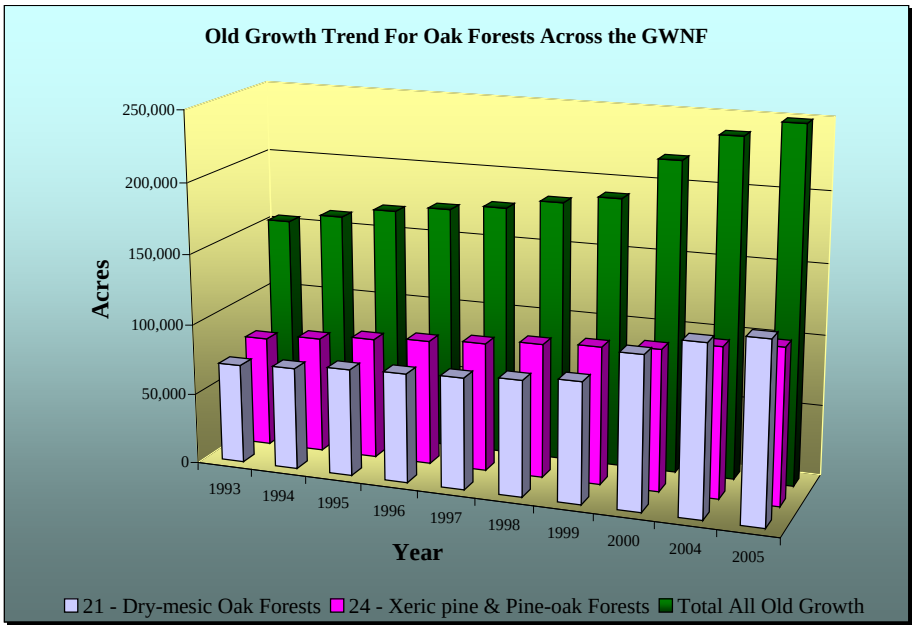
Old growth forests were selected as a management indicator in the GWNF Revised Plan because late successional forest conditions are an important element of plant and animal habitat diversity and “old growth” is a social issue. These late successional (i.e. “mature”) forest conditions are biological communities (GWNF FEIS, page J-12). There are ten 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 a condition that is typically necessary for species requiring mature forests.

The number of acres reaching the minimum age to be considered old growth is increasing annually as the forest ages. An important point is that the age at which old growth conditions develop varies by forest type and is not simply 150 or 200 years old for all forest types. Minimum ages vary from 80 years for the drier pine dominated types to 180 for the more mesic cove types. Forestwide the forest is aging and the number of acres in earlier successional stages or open woodland conditions is decreasing. From 2000 to 2005 total older forest acreage increased 30,078 acres. From 1993 to 2005 total older forest acreage increased by 94,763 acres.

Currently the GWNF Forest Plan states that 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 were cut for timber 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 2005 there was an increase of 18,745 acres. From 1993 to 2005 an increase of 56,522 acres occurred. Thus, timber harvesting is not significantly limiting the old growth forest conditions on the GWNF, and in particular OGFT #21 since it is the most common and widespread group on the GW.

Fire is a natural disturbance process common to most OGFTs, but is very infrequent in northern hardwoods, spruce/fir, and riverfront forests (USDA 1997, Trombulak 1996). 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 vegetation in species composition and structure more typical of the fire regime these forests experienced prior to active fire suppression (~1930's). In the absence of fire as a major landscape scale disturbance (which it once was) the structure and composition of forests, regardless of age, will not meet historic old growth conditions (NatureServe, Landfire, Native Tree Society). These forests will be much more closed canopy and closed understory as opposed to the open canopy and very open understory that historically existed. We will meet the age requirements for an old growth forest but will lack much of the associated structure. Thus, the acreage of all old growth forest types meeting minimum necessary ages is steadily increasing as the forest continues to increase in age, but stand structure in most types is not being met due to lack of fire related disturbances.



This discussion focuses on the dry-mesic oak forest group (OGFT 21) since it was the one group where silvicultural activities could occur. Acreage figures given here for 1993 differ from those presented in the 1993 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 FSVEG/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. In 1993, an estimated 70,000 acres of Dry-mesic oak existed with old growth characteristics (2004 M&E Report at Appendix G, page 39). The trend in Dry-mesic oak with potential old growth characteristics is shown in the above graph.

In 2008, as displayed in the table that follows, the Dry-mesic oak old growth type group increased to about 123,000 acres. Of this, about 39,000 acres occurs on land unsuitable for timber production and 83,000 occurs on land suitable for timber production.

Furthermore, given hemlock wooly adelgid and based on professional observations, the amount of hemlock, particularly as a component of old growth, has decreased on the Forest.

The amount and distribution of old age forest type groups previously published by the Forest in the 2004 Monitoring Report are slightly different from the amount and distributions in this report. Stands with no age year coded (i.e. null set) were erroneously included in past calculations of minimum age year for a stand to initially be considered as potential old growth. As part of updating the Forest's resource data bases, age year where known, were updated to reflect current conditions. The old growth acreages presented here represent the latest and most up-to-date inventories.

Minimum ages for stands to exhibit “old growth characteristics” used in the 1993 Plan (See FEIS Appendix H) are different that those ages used in the subsequent 1997 Southern Region guidance report (R8-FR 62). The following tables show the comparisons using different minimum ages. As an example, when using the R8 guidelines, the amount of Xeric Pine & Pine-oak (OGFT 24) decreases because the R8 guidelines use a minimum age of 100 while the 1993

GW Plan used a minimum age of 80, therefore the number of acres meeting the minimum age would be less.

The Forest has not identified actual existing old growth that has never been harvested.

The following sets of maps summarize old growth utilizing ages from the 1993 plan and from the Region 8 old growth guidelines. Furthermore, one set depicts future old growth given the existing 1993 Plan allocations.

1. GW North Half - Summarized Old Growth by 1993 Plan Ages
2. GW South Half - Summarized Old Growth by 1993 Plan Ages
3. Entire GW - Summarized Old Growth by 1997 Region 8 Guideline Ages by Patch Sizes
5. GW North Half - Summarized Future Old Growth by 1993 Plan Management Area Allocations
6. GW South Half - Summarized Future Old Growth by 1993 Plan Management Area Allocations

Number of Existing Old Growth Patches by Patch Size Under 1993 George Washington Revised Forest Plan Allocations by Old Growth Forest Type Groups

(Based on Ages in GW FEIS Appendix H)

Old Growth Forest Type Groups	Existing Number of Small Patches (1 to 99 Acres)		Existing Number of Medium Patches (100 to 2,499 Acres)		Existing Number of Large Patches (>2,500 Acres)		Existing Total Number of All Patches	
	Based on Ages		Based on Ages		Based on Ages		Based on Ages	
	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland
01 - Northern Hardwood Forests								
02 - Conifer & North. Hardwood Forests								
2a-Hemlock-North. Hardwd Subgroup		9		3				12
2b-Wh. Pine-North. Hardwd Subgroup								
2c-Spruce-North. Hardwood Subgroup	3	7					3	7
05 - Mixed Mesophytic Forests	5	18		2			5	20
10 - Hardwood Wetland Forests								
21 - Dry-mesic Oak Forests	859	1,038	75	180			934	1,218
22 - Dry and Xeric Oak Woodlands		2						2
24 - Xeric pine & Pine-oak Forests		2,116		239				2,355
25 - Dry & Dry-mesic Oak-pine Forests	59	87	4	15			63	102
28 - Eastern Riverfront Forests	2	3					2	3
37 – Rocky, Thin-soil Conifer Wood.								
Total Number of Patches By Timber Suitability	928	3,280	79	439			1,007	3,719

Acres by Existing Old Growth Patches Under 1993 George Washington Revised Forest Plan Allocations by Old Growth Forest Type Groups

(Based on Ages in GW FEIS Appendix H)

Old Growth Forest Type Groups	Existing Acres Within Small Patches (1 to 99 Acres)		Existing Acres Within Medium Patches (100 to 2,499 Acres)		Existing Acres Within Large Patches (>2,500 Acres)		Existing Total Acres Across All Patches	
	Based on Ages		Based on Ages		Based on Ages		Based on Ages	
	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland
01 - Northern Hardwood Forests								
02 - Conifer & North. Hardwood Forests								
2a-Hemlock-North. Hardwd Subgroup		366		1,051				1,417
2b-Wh. Pine-North. Hardwd Subgroup								
2c-Spruce-North. Hardwood Subgroup	91	217					91	217
05 - Mixed Mesophytic Forests	96	636		262			96	898
10 - Hardwood Wetland Forests								
21 - Dry-mesic Oak Forests	22,728	31,943	16,271	51,023			38,999	82,966
22 - Dry and Xeric Oak Woodlands		80						80
24 - Xeric pine & Pine-oak Forests		64,057		46,737				110,794
25 - Dry & Dry-mesic Oak-pine Forests	1,979	2,326	865	2,490			2,844	4,816
28 - Eastern Riverfront Forests	14	12					14	12
37 – Rocky, Thin-soil Conifer Wood.								
Total Future Acres Within Different Patches By Timber Suitability	24,908	99,637	17,136	101,563			42,044	201,200

Number of Existing Old Growth Patches by Patch Size Under 1993 George Washington Revised Forest Plan Allocations by Old Growth Forest Type Groups

(Based on Ages in R8 Old Growth Guidance)

Old Growth Forest Type Groups	Existing Number of Small Patches (1 to 99 Acres)		Existing Number of Medium Patches (100 to 2,499 Acres)		Existing Number of Large Patches (>2,500 Acres)		Existing Total Number of All Patches	
	Based on Ages		Based on Ages		Based on Ages		Based on Ages	
	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland
01 - Northern Hardwood Forests	8	23		1			8	24
02 - Conifer & North. Hardwood Forests								
2a-Hemlock-North. Hardwd Subgroup	3	24		5			3	29
2b-Wh. Pine-North. Hardwd Subgroup	8	9					8	9
2c-Spruce-North. Hardwood Subgroup		2						2
05 - Mixed Mesophytic Forests	45	88		5			45	93
10 - Hardwood Wetland Forests								
21 - Dry-mesic Oak Forests	859	1,038	75	180			934	1,218
22 - Dry and Xeric Oak Woodlands	1	3		1			1	4
24 - Xeric pine & Pine-oak Forests		1,038		84				1,122
25 - Dry & Dry-mesic Oak-pine Forests	119	179	7	21			126	200
28 - Eastern Riverfront Forests		1						1
37 – Rocky, Thin-soil Conifer Wood.								
Total Number of Patches By Timber Suitability	1,043	2,405	82	297			1,125	2,702

Acres by Existing Old Growth Patches Under 1993 George Washington Revised Forest Plan Allocations by Old Growth Forest Type Groups

(Based on Ages in R8 Old Growth Guidance)

Old Growth Forest Type Groups	Existing Acres Within Small Patches (1 to 99 Acres)		Existing Acres Within Medium Patches (100 to 2,499 Acres)		Existing Acres Within Large Patches (>2,500 Acres)		Existing Total Acres Across All Patches	
	Based on Ages		Based on Ages		Based on Ages		Based on Ages	
	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland
01 - Northern Hardwood Forests	119	743		187			119	930
02 - Conifer & North. Hardwood Forests								
2a-Hemlock-North. Hardwd Subgroup	11	843		1,502			11	2,345
2b-Wh. Pine-North. Hardwd Subgroup	176	305					176	305
2c-Spruce-North. Hardwood Subgroup		118						118
05 - Mixed Mesophytic Forests	976	2,374		654			976	3,028
10 - Hardwood Wetland Forests								
21 - Dry-mesic Oak Forests	22,728	31,943	16,271	51,023			38,999	82,966
22 - Dry and Xeric Oak Woodlands	40	105		186			40	291
24 - Xeric pine & Pine-oak Forests		31,865		14,747				46,612
25 - Dry & Dry-mesic Oak-pine Forests	3,390	4,980	1,366	3,713			4,756	8,693
28 - Eastern Riverfront Forests		6						6
37 – Rocky, Thin-soil Conifer Wood.								
Total Future Acres Within Different Patches By Timber Suitability	27,440	73,282	17,637	72,012			45,077	145,294

Number of Future Old Growth Patches by Patch Size Under 1993 George Washington Revised Forest Plan Allocations by Old Growth Forest Type Groups

(Regardless of Age, Based on Forest Plan Mgmt Area Allocation)

Old Growth Forest Type Groups	Future Number of Small Patches (1 to 99 Acres)		Future Number of Medium Patches (100 to 2,499 Acres)		Future Number of Large Patches (>2,500 Acres)		Future Total Number of All Patches	
	1993 Plan Allocation		1993 Plan Allocation		1993 Plan Allocation		1993 Plan Allocation	
	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland
01 - Northern Hardwood Forests	36	63	5	5		1	41	69
02 - Conifer & North. Hardwood Forests								
2a-Hemlock-North. Hardwd Subgroup	40	82	1	13			41	95
2b-Wh. Pine-North. Hardwd Subgroup	641	286	47	16			688	302
2c-Spruce-North. Hardwood Subgroup	4	10		1			4	11
05 - Mixed Mesophytic Forests	494	518	63	58		1	557	577
10 - Hardwood Wetland Forests	6						6	
21 - Dry-mesic Oak Forests	1,128	1,244	297	259	25	31	1,450	1,534
22 - Dry and Xeric Oak Woodlands	3	8		1			3	9
24 - Xeric pine & Pine-oak Forests		2,343		261		1		2,605
25 - Dry & Dry-mesic Oak-pine Forests	942	1,223	115	184			1,057	1,407
28 - Eastern Riverfront Forests	2	4		1			2	5
37 – Rocky, Thin-soil Conifer Wood.		2						2
Total Number of Patches By Timber Suitability	3,296	5,783	528	799	25	34	3,849	6,616

Acres by Future Old Growth Patches Under 1993 George Washington Revised Forest Plan Allocations by Old Growth Forest Type Groups

(Regardless of Age, Based on Forest Plan Mgmt Area Allocation)

Old Growth Forest Type Groups	Future Acres Within Small Patches (1 to 99 Acres)		Future Acres Within Medium Patches (100 to 2,499 Acres)		Future Acres Within Large Patches (>2,500 Acres)		Future Total Future Acres Across All Patches	
	1993 Plan Allocation		1993 Plan Allocation		1993 Plan Allocation		1993 Plan Allocation	
	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland
01 - Northern Hardwood Forests	714	1,979	785	859		5,288	1,499	8,126
02 - Conifer & North. Hardwood Forests								
2a-Hemlock-North. Hardwd Subgroup	1,088	2,499	111	2,876			1,199	5,375
2b-Wh. Pine-North. Hardwd Subgroup	18,207	5,798	10,420	3,286			28,627	9,084
2c-Spruce-North. Hardwood Subgroup	104	285		134			104	419
05 - Mixed Mesophytic Forests	14,220	13,210	13,307	13,446		3,330	27,527	29,986
10 - Hardwood Wetland Forests	111						111	
21 - Dry-mesic Oak Forests	27,643	31,973	140,755	108,015	108,567	261,954	276,965	401,942
22 - Dry and Xeric Oak Woodlands	99	208		186			99	394
24 - Xeric pine & Pine-oak Forests		70,608		50,747		3,015		124,370
25 - Dry & Dry-mesic Oak-pine Forests	28,020	36,928	20,519	37,053			48,539	73,981
28 - Eastern Riverfront Forests	14	62		118			14	180
37 – Rocky, Thin-soil Conifer Wood.		24						24
Total Future Acres Within Different Patches By Timber Suitability	90,220	163,574	185,897	216,720	108,567	273,587	384,684	653,881

The following tables show that number of patches and acreages change when all individual OGFT are aggregated into as big a patch as possible.

Number of Existing and Future Old Growth Patches Under 1993 George Washington Revised Forest Plan Allocations (Aggregated Regardless of Type)

Category	Number of Small Patches (1 to 99 Acres)		Number of Medium Patches (100 to 2,499 Acres)		Number of Large Patches (>2,500 Acres)		Total Number of All Patches	
	1993 Plan Allocation		1993 Plan Allocation		1993 Plan Allocation		1993 Plan Allocation	
	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland
(Existing Potential Old Growth Using 1993 Forest Plan Ages)	875	2,292	79	438	0	3	954	2,733
Existing Potential Old Growth (Using 1997 R8 Guideline Ages)	933	1,635	87	320	0	3	1,020	1,958
Future Potential Old Growth	N/A	1,092	N/A	240	NA/	28	NA/	1,360

Acres of Existing and Future Old Growth Patches Under 1993 George Washington Revised Forest Plan Allocations (1,000 Acres) (Aggregated Regardless of Type)

Category	Acres of Small Patches (1 to 99 Acres)		Acres of Medium Patches (100 to 2,499 Acres)		Acres of Large Patches (>2,500 Acres)		Total Acres of All Patches	
	1993 Plan Allocation		1993 Plan Allocation		1993 Plan Allocation		1993 Plan Allocation	
	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland	Suitable Timberland	Unsuitable Timberland
(Existing Potential Old Growth Using 1993 Forest Plan Ages)	23,000	69,000	19,000	122,000	0	11,000	41,000	201,000
Existing Potential Old Growth (Using 1997 R8 Guideline Ages)	25,000	49,000	20,000	85,000	0	11,000	45,000	145,000
Future Potential Old Growth	N/A	33,000	N/A	88,000	N/A	533,000	N/A	654,000

The tables presented above show not only acres by OGFT, but also by "patch size". The 1997 Regional Guidance states that as part of the old-growth management strategy each Forest will develop a network of old-growth areas, although there is no need for these patches to be physically interconnected by the use of old growth corridors (R8 Guidance, 1997). Numbers and acres of existing and future patches were derived from FSVEG stand-level data and analyzed using GIS. Acres are presented using ages from both the 1993 Plan and 1997 Regional Guidance. One item of note is that as the Forest gets older (stands age), the number of small and medium patches decreases as they aggregate together to make large patches, therefore the number of large patches increases dramatically over time.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? Change in the Plan is warranted with regards to old-growth to incorporate 1997 Regional guidance into the Plan.

c. Tentative Options or Proposed Actions for Change:

C-1. Adopt the Region 8 guideline and its ages; Remove acres of old-growth forest types 1, 2a, 2b, 2c, 5, 10, 22, 24, 25, 28, and 37 occurring on lands suitable for timber production from suitable base. All OGFT 21 on suitable acreage will be inventoried for old-growth characteristics prior to any timber harvest project (similar to current Plan). All other existing potential old growth is allocated to a network of small, medium, and large patches for developing or restoring old growth conditions.

C-2. Adopt the Region 8 Guideline and its ages; Remove acres of old-growth forest types 1, 2a, 2b, 2c, 5, 10, 22, 24, 28, and 37 occurring on lands suitable for timber production from suitable base. All OGFT 21 and 25 on suitable acreage will be inventoried for old-growth characteristics prior to any timber harvest project. All other existing potential old growth is allocated to a network of small, medium, and large patches for developing or restoring old growth conditions.

C-3. Adopt the Region 8 Guideline and its ages; Remove acres of old-growth forest types 1, 2a, 2b, 2c, 5, 10, 22, 24, 28, and 37 occurring on lands suitable for timber production from suitable base. OGFT 21 and 25 on suitable acreage will not be inventoried for old-growth characteristics since acreage and patches existing and developing will be enough to meet late successional or old growth needs and no inventory or analysis will be done prior to any timber harvest project.

C-4. Defer all Plan allocations until we have a better inventory on where existing old growth exists on the Forest. Follow Jefferson Forest Plan process of looking at old 1930's aerial photography along with ground-truthing inventory. From that, create a GIS data base inventory of known existing old growth. Continue to inventory all stands using the R8 criteria and follow Region 8 process at the site-specific timber sale project level for newly identified old growth.

5. What are the Consequences of Not Changing?

We would not acknowledge that we are using the current Regional guidance. There will be very little consequences on old growth as site-specific inventory and analysis would still occur at the project level. The agency would not propose to harvest in any OGFT except OGFT 21, even though acres of other OGFT are located on suitable timberland. Based on the past trends, the future of the existence of old-growth is promising as over time true old growth characteristics will develop where timber management does not occur. We would continue to inventory for old growth characteristics in suitable timber stands, even though an adequate network of growth or potential old growth is already in place.

Proposed Action

Propose Option C3.

6. Recommendations for Plan Revision

The George Washington is an aging Forest. The acres of Forest that meet the definition of old growth increased from 154,000 to 253,000 between 1993 and 2008. During the next fifteen years it is expected to increase another 130,000 acres. Combined with the future old growth that will develop in wilderness, backcountry recreation areas and special biological areas, this old growth will be well distributed in a network of small, medium and large blocks across the Forest,

We should adopt the Region 8 guidelines to be compatible with the other Forests and make all Old Growth Forest Types, except types 21 (Dry-Mesic Oak Forests) and 25 (Dry & Dry-Mesic Oak-Pine Forests), unsuitable for timber production. With the large amount of land already identified as old growth in these two forest types and the amount of land that will be soon qualifying as old growth, the need for diversity of age and structure within these forest types is more important than the need for additional acres of old-aged stands. All stands will be inventoried for their old growth characteristics before making a decision to harvest.

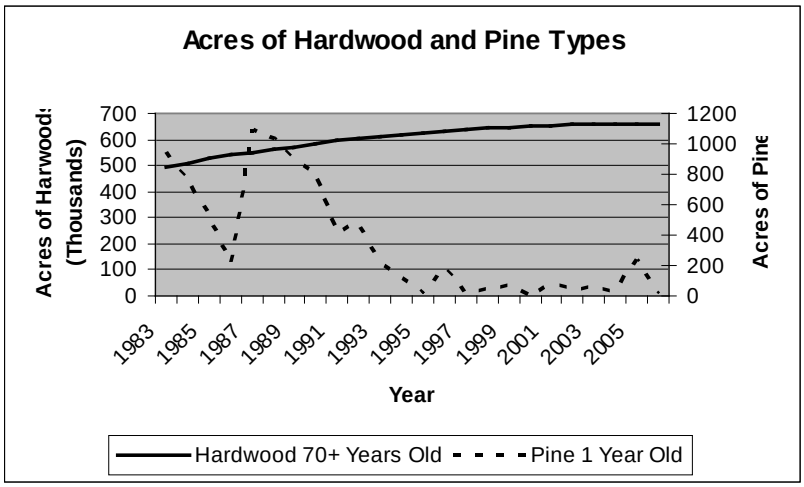
C. Conversion

1. What was the Plan Striving For?

The Plan provided guidance that direct planned type conversion was not appropriate on the Forest (Plan page 2-6). Type conversion in this context means planting pines on sites currently supporting hardwoods. Specifically, no conversion of hardwood forest types to pine forest types was needed to meet the desired condition of any management area.

2. Where is the Plan Now?

The following graph shows the trend in hardwood to pine types. Additionally, the Forest does not know of any project where a hardwood stand was converted to a pine stand since the 1993 Plan was approved.



3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes. Although the acres of 1 year old pine includes acres of former pine types that have been regenerated, the sharp decrease in acres of 1 year old pine in 1992 indicates the effectiveness of the "no conversion" goal of the GW Plan.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? No.

b. Why? We have discontinued conversion of hardwood stands to pine through planting. There is still no need for increased pine conversion to meet Forest Plan Goals and Objectives. This issue will not be addressed any further.

D. Riparian Areas

1. What was the Plan Striving For?

The GWNF Plan managed riparian areas as a separate management area to protect and enhance the unique riparian resource values (Plan page 2-7, 3-92 to 3-100). Riparian areas were recognized as important components of the forest ecosystem because of the large number of species of plants and animals they support and the associated ecological, social, and economic benefits. Functioning riparian ecosystems were described as being healthy, diverse, productive and self-sustaining. Riparian dependent resources and values were given priority. One of the overall objectives of the Plan was the restoration, maintenance, and enhancement of riparian areas and their dependent resources. This included the following desired conditions for riparian areas: (1) Aquatic habitats maintain aquatic biodiversity and contain water quality, food, and necessary habitat for all life stages of native fish and economically important non-native species. (2) Vegetation (both living and dead) is taxonomically diverse. The abundance and structural diversity of plant communities provide stable, complex, and self-sustaining habitats for various life states of wildlife. (3) Dispersed recreation opportunities, such as hunting, fishing, hiking, and watching wildlife are generally associated with riparian areas, but impacts are minimized by limiting the size and location of the recreation. Activities are monitored and, where necessary, controlled to minimize impacts on the riparian areas. (4) Natural variation and succession of plant communities occurs. Rehabilitation of past and future

impacts (both natural and human-caused) may be necessary to protect valuable resources and to enhance the recovery of riparian form and function. (5) Water quality meets or exceeds state standards, for aquatic biodiversity and beneficial uses downstream. Sedimentation rates are in equilibrium with the watershed and stabilize or improve the biological condition of the stream. Specific objectives for instream habitat were: pool habitats occupy 35% to 65% of available habitat; streams supporting cold water habitats have 125 to 300 pieces of large woody debris (LWD) per stream mile, a maximum water temperature of 69°F, and dissolved oxygen values greater than 7.0 ppm; streams supporting cool water habitats have 75 to 200 pieces of LWD per mile, a water temperature regime within 2°F of ambient, and dissolved oxygen values greater than 7.0 ppm or saturation values.

Most of the riparian areas on the Forest were allocated to Management Area 18 (Plan pages 3-92 to 3-100). Management direction for this management area complemented the management direction for adjoining management areas. Therefore, riparian areas were to be managed three different ways depending on whether they were adjacent to lands suitable for timber production, lands unsuitable for timber production, or lands upstream of municipal water supplies.

Physical and biological characteristics were to be used to determine riparian area widths. Streamside management zones were to be applied to both perennial and intermittent streams. These were 66 feet wide for perennial streams and 33 feet wide for intermittent streams, with increased widths for filter strips on steeper slopes. Depending on the width of the riparian area, streamside management zones might be located entirely within, or partially outside, the riparian area. In the portion of the streamside management zone outside the riparian area, up to 20% basal area removal of trees was allowed along perennial streams. Up to 50% basal area removal of trees was allowed along intermittent streams within the streamside management zone.

Adjacent to lands suitable for timber production, the riparian area beyond the 66-foot streamside management zone was suitable for timber production. For the riparian area within the streamside management zone, vegetation was managed to meet the desired condition of the aquatic resources.

Springs and permanent seeps were to be protected from disturbance during management activities. Lakes, ponds, and wetlands were included as part of the riparian area.

2. Where is the Plan Now?

DFC 1 – Aquatic habitats

LWD and instream habitat surveys

Forest personnel surveyed stream habitat to measure DFC parameters identified in the 1993 Revised GWNF Forest Plan. Surveys were conducted on portions of the Pedlar Ranger District in 1995 and 2005, Lee District in 2001, Dry River District in 2002, 2003, 2004 and 2005, and the Warm Springs in 2005. Overall, 631 km (392 miles) of streams were surveyed using a modified Basinwide Visual Estimation Technique (BVET [Dolloff et al. 1993]) to estimate woody debris loading, percentage of pool and riffle area, and the width of the riparian area of streams.

The distribution of woody debris was also mapped. See the table below for a summary of LWD and % pool area.

Miles of Stream Habitat Surveyed In 1995-2005
George Washington National Forest

Year Surveyed	# of Stream Miles Surveyed	% of Streams Below Minimum Pool Area DFC	% of Streams Below Minimum LWD DFC
1995	113	48	44
2001	75	75	35
2002	57	62	33
2003	55	70	19
2004	35	71	78
2005	57	96	83

A comparison of individual streams surveyed in 1995 and again in 2005 on the Pedlar District showed a decrease in the median number of pools, number of riffles, and total LWD per km, while the median pool and riffle surface area increased. This report suggests that in 1995 only 25% of streams met the DFC for stream area in pools and less than half of streams met the DFC for total LWD. By 2005 no streams met the DFC for pool area and 75% of streams did not meet the DFC for total LWD. The changes in pool/riffle ratio, number of pools and riffles per km, and pool and riffle surface area are all consistent with decrease in total LWD. The largest decrease of LWD was in the smallest size class. These pieces most often form pool habitat by combining with other small woody debris to form debris jams. In general the smallest size classes are the most easily dislodged and transported downstream or out of the active stream channel during high flows (Hilderbrand et al. 1998, Montgomery et al. 2003). Loss of debris accumulations from long riffle areas following flood events could result in the changes in stream habitat observed. The median amount of the largest size classes of LWD either remained the same or increased in the reaches between 1995 and 2005.

Stream structures

Following Plan approval, across all Ranger Districts, large woody debris was deliberately added to many streams that did not meet the DFC. In addition, efforts were made in the North River to return a highly modified stream channel to a more natural condition. Past hydrological modifications of the North River include bank armoring with rock gabions and channelization to protect the road from frequent floods. These modifications resulted in a wide, shallow channel that lacks fisheries habitat complexity. Under a recent project, rock veins and weirs, and other structures made of natural materials were placed in the stream channel to consolidate streamflow and increase sinuosity. Non-functional rock gabions blocking the natural floodplain were removed.

Water Quality

See Water Quality section elsewhere in this report for a discussion about stream water quality, benthic macroinvertebrates, and sedimentation.

DFC 2 – Stable and complex vegetation community

The Forest Plan allowed up to 20% basal area removal of trees along perennial non-native trout streams and 50% basal area along intermittent streams. There was no regulation of vegetation management along ephemeral streams. One timber sale was designed to specifically address the issue of removing non-native pine plantations along the North River.

DFC 3 – Dispersed Recreation opportunities and impacts

The following are examples of projects that were done to improve riparian conditions. It is not an all-inclusive list, and it is recognized that many more projects have occurred to improve watershed conditions (see the Watershed Improvement Needs list and Soil Productivity discussion elsewhere in this report). In addition, projects specific to fishery development and angler access are in the Fisheries discussion elsewhere in this report). It is also recognized that many more dispersed recreation opportunities and problems exist across the Forest, and have yet to be addressed.

- Relocated portions of North River Road outside riparian area and reduced number of times road crossed North River.
- Moved ½ mile of stocking road along Jackson River at Poor Farm to reduce soil and water impacts, Warm Springs District
- Closed and rehabilitated ½ mile of stocking road along Jackson River at Hidden Valley to reduce soil and water impacts, Warm Springs District
- Closed unauthorized user-created roads, improving 4 acres in the Wilson Creek watershed, Warm Springs District
- Constructed bridges and hardened fords on the Taskers Gap ATV area, Lee District
- Closed and rehabilitated 2.5 miles of Horse Mountain Road, James River District
- Closed and rehabilitated 2.5 miles of Childrens Forest Road, James River District
- Moved portion of Peters Mill OHV road away from the stream, Lee District

DFC 4 – Rehabilitation from natural and human impacts

- Planted trees to establish a forested riparian buffer along Hidden Valley hayfields, Warm Springs District
- Moved road away from Brown Mountain pond, Warm Springs District
- Moved portion of North River Road out of floodplain, North River District
- Restricted vehicular access to Potts Pond, James River District
- Rehabilitated landslides in 4 watersheds following 1995 and 1996 floods, Pedlar District
- Closed 1 mile of road near Laurel Run to prevent dispersed vehicle camping and vehicle use along the stream, Warm Springs District

Site-specific operational Projects that have not moved the Forest toward the Riparian DFC

- Developed Crabtree Falls Parking lot in riparian area.
- Have not moved toilets out of floodplain where they repeatedly get flooded at Elkhorn Lake.
- Use of portions of Peavine, Shoe Creek, and Otter Creek OHV roads continue to impact riparian areas along applicable creeks.
- Some dispersed camping sites within riparian areas continue to degrade soils and vegetation.

- Efforts to fence cows out of the Shenandoah River have failed and cows continue to cause bank erosion and resulting sedimentation in the grazing allotment(s).

DFC 5 – Water quality and sedimentation

See Water Quality section elsewhere in this report for a discussion about stream water quality, benthic macroinvertebrates, and sedimentation.

3. Did Management Activities Move the Forest towards the Desired Future condition?

DFC 1 – Aquatic habitats

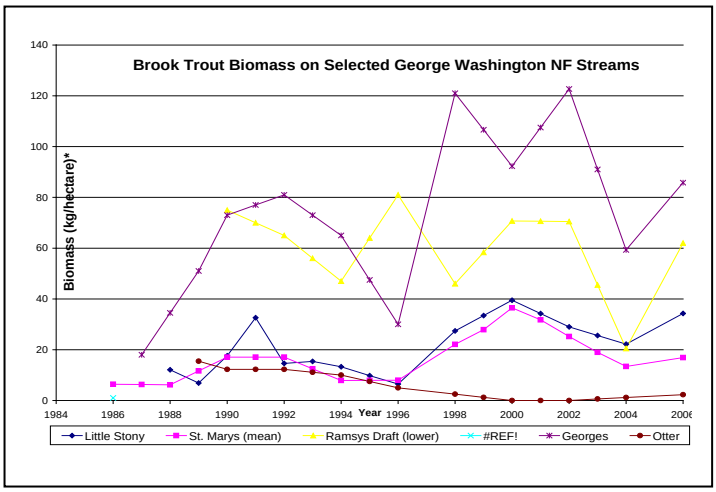
Management actions such as adding large woody debris and other types of in-stream structures moved particular streams toward meeting the DFC. However, the vast majority of the Forest's streams received no direct management action. Although comparisons of 1995 and 2005 stream surveys showed a decrease in streams meeting the desired future conditions for pool/riffle ratio and total LWD, the median amount of the largest size classes of LWD either remained the same or increased during that time period. The largest size classes (size 3: > 5 m long, 10-50 cm diameter; size 4: >5 m long, >50 cm diameter) are most stable and can easily have residence times of greater than 10 years in Appalachian streams with relatively little movement (Andy Dolloff, unpublished data). Continued supply of these size classes to the stream may result in increases in total pool habitat in the future.

Such differences highlight the fact that LWD dynamics are governed by a wide array of chronic and acute events, both natural and anthropogenic, including flooding, fires, stand maturation, riparian composition, and timber harvest (Dolloff and Warren 2003, Benda et al. 2003). For example, insect infestations such as gypsy moth or hemlock wooly adelgid can result in the relatively rapid death of many trees. Smaller size classes of LWD are added to the stream as dead trees standing in the riparian area begin to shed branches and larger size classes are added as these trees continue to decompose and eventually fall across the stream channel. Natural additions of LWD can come through slow attrition or in large pulses if stands are impacted by events such as hurricanes. It is expected that streams will move toward the DFC through natural process if riparian forests are allowed to mature and more trees are left in the vicinity for recruitment of future LWD (Benda et al. 2003; Dolloff and Warren 2003, Boyer and Berg 2003, Reich et al. 2003, Morris et al. 2007).

BROOK TROUT- Under the 1993 Revised Plan, fisheries resources were to be managed to develop and maintain aquatic habitats that contain suitable water quality, food chains, and necessary habitats for all life stages of native fish, and to facilitate sport fishing. Lakes, ponds, reservoirs and most perennial streams are contained in Management Area 18. The desired future condition for Management Area 18 gives specific objectives for large woody debris, water temperature, sedimentation, and dissolved oxygen levels for streams. Fisheries direction for lakes, ponds, and streams is provided in the discussion of Forest Plan Management Area 18 and in the Riparian Area and Water Quality sections.

As shown in the table, populations of brook 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). As documented in Appendix G of the annual M&E reports, timber harvesting and other management activities did not significantly decrease

habitat or populations of brook trout. Furthermore, some management activities, such as stream liming and habitat restoration, were specifically designed to improve brook trout habitat and increase their populations.



The following are examples of projects done to increase angler access and recreational fisheries.

Development of New Fisheries and General Angler Access.

- Developed Pedlar River delayed harvest fishery and angler access, Pedlar District
- Fishing access steps at Brandywine Lake, North River District
- Rehabbed angler access point on Jackson River at Hidden Valley, Warm Springs District
- Rehabbed angler access point on Jackson River at Poor Farm, Warm Springs District

Universally Accessible Fishing Piers

- Sherando Lake, Pedlar District
- Lake Moomaw, Warm Springs and James River Districts
- Rockcliff lake and Tomahawk Pond, Lee District

CENTRARCHID (SUNFISH) FAMILY - As documented in Appendix G of the annual M&E reports, Forest Service activities, such as the creation of structures in reservoirs, are beneficial to members of the sunfish family. However, even though 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 (Spotte 2007; Noble 2002; Quinn 2002; Wilson and Dicenzo 2002; Swennson 2002). Because of this, we recommend that the Forest continue to work with State agencies to monitor warm water fish and enhance habitat on the Forest land, but not include the sunfish family as a Species of Interest in the revised Forest Plan.

DFC 2 – Stable and complex vegetation community

Few vegetation management activities occurred in the streamside management zones near perennial streams. A timber sale was developed and sold to remove non-native red pine from

the riparian area of North River. Vegetation management did take place along intermittent and ephemeral stream channels for non-riparian purposes. Insect infestations of gypsy moth and hemlock wooly adelgid, floods, and landslides changed the composition of the riparian vegetation in specific locations. As shown in the above examples, the Forest moved toward the DFC in some areas but not in others.

DFC 3 – Dispersed Recreation opportunities and impacts
DFC 4 – Rehabilitation from natural and human impacts
DFC 5 – Water quality and sedimentation

As shown in the above examples, the Forest moved toward the DFC in some areas but not in others.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? See viewpoints 1 and 2 that follow.

Viewpoint 1

Riparian Resources

Although the existing Plan recognizes the value of riparian areas and strives to protect and enhance the unique riparian resource values, the standards and streamside management zone widths are tiered to the protection of water quality and instream resources, and do not accommodate the more terrestrial riparian-dependent resources (Crawford and Semlitsch 2006, CRWP and Schwartz 2006, DeGraaf and Yamasaki 2000, Semlisch and Bodie 2003, Tiner 1999, Wenger 1999). Crow et al. (2000) give an example of recommended buffers 20 to 30 ft wide for small mammals, 10 to 300 ft for amphibians, and 650 ft for wood ducks. Recommendations of buffer width vary by species group, but should also depend on the context in which riparian areas exist in the broader landscape.

Intermittent and Channeled Ephemeral Streams

The existing Plan only considers perennial streams as having riparian areas. This is in contrast to the concepts identified by Ilhardt *et al.* in the book Riparian Management in Forests of the Continental Eastern United States (2000) where she states:

> Despite these differences in riparian components and their character of components from an ecological perspective, there is agreement that a riparian area:
> - Includes the water or feature that contains or transports water for a portion of the year
> - Is an ecotone of interaction between the aquatic and terrestrial ecosystem
> - Has highly variable widths or boundaries

In the existing GWNF Plan only intermittent streams with bankfull widths greater than 3 feet are provided with buffer zones. Intermittent streams with scoured widths less than 3 feet or channeled ephemeral streams are given no protection. Richards and Hollingsworth (2000) state that "although intermittent or seasonally dry channels are often ignored or regarded as insignificant by managers, most sediment enters stream systems through these small streams during storms. Riparian management must include guidelines and best managements practices (BMPs) designed to protect the integrity and functions of headwater streams". Welsch

et al. (2000) further emphasize that to be effective, riparian guidelines must include small streams and dry channels.

An intermittent stream channel is a watercourse that flows in response to a seasonally fluctuating water table; a channeled ephemeral stream is a watercourse that flows in direct response to precipitation in a well defined channel. There are not discreet boundaries between a perennial, intermittent, and channeled ephemeral stream; they are all part of channel continuum that shifts in response to climatic and watershed conditions. Illustrating this is John Hewlett's variable source area concept. Based on observations and data from Coweta, Hewlett explained that during floods, streamflow increases as the variable source extends into ephemeral channels. During a large storm, channel length increases "to perhaps ten or twenty times the perennial length" (Hewlett 1961). It is important to recognize that intermittent and channeled ephemeral streams are part of the overall riparian system. The stream continuum has longitudinal physical, chemical, and biological gradients (Parrott et al. 2000).

In addition to being part of the overall channel continuum, intermittent and channeled ephemeral streams strongly influence downstream ecosystems by controlling the input of sediment, water, woody debris, and nutrients to the rest of the channel system. Not only are a high proportion of watershed products (sediment, water, woody debris, and nutrients) produced from intermittent and ephemeral channels, but these channels also store large volumes of hill slope materials and release them over long periods. For example, much of the sediment eroded from hill slopes during a major storm may be stored in the smallest channels, allowing it to be released gradually at levels that may not harm downstream environments. These sites can be particularly important as potential sediment sources because many are susceptible to gully formation and debris flow erosion when destabilized (Kappesser 1999).

Following the extensive logging that occurred over much of the Forest in the past 200 years, slash and debris could persist for 20 to 50 years in streams before declining to lower levels. Wood loading in streams would then gradually increase over many years as the riparian forest matured and provide a source of large wood (Dolloff and Webster 2000). This last process may require centuries (Hornbeck and Kochenderfer 2000). As stated in the previous section, it is expected that streams will move toward the DFC through natural process if riparian forests are allowed to mature and more trees are left in the vicinity for recruitment of future LWD. Managing for big trees in riparian areas can speed the accrual of woody debris to streams, including intermittent and ephemeral channels (Richards and Hollingsworth 2000). Although it has long been recognized that LWD is important in perennial streams as a source of habitat complexity, and is positively correlated with increased fish production (Richards and Hollingsworth 2000); the importance of allochthonous matter (leaves and wood) increases as stream size decreases. In addition to leaves and twigs being the basis of the food chain in headwater streams, large pieces of wood influence flow velocity, channel shape, and sediment storage and routing. The stair-step profile created by woody debris dams dissipates much of the energy in small, high-gradient streams (Dolloff and Webster 2000). Research indicates that one-third of the biomass of litter in a stream comes from distances beyond 100 ft. This distance exceeded the mean maximum tree height for the study system of approximately 72 ft (Palik et al. 2000). Welsch et al. (2000) recommend riparian forest buffer widths equal to at least two tree lengths.

Pauley et al. (2000) recognize the riparian zones associated with headwater streams as being transitional areas between shallow water and terrestrial habitat and supporting a diversity of salamanders and frogs. The maintenance of streamside forests at the scale of entire

watersheds will help determine long-term persistence and local viability of amphibian populations (Duncan 2003). No reptiles use these areas for permanent residence, but often use these zones for foraging, thermoregulation, and moisture retention (Pauley et al. 2000). Burrowing crayfish often use the moist soil conditions prevalent in headwater streams. Likewise, the American woodcock is an example of a bird that requires moist soil containing earthworms and is found almost exclusively in wooded riparian habitats during dry summers and through the autumn migration. Many other birds depend on riparian forest habitats for nesting and roosting (DeGraaf and Yamasaki 2000).

A wealth of scientific research over the past decade has recognized the important role of intermittent and channeled ephemeral headwater streams in maintaining water quality and quantity, recycling nutrients, and providing habitat for plants and animals. It is appropriate to provide management direction for the areas around not only perennial stream channels, but also intermittent and channeled ephemeral streams.

Aquatic Organism Passage and Riparian Grazing

The GWNF Forest Plan did not specifically address several other important issues: aquatic organism passage and riparian grazing.

Recent National and Regional attention has focused on the issue of aquatic organism passage. Land managers recognized that instream barriers can prevent migration, dispersal, and colonization, leading to genetic isolation and possible extirpation. Specifically, culverts at road crossings can be barriers to fish or other aquatic organisms (Gibson et al. 2005, Verry 2000).

Forest Service researchers used the '*National Inventory and Assessment Procedure for Identifying Barriers to Aquatic Organism Passage at Road-Stream Crossings'* developed by the USFS San Dimas Technology and Development Center to assess road stream crossings on the Forest. On the GWNF, over 500 stream-road crossing surveys were conducted between 2003 and 2006. The majority of crossings were not passable for all fish types (strong, moderate, or weak swimmers and leapers). This inventory can be used to identify barriers to aquatic passage and prioritize them for replacement/repair based on maximum benefit to aquatic organisms or habitat.

Streams where bottomless arch culverts were installed at road crossings to improve aquatic organism passage on the GWNF include:

- Laurel Run and Hunkerson Gap on the Lee District
- Middle River and Slatelick on the North River District
- Mill Creek on the Pedlar District

Efforts to fence cows out of the Shenandoah River have failed at some sites and they are causing bank erosion and sedimentation in the grazing allotment(s). The current GWNF plan is silent on the management of grazing allotments in riparian areas. Because of the need for streambank stability, shading, limiting sedimentation, and diverse vegetative communities, Welsch et al. (2000) recommend limiting grazing activities at the water's edge and severely restricting livestock's access to streams to benefit mammal, bird, amphibian, and reptile riparian habitats, in addition to benefiting aquatic habitats.

Best Management Practices

Regarding Best Management Practices, GWNF Forest Plan Standard 208 (page 3-145) states that: The Forest stays current with Virginia and West Virginia "best management practices"

(BMPs) and erosion and sediment control regulations and amends the Forest Plan if BMP modifications or regulation changes become more restrictive than Revised Plan standards.

The following table compares current BMPs with GWNF Plan and revised Jefferson Plan standards for streamside management zones. *VZ=Vehicle Exclusion Zone, SS=Shade Strip, FS=Filter Strip. Percentages refer to % slope.

Stream Characteristic	Virginia BMPs	WV BMPs	1993 GWNF Plan*	2004 Jefferson Plan
Perennial	warm water fisheries (all other waters including wetlands) = 50 ft Trout water 0-10% = 60 ft Trout water 11-20% = 70 ft Trout water 21-45% =100 ft Trout water 45+% =120 ft Municipal 0-10%=100 ft Municipal 11-20%=145 ft Municipal 21-45%=145 ft Municipal 45+%=200 ft	100 ft	66 ft for VZ & SS. FS 0-20% = 66 ft FS 21-45% = 100 ft FS 45+% =200 ft	0-10% = 100 ft 11-45% =125 ft 45+% =150 ft
Intermittent	warm water fisheries (all other waters including wetlands) = 50 ft	100 ft	33 ft for VZ & SS. FS 0-20% = 33 ft FS 21-45% = 50 ft FS 45+% =100 ft	0-10% = 50 ft 11-45% =75 ft 45+% =100 ft
Channeled ephemeral		25 ft		25 ft

Current GWNF Plan standards are not consistent with the current VA and WV BMP widths. The State BMP widths also vary in their recommendations on management activities.

Jefferson Riparian Corridor

Similar to the GWNF Plan, the revised Jefferson Plan manages riparian areas as a separate Management Area (Riparian Corridor) with a focus on riparian resources. However, in contrast to the GWNF Plan, the revised Jefferson Plan incorporated wider management zones, recognizing riparian values other than, and in addition to, aquatic resources and buffering streams. It is also more in line with current Virginia and West Virginia BMPs. Although the Riparian Corridor area has pre-defined widths to facilitate implementation and analysis, the actual corridor widths can be changed on a site specific basis through IDT input. In addition, the portion of the corridor that is extended based on slope is managed as a vehicle exclusion zone, and does not prohibit timber management. In this way, Jefferson Plan Riparian Corridor direction tried to recognize the need to easily implement direction on the ground, and also the variability in riparian systems. Standards that address channeled ephemeral streams are included in the Forestwide direction. Management direction for the 25 foot corridor on either side of a channeled ephemeral stream does not prohibit timber management, but does focus attention on the importance of these streams, and their relationship to the overall hydrologic system.

Currently within the GWNF National Forest, the same management direction as the Jefferson Forest Plan riparian corridors is applied to 157,465 acres (15%) of the GWNF through

provisions contained in the Federally Listed Threatened and Endangered Mussel and Fish Conservation Plan. These acres are in sixth code HUC watersheds containing aquatic T&E species.

Viewpoint 2

a. The current GWNF Streamside Management Zones are 66' and 33' for perennial and intermittent streams, respectively. The current Virginia BMP's are 50' for both non-trout streams and intermittent streams, respectively. The Virginia BMP ranges from 60 – 100' for perennial trout streams depending upon steepness of slope. The current West Virginia BMP's are 100' for both perennial and intermittent streams and 25' for ephemerals. Vegetation management is permitted within these zones to varying degrees. During timber sale layout, we have been implementing either the appropriate State BMP's or the Forest Plan SMZ, whichever is more restrictive. In those circumstances where the State guidelines were wider, they did not conflict with the Forest Plan; thus no Forest Plan Amendment was necessary. However, during Forest Plan Revision it would be prudent to revise the SMZ guidelines to correspond to the respective State BMP's.

b. Adoption of the Conservation Plan in the approximately 20% of the Forest that occurs in Virginia for which it was intended will provide a more balanced approach to multiple use management in the remaining approximately 80% of the Forest to which the Conservation Plan does not apply. Every 660' of a perennial stream (both sides) in a non T&E 6th Level HUC represents an additional 1 acre of multiple use management that may occur if only the existing GWNF SMZ's and VA State BMP's are used. Similarly, every 870' of ephemeral stream would represent an additional 1 acre of multiple use management. While this amount may seem small on an individual project basis, it is roughly estimated that adoption of the State BMP's in non-T&E watersheds could allow as much as 75 to 100 acres more vegetation management than if the more restrictive Conservation Plan Guidelines were in place.

Furthermore, the wider buffer strips required under the Conservation Plan are not likely to substantially increase the pools and LWD metrics that are of concern – at least not along perennial streams. Assume a 110' to 120' tree falls precisely perpendicular to the stream at the very edge of the buffer strip. Under the current Streamside Management Zone (SMZ) standard (66 feet), the top 40-50% would fall in or across the stream. Under the Conservation Plan SMZ (100 feet) the portion of that top becomes reduced as one moves from 66' to the outer limit until 10-15% of that tree falls in or across the stream. Thus a smaller and smaller portion and size of a tree top is potentially added to LWD as the SMZ becomes wider. The additional width on perennial streams does not result in a substantially large increase in LWD. This is not true of ephemeral streams; since there is no current SMZ applied to ephemerals in Virginia, adoption of the Conservation Plan in Virginia would result in significantly more LWD than current management provides for.

c. Tentative Options or Proposed Actions for Change

C-1. Adopt as standards and guidelines the Jefferson Forest Plan Riparian Corridor and Forest-wide Channeled Ephemeral standards (consistent with the Federally Listed Fish and Mussel Conservation Plan) into the plan and have them applicable across the entire George Washington National Forest.

C-2. Adopt as standards and guidelines appropriate updated State Best management Practices (BMP's) in the approximately 80% of the Forest that is not subject to the

Federally Listed Fish and Mussel Conservation Plan (Conservation Plan). Adopt as standards and guidelines the Jefferson Forest Plan Riparian Corridor and Forest-wide Channeled Ephemeral standards (consistent with the Federally Listed Fish and Mussel Conservation Plan) into the plan and have them applicable only to those 6th level HUC watersheds that contain federally listed fish and mussels.

C-3. Do nothing. Leave the GW riparian management area in place as is.

5. What are the Consequences of Not Changing?

There would be inconsistency with state BMP's within Virginia and West Virginia, inconsistency across the GWNF Forest between the watersheds covered under the Federally Listed Fish and Mussel Conservation Plan and those that are not, and inconsistency with the Revised Jefferson Forest Plan standards for riparian corridors and channeled ephemeral streams. This would result in inconsistency of riparian standards within and between districts, and potential confusion in Forest Plan implementation and loss of credibility with partners and the public.

Proposed Action

Propose Option C1.

Additional Information

Comments were received that indicated a need to expand or enhance the riparian guidelines beyond what was proposed with the Jefferson guidelines. In particular, was a publication from Wild Virginia entitled, The State of Our Water: Managing and Protecting the Drinking Water Resources of the George Washington National Forest. This report identified the need to examine the use of special guidelines in drinking water watersheds. The following summarizes additional examination of this topic.

The Jefferson Forest Plan Riparian Corridor and Forest-wide watershed direction and standards were developed to provide a variety of ecosystem services within a predominantly forested landscape. One of the underlying purposes for the creation of the National Forest System was to provide the ecosystem service of abundant, clean water (Dombeck 1999). Examples of other services related to riparian areas include, but are not limited to, maintaining streambank stability for the control of erosion and sedimentation, water temperature control for in-stream habitat, minimization of direct impacts by people and livestock, pollutant removal, and fisheries/wildlife habitat.

The Jefferson Forest Plan Riparian Corridor and Forest-wide watershed standards were developed after reviewing much literature and are generally consistent with buffer guidelines proposed by Wenger (1999). This includes a minimum 100 foot buffer on perennial streams, which increases with slope, includes the floodplain and wetlands, and buffers perennial, intermittent and ephemeral streams. Wenger stated that not only were these "defensible given the scientific literature", they provide adequate protection for stream corridors, including good control of sediment and other contaminants, maintenance of quality aquatic habitat, and some measure of terrestrial wildlife habitat.

In response to the above issue of maintaining water quality in drinking water watersheds, more recent literature was reviewed with a focus on watershed research and riparian buffers specific

to maintaining water quality. Most of this recent research revolved around nutrient removal effectiveness, specifically, nitrogen.

The 2003 Riparian Buffer Effectiveness Literature Review by Straughan Environmental Services, Inc. focused on the role riparian buffers play in preventing nitrogen from entering water. There are some discrepancies regarding width requirements for a buffer, but most agree on a 3 tier system and that the buffers should be no less than 75 feet wide on each side of the stream. Generally, Zone 1 is 15 feet and consists of trees to provide shade and control stream erosion. Zone 2 is 60 feet and the trees are selectively harvested to remove stores of nitrogen. Zone 3 is 20 feet and comprised of grass to slow water velocity and facilitate infiltration.

Sweeney et al. (2004) examined 16 streams in eastern Pennsylvania for Stroud Water Research Center to determine the differences in pollutant processing capacity between forested and non-forested segments. They found that not only do forest buffers prevent nonpoint source pollutants from entering small streams; they also enhance the in-stream processing of both nonpoint and point source pollutants, thereby reducing their downstream impact. This research shows that small to intermediate streams, which represent >90% of the total stream lengths in most watersheds, can play a major role in collecting, processing, and exporting nutrients to downstream rivers and estuaries.

A quantitative review of riparian buffer width guidelines from Canada and the United States (Lee et al. 2004), revealed that most jurisdictions (80%) allowed timber harvest within buffers. In addition, trends are (1) shifting toward more complicated guidelines based on site specific goals and land type, and (2) expanding to larger-scale, watershed planning of riparian areas.

The US Environmental Protection Agency (EPA) looked at riparian buffer width, vegetative cover, and nitrogen removal effectiveness in a 2005 review of current science and regulations. Nitrogen removal effectiveness varied widely among riparian zones, but the "most effective buffers are at least 30 meters wide composed of native forest, and are applied to all streams, including very small ones." To maintain maximum long-term effectiveness, buffer integrity should be protected against soil compaction, loss of vegetation, and stream incision (disconnection from the floodplain). Maintaining buffers around stream headwaters will likely be most effective at maintaining overall watershed water quality.

Gunther et al. (2008) reviewed over 150 published scientific papers, written over the preceding forty years, on riparian and wetland buffer widths, on the subject of providing "ecosystem services". The published studies were grouped by types of ecosystem services provided, buffer widths examined, and capacities for protection of water quality. For stream bank stability, temperature control, minimization of direct impacts, and pollutant removal capacities, substantial benefits are achieved within the first 50 feet of vegetative buffer width. Marginal increase in benefits may accrue when buffer widths are increased beyond 50 feet.

The 1993 landmark agreement between EPA and New York City (NYC) saved taxpayers billions of dollars by avoiding filtration while protecting drinking water quality through targeted land acquisition and management programs. It is often used as a model for watershed management and illustrates the economic importance of ecosystem services (Mates and Reyes 2006). NYC complies with Federal drinking water regulations by implementing a comprehensive watershed

protection program for the 1.26 million acres of land that supplies their water.
(http://www.epa.gov/OWOW/watershed/ny/nycityfi.html)

The crux of NYC's watershed protection program revolves around managing their land and water resources in six program areas.
(http://www.nyc.gov/html/dep/html/watershed_protection/html/resources.html)

1) *Farms* - The Watershed Agricultural Program is a voluntary partnership between the City and farmers to reduce nonpoint sources of agricultural pollution, particularly waterborne pathogens, nutrients and sediment.
2) *Streams* - Restoration of stream stability and ecosystem integrity is the primary goal of the Stream Management Program. The NY Department of Environmental Protection (DEP) encourages long-term stewardship of Catskill Mountain streams and floodplains by establishing partnerships with the region's Soil and Water Conservation Districts, landowners and other local agencies and municipalities.
3) *Forestry* – Forests cover more than ¾ of the NYC water supply watersheds, most privately owned and managed by thousands of individual landowners. In partnership with forest landowners, loggers and the forest industry, DEP supports a voluntary Watershed Forestry Program. Well-managed forests are not only a preferred open space land use for watershed protection; they're also a working landscape that supports the rural upstate economy. The use of New York State's Forestry Best Management Practices for Water Quality are encouraged, with particular focus on minimizing the impacts of logging equipment, protecting water quality at stream crossings, and reducing soil erosion from forest roads, skid trails and log landings.
(http://www.dec.ny.gov/docs/lands_forests_pdf/dlfbmpguide.pdf)
4) *Land Acquisition* - The purchase of sensitive, vacant lands within the eight county watershed is a critical component of the New York City's program to preserve water quality over the long-term.
5) *Land Management* - DEP water quality mission includes the proper management and stewardship of City-owned watershed lands and waters. Under an Access Permit system designated areas of New York City's watershed lands are available for hiking, fishing, deer hunting and other passive recreation activities compatible with water quality protection.
6) *Waterfowl* – To address the seasonal spikes in fecal coliform bacteria, DEP developed a management program to eliminate waterbirds –– geese, gulls, cormorants and ducks –– from select reservoirs using non-lethal measures.

During public comment for the revision, it was recommended the GWNF use New York City's (NYC) water quality protection measures as an example for potential policy and management objectives. In light of that suggestion, the NYC watershed protection program was explored.

The *Streams* and *Forestry* program areas most closely relate to Forest Service management activities and are described below. A summary of all the areas is included in the water quality section of the report.

Streams - Restoration of stream stability and ecosystem integrity is the primary goal of the Stream Management Program. The NY Department of Environmental Protection (DEP) encourages long-term stewardship of Catskill Mountain streams and floodplains by establishing partnerships with the region's Soil and Water Conservation Districts, landowners and other local

agencies and municipalities to address chronic and pervasive problems of Catskill Mountain streams, which are the source of 90% of the City's water supply. These issues include streambank and bed erosion, compromised water quality, flood hazard risks and fisheries habitat degradation. The catastrophic floods of January 1996, clearly demonstrated that the traditional approach of repairing isolated streambanks doesn't effectively address the real causes of stream instability.

DEP's program works to restore stream system stability and ecological integrity by:

- approaching stream management across watershed stream sub-basins, rather than at isolated erosion sites
- integrating multiple objectives, like minimizing flood hazards, increasing fish habitat and improving water quality;
- involving local communities, organizations and affected landowners
- using the science of river physical processes, called fluvial geomorphology (see below table for comparison with GWNF), as the basis for management recommendations.

Geomorphic Approach of NYC Stream Management Program	Proposed Desired Future Condition of Riparian Areas/Corridors for the GWNF
The geomorphic approach recognizes that the physical structure of stream channels governs habitat quality, fisheries' health, flood behavior, rates of erosion and, ultimately, water quality. The shape and size of a stream channel adapts itself to the amount of water and bedload it needs to carry. Within certain limits, the form, or morphology, of a stream is self-adjusting, self-stabilizing, self-sustaining. If a stream management plan exceeds those limits, however, the stream may remain unstable for a long time. (http://www.nyc.gov/html/dep/html/watershed_protection/html/)	Streams are in dynamic equilibrium; that is, stream systems normally function within natural seasonal ranges of flow, sediment movement, temperature, and other variables. The geomorphic conditions of some channels reflect the process of long-term adjustment from historic watershed disturbances (e.g., past intensive farming or logging practices). The combination of geomorphic and hydrologic processes creates a diverse physical environment, which, in turn, fosters biological diversity. The physical integrity of aquatic systems, stream banks and substrate, including shorelines and other components of habitat is intact and stable.

Forestry – Forests cover more than ¾ of the NYC water supply watersheds, most privately owned and managed by thousands of individual landowners. In partnership with forest landowners, loggers and the forest industry, DEP supports a voluntary Watershed Forestry Program. Well-managed forests are not only a preferred open space land use for watershed protection; they are also a working landscape that supports the rural upstate economy. The use of New York State's Forestry Best Management Practices for Water Quality are encouraged, with particular focus on minimizing the impacts of logging equipment, protecting water quality at stream crossings, and reducing soil erosion from forest roads, skid trails and log landings. (http://www.dec.ny.gov/docs/lands_forests_pdf/dlfbmpguide.pdf)

The following description of the Watershed Forestry Program is an excerpt from the book Watershed Management for Potable Water Supply: *Assessing the New York City Strategy*, Committee to Review the New York City Watershed Management Strategy, National Research Council ISBN: 0-309-51426-6, 564 pages, (2000):

> The Watershed Forestry Program (WFP) was established in 1997 to improve the economic viability of forest land ownership and the forest products industry in ways compatible with water quality protection and sustainable forest management. Patterned after and affiliated with the Watershed Agricultural Program, the WFP was formed following the deliberations of a Watershed Forest Ad Hoc Task Force. The Task Force—comprised of foresters, local landowners, loggers, local and regional forest products industry representatives, representatives of nonprofit groups, and New York City and State officials—synthesized information about forests and forestry in the watershed region, identified problems and opportunities, and developed five overarching position statements for the WFP (Table 9-5).
>
> The ideas, goals, and objectives set forth by the WFP correspond closely with other recent approaches, including the Massachusetts Metropolitan District Commission's management of the Quabbin Forest (Barten et al., 1998; MDC, 1995), the USDA Forest Service-sponsored Stewardship Incentive Program, and other contemporary examples (Bentley and Langbein, 1996; NRC, 1990, 1998). Although they are more comprehensive and sophisticated, most of the Task Force's findings and recommendations echo more general turn-of-the-century calls for conservation of forest resources.

TABLE 9-5 Position Statements of the Watershed Forestry *Ad Hoc* Task Force and Corresponding Policy Recommendations[a]

Position Statements	Policy Recommendations
1. Well-managed forests provide the most beneficial land cover for water quality protection.	• Educate the public about the linkages between forests, forestry, water quality, and rural economies. • Use conservation easements that allow for traditional uses and maintain undeveloped land.
2. Existing forest management activities are a negligible nonpoint source of pollution; however more extensive use of Best Management Practices (BMPs) will further reduce sediment and nutrient loading from forest management activities.	• Expand the logger training and certification program. • Develop a user-friendly BMP field manual tailored to watershed conditions. • Expand forest management outreach and plan development with landowners. • Conduct a watershedwide, posttimber harvest survey to assess the effectiveness of New York State's timber-harvesting guidelines. • Develop regulatory and economic incentives to improve BMP compliance and on-the-ground performance.

3. High property taxes discourage stewardship of private forest land.	• Reform New York State forest tax law (RPTL 480-a) to a current-use strategy equivalent to that of neighboring states with reimbursement to local governments. • Develop alternative or supplemental funding sources for local governments and school districts (in addition to local property tax revenue). • Establish a system of incentives to encourage owners of smaller parcels (<50 acres) to maintain their holdings.
4. Retention and growth of primary and secondary forest products manufacturing are essential to a healthy forest-based economy, forest land retention, natural resource protection, and sound forest conservation and management.	• Provide technical and financial assistance to forest landowners interested in long-term management to ensure a continuous supply of high-quality timber for local manufacturing. • Foster an improved business climate to develop and sustain local forest-based industry. • Promote the inclusion of forestry and the forest products industry in economic development studies.
5. Existing public forest lands should provide a model for sound resource management that complements private stewardship.	• NYS DEC and NYC DEP forest lands should, where appropriate, serve as examples of sustainable forest management.
[a] Position statements are direct quotations from the original source while policy recommendations are paraphrased. Source: WFAHTF (1996).	

In summary, the NYC strategy views a managed forest landscape as the preferred land use. It promotes active management within fixed-width setbacks to achieve the pollutant removal efficiencies attributed to buffer zones. The distance of the setback depends on land use and the type of waterbody. There are no prescribed setbacks for forestry activities in the Memorandum of Agreement between EPA and NYC; instead they deal with uses such as septic tanks, landfills, impervious surfaces and underground oil storage. A 100 ft setback was used to model removal effectiveness for various pollutants (National Research Council 2000, p 442). The setback distances in the NYC watersheds are similar to, or greater than, those found in other locations (National Research Council 2000, p 462).

Setbacks, in contrast with buffer zones, are simply prescribed distances between pollutant sources and a resource or aquatic ecosystem that needs protection. Only if a setback is subject to management or natural preservation can it be considered a “buffer” that reliably insulates ecosystems and resources from nonpoint source pollution (National Research Council 2000, p 427). Setbacks must be naturally regenerated or planted with the appropriate vegetation for retaining nutrients, sediment, and other pollutants. Forested setbacks are recognized as the most effective buffers, in most cases. If setbacks are managed as buffers, they should be managed as described in the USDA three-zone buffer specification, and consideration should be given to periodic vegetation harvesting in Zones 2 and 3 (National Research Council 2000, p 462). The three-zones are described as:

Zone 1 – Undisturbed forest along the water edge for shade, cover, food web functions, and bank stability.
Zone 2 – Managed forest for nonpoint source pollutant assimilation.
Zone 3 – Vegetated area for runoff control (National Research Council 2000, p 431).

Within the NYC Watershed Forestry Program, riparian forest buffers are subject to special operating restrictions, often specified by state forest practice acts, to minimize undesirable changes in site conditions. The most important restriction is the prohibition of direct access by heavy equipment. Selective harvesting of trees within zones 2 and 3 can and should occur. However, logs can only be winched on a steel cable to a machine located outside of the buffer or removed by a mechanical harvester with a hydraulic boom. Restricting access by heavy equipment virtually eliminates the soil disturbance and compaction responsible for generating and conveying nonpoint source pollution. Except for the restriction on equipment access, the transition between the harvest unit and the riparian forest buffer should, by design, be gradual and indistinct. Basic silvicultural practices to maintain or enhance the health, vigor, and growth rate of trees should be implemented in the riparian forest buffer (National Research Council 2000, p 436-7). New York State Forestry BMP's are encouraged to reduce erosion and prevent sedimentation to streams. The following table compares the NY State Forestry BMP and the proposed GWNF riparian management.

	NY State Forestry BMPs	GWNF proposed riparian management*
Riparian buffers	Buffer strips are filter strips between streams and soil disturbance (NY BMP, p 65).	Pre-defined widths to facilitate implementation and analysis, the actual corridor widths can be changed on a site specific basis through IDT input. The corridors are managed for riparian dependant resources (water quality, stream channel stability, aquatic and riparian biota).
		The portion of the corridor that is extended based on slope is managed as a vehicle exclusion zone and filter strip, and does not prohibit timber management. The proposed Riparian Corridor management was developed to easily implement direction on the ground, and also to recognize the variability in riparian systems.
	Slope (%) Recommended filter (ft) 0-10 50 11-20 51-70 21-40 71-110 41-70 111-150	Perennial Slope (%) Riparian Corridor (ft) 0-10 100 11-45 125 45+ 150
		Intermittent Slope (%) Riparian Corridor (ft) 0-10 50 11-45 75 45+ 100
		Channeled Ephemeral Slope (%) Riparian Corridor (ft) all 25

* Management direction for the 25 foot corridor on either side of a channeled ephemeral stream does not prohibit timber management, but does focus attention on the importance of these streams, and their relationship to the overall hydrologic system.

In summary, the Jefferson Riparian Corridor and Forest-wide watershed standards are consistent with the Federally Listed Threatened and Endangered Mussel and Fish Conservation Plan, and were developed to focus on riparian resources and provide protection for all streams, lakes, and wetlands across the forest. Following review of additional research, they are generally consistent with recommendations for maintenance of Ecosystem Services as defined as "the processes by which the environment produces resources, such as clean water" (Gunther et al. 2008). In addition, they exceed the applicable watershed measures implemented by NYC, as approved by EPA for maintenance of drinking water standards. Accepting the proposal to

adopt these measures for the George Washington National Forest Plan Revision would afford similar protection to all water resources on the Forest.

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The 1993 Plan did not consider beavers and the usefulness of beavers in creating and maintaining habitat and restoring riparian areas. The North American beaver (Castor canadensis) is a semi-aquatic mammal occurring in rivers, streams, lakes and wetlands across North America. Beavers are unique in their ability to create and modify their habitat by building dams. Because they exert such a strong influence on aquatic and riparian communities, the beaver is considered a keystone species (Boyle and Owens, 2007).

Beavers alter ecosystem hydrology, biogeochemistry, vegetation, and productivity with consequent effects on the plant, vertebrate, and invertebrate populations that occupy beaver-

modified landscapes. Their impoundments trap fine textured sediments that act as water storage reservoirs, resulting in slow, sustained discharge that maintains streamflows during dry periods; afford protection from flooding of downstream areas; and produce a raised water table that enhances riparian zones. Additionally, beaver habitat modifications can reduce pollution and improve water quality in aquatic ecosystems, by trapping sediment and nutrients, reducing downstream turbidity, and purifying water from acidification and other non-point source pollutants.

The capability of beavers to store water, trap sediment, reduce erosion, and enhance riparian vegetation can be used as a management tool to restore degraded aquatic and riparian ecosystems. Beavers are a habitat-modifying species and play a pivotal role in influencing community structure in many riparian and wetland systems.

Beaver altered landscapes can also increase open wetland habitat and open terrestrial habitat that is used by many other species. The cycle of beaver dam construction, pond formation, pond abandonment, and subsequent pond reoccupation creates unique habitat in otherwise wooded landscapes. The various successional stages created by beavers are important for ruffed grouse, woodcock, waterfowl, and a variety of neo-tropical migratory songbirds. Beaver created habitat increases bird species richness and diversity.

Benefits of beaver activity:

- Wetland creation
- Groundwater recharge
- Water table elevation
- Sediment and organic matter retention
- Mitigation of high flows – reduction of stream kinetic energy, erosion, flooding
- Mitigation of low summer flows – some intermittent streams can become perennial
- Reduced carbon turnover rate (24 years in a riffle vs 161 years for a beaver pond)
- Raise water pH, ANC, N (N-fixing bacteria in sediments), NH4
- Reduce SO2 ,Al, NO3
- Wildlife habitat
    - Increase aquatic productivity
    - Fish
    - Amphibians
    - Reptiles
    - Bats
    - Wildlife
        - Mink
        - Otter

    - Muskrat
    - Small mammal density increases
    - Deer – browsing and bedding
    - Bird species richness and diversity increase
- Waterfowl –nesting and brooding habitat, feeding and resting during migration
- Insects – odonate species richness and diversity increases
- Aquatic and wetland plants – riparian species richness is increased, esp. in meadows
- Early successional species
    - Grouse
    - Woodcock
    - Songbirds
- Creation of spatial and temporal landscape mosaic –
    - increase landscape heterogeneity
    - Increase in landscape species diversity
    - Beaver ponds
    - Increased riparian zone
    - Mud flats
    - Beaver meadows

The primary conservation concerns are to maintain existing beaver populations and to restore beaver populations to unoccupied habitat where appropriate to take advantage of their capability to restore and strengthen the ecological integrity of aquatic and riparian ecosystems.

6. Recommendations for Plan Revision

Adopt as standards and guidelines the Jefferson Forest Plan Riparian Corridor and Forest-wide Channeled Ephemeral standards (consistent with the Federally Listed Fish and Mussel Conservation Plan) into the plan and have them applicable across the entire George Washington National Forest.

The Plan should acknowledge the importance of beavers in restoration of riparian ecosystems and develop plan components to enhance their populations.

E. Management Indicator Species

1. What was the Plan Striving For?

Management Indicator Species (MIS) selected for the 1986 Forest Plan included black bear, wild turkey, white-tailed deer, common flicker, and pileated woodpecker. In order to adequately monitor the effects of management practices on biological communities, plant and animal

populations, and ultimately biological diversity, additional MIS were selected for the 1993 Revised Plan. These were selected to measure the effects of forest fragmentation, gypsy moth defoliation, and management activities as well as to represent all forest ecosystems.

Management indicator species selected for the 1993 Revised Plan were:

- Demand Species: white-tailed deer, black bear, and wild turkey.
- Ecological Indicators: cave dwelling bats, brown-headed cowbird, oven bird, worm eating warbler, Cow Knob salamander, tiger salamander, brook trout, sunfish family (centrarchid), common flicker, pileated woodpecker, yellow pine community (pitch, table mountain, Virginia and shortleaf pine), old growth forest types.
- Threatened and Endangered Species: Indiana bat, northern flying squirrel, peregrine falcon, bald eagle, James Spinymussel, shale barren rockcress, swamp pink, northeastern bulrush.

The rationale for the selection of MIS may be found in Appendix J of the FEIS. MIS were used to monitor the Implementation of the Revised Plan, and the effects on diversity and population viability of all native and desirable non-native plants and animals. MIS were to determine if the Revised Plan was achieving the desired future condition across the Forest and in each management area.

Monitoring of MIS included individual species, but these species were not always monitored on a single species basis. Rather, monitoring of groups of species or biological communities often more accurately described diversity, population viability, and changes as a result of management activities. The desired condition for the Revised Plan was to provide suitable habitat to maintain viable populations of all native and desirable non-native plants and animals.

The trends for the current species are valuable information for identifying any need for change in management direction. These trends are reported in other sections of this document.

3. Did Management Activities Move the Forest towards the Desired Future condition?

See other sections for the results for individual MIS.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? A complete analysis of MIS was done for the Jefferson Forest Plan. Since the Jefferson and George Washington are administratively combined and share common issues and management direction, it would be more efficient to have the same MIS. The exception would be that the Peaks of Otter salamander occurs only on the Jefferson NF and the Cow Knob salamander occurs only on the GWNF.

5. Recommendations for Plan Revision

Use the following species as MIS for the Plan:

Common Name	Scientific Name	Primary reason(s) for selection
Pileated woodpecker	*Dryocopus pileatus*	To help indicate the effects of management on snag dependent wildlife.
Ovenbird	*Seiurus aurocapillus*	To help indicate the effects of management on mature forest interior species.

Common Name	Scientific Name	Primary reason(s) for selection
Chestnut-sided warbler	*Dendroica pensylvanica*	To help indicate the effects of management on high-elevation early-successional species.
Acadian flycatcher	*Empidonax virescens*	To help indicate the effects of management on mature riparian forest dependent species.
Eastern towhee	*Pipilo erythrophthalmus*	To help indicate the effects of management on early-successional forest wildlife.
Black bear	*Ursus americanus*	To help indicate the effects of management on meeting hunting demand for this species.
Wild turkey	*Melagris gallopavo*	To help indicate the effects of management on meeting hunting demand for this species.
White-tailed deer	*Odocoileus virginianus*	To help indicate the effects of management on meeting hunting demand for this species.
Hooded warbler	*Wilsonia citrina*	To help indicate the effects of management on mid- and late-successional mesic deciduous forest species. This includes mixed mesophytic and oak and oak-pine forests.
Scarlet Tanager	*Piranga olivacea*	To help indicate the effects of management on species found in drier mid- and late-successional oak and oak-pine forests.
Pine warbler	*Dendroica pinus*	To help indicate the effects of management on mid- and late-successional pine and pine-oak forest species.
Wild trout (brook trout, rainbow trout, brown trout)	*Salvelinus fontinalis, Oncorhynchus mykiss, Salmo trutta*	To help indicate the effects of management on cold-water streams and meeting fishing demand for these species.
Cow Knob salamander	*Plethodon punctatus*	Endemic sensitive species found only on the GWNF

F. Threatened, Endangered, and Sensitive (TES) Species

1. What was the Plan Striving For?

The 1993 Revised Plan provides habitat for the continued existence of all populations of threatened, endangered, and sensitive plant and animal species in the Forest. The habitats and populations of threatened, endangered and sensitive species throughout the Forest are protected and maintained as appropriate. Many TES species are tied to unique habitats and Special Biological Areas. See the Unique Natural Community and MIS sections of the report for further discussion.

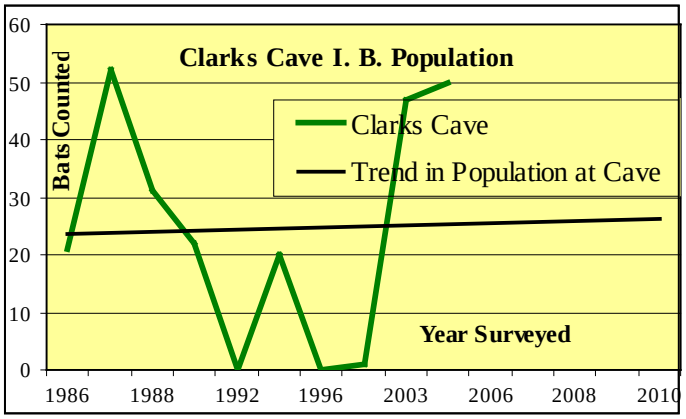
Appendix L of the 1993 Revised Plan contains charts showing which TES species occur or are likely to occur in the Forest; their global and state rankings; their occurrences by ranger districts and management areas; and the generalized type of habitat appropriate for the species.

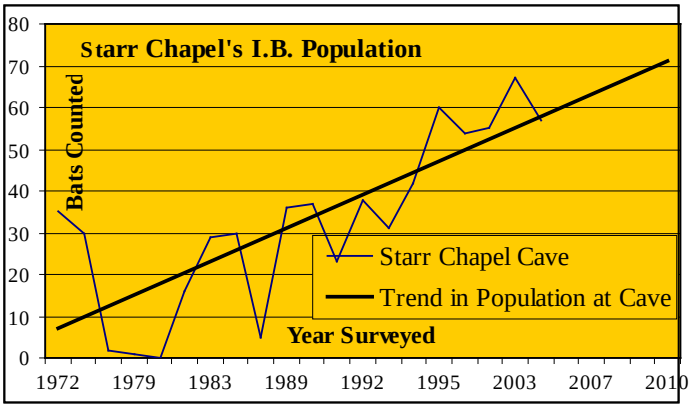
2. Where is the Plan Now?

INDIANA BAT – The Indiana bat was individually selected because it is a federally listed endangered species and there is direct interest in its population levels based on the fact that it is generally a woodland and forest dwelling bat during the non-hibernation months that may be affected during some management activities.

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 fire 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).

This amendment also showed the seven cave protection areas for the bat, three areas on the Jefferson and four on the GW. The four areas on the GW are: Starr Chapel, Clark's, Hupman's Saltpetre, and Mountain Grove Saltpetre Cave Protection areas. However, the GW Forest Plan does not explicitly show these areas, whereas the three areas on the Jefferson were explicitly shown as management areas when





the Jefferson Plan was revised in 2004. Likewise, the Jefferson Forest Plan provided the same direction through use of specific allocations, whereas, in the GW Plan, this same direction was provided only in the forestwide direction of the Forest Plan.

Within Starr Chapel Cave's Protection Areas, land has been acquired since the time of the amendment.

VIRGINIA NORTHERN FLYING SQUIRREL - The Virginia northern flying squirrel (*Glaucomys sabrinus fuscus*) was listed as endangered in 1985 by the USFWS. This squirrel was selected for the George Washington Forest Plan 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. 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*. At the time the first Plan revision was signed (1993), monitoring estimated that there were fewer than 20 northern flying squirrels (NFS) on the Forest (all in the Laurel Fork area). Northern flying squirrels have been monitored in the Laurel Fork area between 1986 and 2004. Analysis results suggest an overall low but stable trend for northern flying squirrel populations on the GWNF. Flying squirrels were captured and released in the Laurel Fork area between 1986 and 1996 to obtain population trend data. The number of squirrels captured ranged from 0 to six. No squirrels were captured in six out of the ten years of trapping. In 2004, one northern flying squirrel was captured, the first in several years of monitoring. Habitat trends for mature spruce/northern hardwood in the Laurel Fork area are estimated to be stable (around 71 acres). The GWNF encompasses a single population of the northern flying squirrel that is disjunct from its almost contiguous boreal distribution across northern North America, the Rocky Mountains, and New England. This species is inherently rare and not naturally well distributed across the Forest, due to its dependence on the spruce-fir/northern hardwood forest type. Northern flying squirrel populations are expected to remain relatively stable in the near future. Current management provides for ecological conditions capable to maintain the flying squirrel population, considering its limited distribution and abundance.

On August 15, 2008 the U.S. Fish & Wildlife Service removed the Virginia northern flying squirrel from the list of Threatened and Endangered wildlife due to recovery. This species is now considered to be a sensitive species on the Forest.

PEREGRINE FALCON – The peregrine falcon (*Falco peregrinius*) was selected because it was a federally threatened species (GWNF FEIS Appendix page J-12). 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 requires specialized nesting habitat (cliffs). 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. In addition, prescribed fire may enhance suitable habitat by controlling vegetation encroachment on suitable cliff areas (NatureServe 2009). 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. In 2005 and 2006, a pair of peregrines nested successfully in a remote section of Shenandoah National Park. In 2000, a nesting pair of peregrine falcons fledged two young in the vicinity of Lost River State Park, just over the state line in West Virginia. Monitoring results indicate there are no resident peregrine falcons on the Forest. Based on the results of GWNF monitoring and evaluation, ecological conditions on the Forest are sufficient to contribute to species viability (persistence over time), if and when peregrine falcons again return to the GWNF (NatureServe 2009).

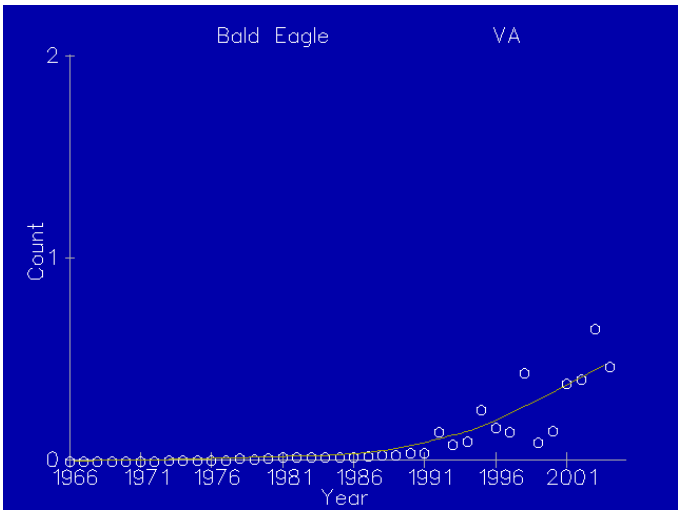
BALD EAGLE - The bald eagle (*Haliaeetus leucocephalus*) was selected by the GWNF Plan because it is a federally endangered species (GWNF FEIS Appendix page J-12). In June of 2007 the U.S, Fish and Wildlife Service removed the bald eagle from the list of Threatened and Endangered wildlife due to recovery. This species is now considered to be a sensitive species on the Forest.

The bald eagle prefers large bodies of water (lakes or larger rivers) adjacent to forested areas with minimal disturbance to its nesting sites. Several bald eagle occurrences are noted on the GWNF annually, however, these represent transient individuals. Currently, active bald eagle nests are known on private land in the Lake Moomaw area (North River RD and Warm Springs RD), near the Jackson

River and Virginia Power (VEPCO) reservoir (Warm Springs Ranger District), and on Forest Service land located on the Dry River and Lee Ranger Districts. Habitat for bald eagles on the National Forests is relatively insignificant when compared to the quantity and quality of habitat in the Chesapeake Bay and the Virginia coastline. USGS Breeding Bird Survey data indicates an overall increasing trend for bald eagle populations in the state, which will likely result in increased use by transient birds and increase probability of future nesting on the GWNF. Bald eagles have not been documented on the avian point counts from the GWJNF's.

Trend in BBS Data of Bald Eagle across the State of Virginia, 1966 To 2005.

Source: http://www.mbr-pwrc.usgs.gov/bbs/bbs.html



The amount of nesting, roosting, and foraging habitat suitable for bald eagles on the GWNF is limited. Lakes such as Moomaw and Sherando, or rivers such as the James, the Calfpasture, and the Shenandoah could provide habitat, and transient eagles may appear at these locations occasionally. When nests are found, protection measures outlined by the USFWS are followed. Based on the results of GWNF 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 (USF&WS 2007).

JAMES SPINYMUSSEL - As documented in Appendix G of the Monitoring and Evaluation (M&E) Report (2004), several new occurrences of the James Spinymussel were located from surveys conducted on streams in Bath County in 2000-2004. The James Spinymussel does occur in watersheds that contain NFS land and occurs both upstream and downstream from the Forest. Current Forest management provides for water quantity and quality that contributes to the persistence of mussel populations.

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.

The Forest is currently working with the US Fish and Wildlife Service and VDGIF to locate James Spinymussel populations on National Forest and habitat suitable for augmentation.

SHALE BARREN ROCKCRESS - The Plan created Special Biological Areas (SBAs) to protect a number of shale barrens and the shale barren rockcress that occurred on them. Appendix G of the 2004 M&E Report states: "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." Between 1994 and 1998 field surveys of shale barrens were conducted on the Forest by DCR-DNH. As a result a number of new SBAs have been proposed to protect both the rare shale barren communities and the shale barren rockcress.

SWAMP PINK – The Plan allocates most of the habitat for swamp pink to Wilderness or to SBAs. 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. Swamp pink populations that are currently in MA 16 (Early Successional Habitat) along the Coal Road would benefit from a change to a special biological area designation that allows for mature forest and lower stems densities.

NORTHEASTERN BULRUSH - 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.

Summary

See the discussion in the Unique Natural Community section for trends in unique habitats.

The Forest is involved in several endeavors to prevent the listing of species as threatened, endangered or sensitive, through cooperative efforts at defining management strategies to manage habitat so their populations would not decline. These endeavors include the endemic Cow Knob Salamander.

The Forest also developed a Federally Listed Fish and Mussel Conservation Plan cooperatively with the USFWS and state partners. The intent was to provide pro-active and consistent management direction for watersheds that contained T&E fish and mussels. Additionally, these conservation plan standards are consistent with the Revised Jefferson Forest Plan Riparian corridor standards. They are currently applied to only 6th level watersheds on the George Washington National Forest.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? The Plan needs to incorporate new information about threatened, endangered and sensitive species.

c. Tentative Options or Proposed Actions for Change

See also the discussion of riparian areas and special biological areas elsewhere in this report.

C-1. Modify the Forest Plan by:

a) Creating new SBA(s) to protect the shale barren rockcress.

b) Creating new SBA(s) to protect the Northeastern bulrush.

c) Make an administrative change by delineating the Primary and Secondary Cave Protection areas (as shown in the Forest's 1998 Indiana Bat Amendment) and correspondingly, adopt the Jefferson Forest Plan direction for these special areas.

C-2. Do Nothing.

5. What are the Consequences of Not Changing?

New locations of federally endangered or threatened species may not be protected. The Indiana bat would still be protected.

Proposed Action

Propose Option C1.

6. Recommendations for Plan Revision

Create new SBA(s) to protect the shale barren rockcress and the Northeastern bulrush (See SBA map). Delineate the Primary and Secondary Cave Protection areas (as shown in the Forest's 1998 Indiana Bat Amendment) and correspondingly, adopt the Jefferson Forest Plan direction for these special areas.

G. Unique Natural Communities (Special Biological Areas)

1. What was the Plan Striving For?

The current Plan allocates 70,000 acres to Management Area 4 (Special Interest Areas or SIAs) to manage and protect 38 Biological SIAs, two Geological SIAs, 12 Historic SIAs, one research natural area and the Shenandoah Mountain Crest SIA, containing special habitat for the Cow Knob Salamander. These areas have been identified by the Forest, state natural heritage programs and wildlife agencies, and the USDI Fish & Wildlife Service as deserving special protection and appropriate management.

Six of these areas (Big Levels, Laurel Run, Maple Flats, Shale Barren Complex, Skidmore, and Slabcamp/Bearwallow) were recommended for further study and possible classification as Research Natural Areas.

2. Where is the Plan Now?

Since the current Plan was implemented potential new shale barrens and SBAs have been identified by the Virginia Natural Heritage Program in reports. Likewise, the respective state natural heritage programs have done inventories of unique areas since the Plan was first revised in 1993. All of this information was reviewed. This review shows that about 13 existing areas should be expanded. There are also 84 new natural communities that are not currently designated SBAs. However, a lot of these areas are inside Congressionally-designated Wilderness or Mt. Pleasant National Scenic Area or other unique areas of the Forest such as the existing Cow Knob Salamander Conservation area.

No area from the 1993 Plan has been nominated to the Chief of the Forest Service to be designated a Research Natural Area.

Review of MIS related to unique natural communities

CAVE DWELLING BATS – Cave dwelling bats were selected as a MIS because they are dependent on relatively undisturbed caves, a habitat element important for maintaining the wide array of animal diversity found on the Forest (GWNF FEIS, Appendix page J-14). Populations of cave dwelling bats are believed to reflect effectiveness of measures to protect these habitats (i.e. caves) from disturbance (primarily human-induced). For a discussion on the Indiana bat, see the Threatened and Endangered Species discussion elsewhere in this report.

As documented in Appendix G of the latest annual M&E report, recent surveys have shown a steady to increasing trend for cave dwelling bats, including the endangered Indiana bat, on the GWNF. Analysis of cave surveys conducted semi-annually in cooperation with VDGIF suggest an overall steady to increasing trend for cave dwelling bats both on and near the GWNF. The Forest is currently working with the US Fish and Wildlife Service and VDGIF to manage habitat suitable for bat use on the Forest including caves, roosting and foraging.

Bat species known to occur in caves on or near the GWNF include: big brown bat, northern myotis (formerly Keen's myotis), eastern small-footed bat, little brown bat, eastern pipistrelle, Virginia big-eared bat, and Indiana bat. Some species such as pipistrelles, gray bats, and Virginia big-eared bats 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.

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 42 caves known to occur on the GWNF. 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. 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 disturbances. 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.

Winter surveys are 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 & Endangered Species 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. Based on individual bat counts in caves on the GWNF for the latest survey (2005) bat populations are estimated at 6,096 individuals in three caves, including 107 Indiana bats. 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 cannot 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 preventing access during the survey period.

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 fire and modified timber harvest techniques).

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.

COW KNOB SALAMANDER – The Plan created the Shenandoah Mountain Crest Special Interest Area in part to protect the known range of the Cow Knob salamander. As documented in Appendix G of the annual M&E reports the habitat trend is one of an aging forest that benefits Cow Knob salamanders and should lead to a stable or increasing population. Recent field surveys (2002-2003) discovered the Cow Knob salamander outside the current range south along Shenandoah Mountain to Hardscrabble Knob. These areas will be managed under the terms of the existing Conservation Agreement and Conservation Assessment. The agency intends to discuss these newly discovered areas with the Salamander's Conservation Team, which includes representatives from the Virginia Department of Game and Inland Fisheries, Virginia Division of Natural Heritage, West Virginia Department of Natural Resources, and the U.S. Fish and Wildlife Service. At this time, the agency is postponing making any proposal to expand the existing Cow Knob Salamander Special Biological Area until it meets with the Conservation Team.

EASTERN TIGER SALAMANDER - The Plan created the Maple Flats SBA in part to protect the Easter tiger salamander. Appendix G of the 2004 M&E report states "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 ongoing, 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." In 2005/2006 eastern tiger salamander egg masses and adults were found at 5 sinkhole ponds outside, and 4-5 miles west, of the Maple Flats Sinkhole Complex.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

Why? The potential SBAs that have been identified may be important components of biodiversity protection on the Forest.

Regarding the potential RNAs identified in the 1993 Plan: after considering the benefits versus drawbacks of RNA status it is felt that these areas are better suited as SBAs so that management can remain flexible to respond to various threats such as insects and disease, invasive species, illegal ATV use, etc.

The wood turtle is listed as a Virginia State Threatened species. A strategy for habitat management is currently being developed cooperatively by the Forest Service, Virginia Department of Game and Inland Fisheries, and West Virginia Department of Natural Resources. The strategy will be used to provide information for the planning process.

b. Tentative Options or Proposed Actions for Change

The Revised Plan would continue to recognize areas of the Forest that possess unique biological characteristics. However, other special area direction may take precedence over management of these areas. For example, if a special biological area is located within a Congressionally-designated wilderness, on maps, the special area may not always be clearly identified. Nevertheless, its special characteristics will be protected and activities designed to restore, sustain, and/or enhance their characteristics.

C-1. Modify the Forest Plan by:

a) Allocating 57 SBAs and changing the boundaries of 21 existing SBAs for a total of 23,000 additional acres of SBAs, with acknowledgement that some or most of these may be in already protected areas such as Wilderness, Mt. Pleasant National Scenic Area or other unique areas of the Forest such as the existing Cow Knob Salamander Conservation area.

b) Removing Big Levels, Laurel Run, Maple Flats, Shale Barren Complex, Skidmore, and Slabcamp/Bearwallow from further consideration as Research Natural Areas.

c) Creating new SBA(s) to protect the newly found eastern tiger salamander populations.

Proposed Expansion of Existing SBAs

Existing Botanical - Zoological Area (SBA)	2010 Acres	1993 SBA Acres	Proposed Expansion Acres
BIG LEVELS Incl LOVES RUN PONDS & MAPLE FLATS	17,751	13,292	4,459
BRANDYWINE/SUGAR RUN SHALE BARRENS	163	44	119
LAUREL FORK	6,694	6,172	522
PINES CHAPEL PONDS	323	204	119
BRATTONS RUN SHALE BARREN	222	119	103
GAUGING STATION BARREN	225	46	179
BROWNS HOLLOW	1,148	1,089	59
ROUGH MOUNTAIN	2,950	2,192	758
SHENANDOAH MOUNTAIN	54,323	53,218	1,105
ELLIOTT KNOB	3,139	1,024	2,115
SISTER KNOBS	1,554	1,280	274
BALD KNOB	146	93	53
HOUSE HOLLOW	1,162	977	185
VANCE'S COVE	6	91	-85
STATONS CREEK	0	55	-55
VARIOUS SMALL AREAS	168	0	168
Totals	**89,974**	**79,896**	**10,078**

Proposed New SBAs

Ranger District	Proposed New Botanical - Zoological Area Name	2010 Acres
James River	Anthony Knobs	31
	Bennetts Run	2,145
	Blue Suck Barren	23
	Cast Steel Pond	540
	Frozen Knob Montane Wetland	51
	Harrington Roadside	24
	Johns Run East Barren	20
	Johns Run West Barren	68
	Johnsons Creek	335
	Morris Hill	291
	Ogle Creek	46
	Cove Mountain Ponds	99
	Cub Run Headwaters	170
	Indian Grave Ridge	17
	Moreland Gap Bog	45
	Overall Riverside	27
	Passage Creek	173
	Pond Run Pond	85
	Waterfall Mountain Cliffs	29
	Waterfall Mountain Seeps	71
North River	Big Cedar Shale Barren	43
	Brushy Knob	48
	Clayton Mill Pond	28
	Daddy Run Barrens	103
	Dunkle Knob	25
	Heavener Mountain Shale Barren	57
	Little Fork Shale Barren	108
	Ratcliff Hill	31
	Road Run Shale Barren	136
	Stuart Run	473
	Swamp Run Trib Shale Barren	14
	Whetmiller Knob	49
Pedlar	Cellar Mountain	280
	Cold Spring Branch	541
	Cole Mountain	135

Ranger District	Proposed New Botanical - Zoological Area Name	2010 Acres
	Humpback Mountain	366
	Mount Pleasant	95
	Mountain View Church	229
	Nicholson Run Seeps	129
	Punchbowl Mountain	16
	Rocky Mountain Glade	42
	Spy Rock	22
	The Priest	723
	Three Ridges Mountain - Flatrock	8
	Three Ridges Mountain - Hanging Rock	12
	Upper Crabtree Creek	209
	Upper St. Marys River	2,208
Warm Springs	Blowing Springs	627
	Chestnut Ridge Seep	127
	Chimney Rocks	160
	Cowardin Run	85
	Hidden Valley	1,074
	Mill Hill	56
	Mill Mountain Pond	31
	Mountain Grove	635
	Nimrod Hall Ridge	131
	Winterberry Pond	59
TOTAL		13,405

C-2. Do Nothing.

5. What are the Consequences of Not Changing?

As noted above, SBAs can be important components of biodiversity protection on the Forest. By not creating new SBAs rare species and rare natural communities may be inadvertently harmed by Forest activities. The proposed research natural areas continue to remain protected as they are special biological areas.

Proposed Action

Propose Option C1.

6. Recommendations for Plan Revision

Adopt the proposed new areas and expansions to existing Special Biological Areas. Do not identify a Special Biological Area for the wood turtle. Rather, incorporate the goals and objectives of the Wood Turtle Species Conservation Strategy into the desired conditions, standards and guidelines and strategies of the revised Plan.

Do not identify the Frozen Knob and Peters Mountain areas as Special Biological Areas. These areas were recommended by the Virginia Natural Heritage Program because they are considered to represent some of the best examples of old-age oak forests. SBA's have been identified to represent rare communities or assemblages of rare species, not just a particular successional stage of a common community. The boundaries of these two areas have been modified and the areas will be identified as unsuitable for timber production. In that way, the Forest will be able to further examine these areas in relation to other areas with old growth characteristics to determine if these two areas are better representatives of old growth oak forests.

H. Fisheries

1. What was the Plan Striving For?

Fisheries were to be managed to develop and maintain aquatic habitats that contain suitable water quality, food chains, and necessary habitats for all life stages of native fish, and to facilitate sport fishing (Plan, page 2-25).

2. Where is the Plan Now?

Fishing continues to be an avid recreational pastime on the forest. See the discussion in the Riparian Area and Water Quality sections for trends in physical and chemical stream habitat.

I. Wildlife

1. What was the Plan Striving For?

The Revised Plan was to provide for a forest environment with a wide variety of habitats to meet the needs of wildlife species inhabiting the Forest, intending to focus management within four management areas (Chapter 2, pp. 2-28-29.) Management Area 14 was to emphasize providing habitat for black bear and other disturbance sensitive species. Management Area 15

was to emphasize providing habitat for wild turkey and other species that favor a more mature forest environment with small, herbaceous clearings and freedom from disturbance during nesting and brood-rearing season. Management Area 16 was to emphasize providing habitat for the ruffed grouse and other species that depend on early forest seral stages. Small game preferring open habitats, and "watchable wildlife" species were to be managed for in Management Area 22.

2. Where is the Plan Now?

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) were a planning tool used to accomplish this requirement (36 CFR 219.19 of 1982 Regulations). They were 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 and to monitor effects of Forest Plan implementation.

The George Washington Forest Plan is designed to provide habitat conditions needed to maintain viable populations of all MIS, along with other species that use similar habitats. The following describes population and habitat trends for MIS wildlife game species.

WHITE-TAILED DEER – The White-tailed Deer (*Odocoileus virginianus*) was selected because it is a species commonly hunted and its populations are of public interest (GWNF FEIS Appendix page J-12). It's a species whose habitats may be influenced by management activities such as prescribed fire, permanent opening maintenance, and timber management activities. Deer population trends are monitored by the Virginia Department of Game and Inland Fisheries (VDGIF) and West Virginia Department of Natural Resources (WVDNR).

In Virginia, deer population trends were evaluated by examining the annual rate of change in the population index (i.e., antlered buck harvest per unit area) over the 10-year period from 1996-2005. An exponential regression (y = aert ; where, y = population index, a = intercept, e = 2.718, r = instantaneous rate of change, and t = year) was used to determine trends in population. The annual rate of change (R) = er – 1. The status of the deer population in each county was considered to be increasing or decreasing if the annual rate of change in the population index was >2.26% (either positive or negative) and the statistical significance level of the exponential regression model was $p < 0.10$ (r2 Value > 0.301). Annual rates of change that exceeded 2.26% represent a change of at least 25% in the population index over the decade (1.022610 = 1.25). Counties that displayed a rate of change between 0 and +2.26 were deemed to be stable. Overall on the GWNF in Virginia, 9 counties, representing 660,476 acres (69% of the 956,264 total acres in Virginia) demonstrated stable population trends, and 4 counties, representing 295,788 acres (31% of total acreage in Virginia) demonstrated decreasing trends. Since 2000, VDGIF harvest data has suggested a more substantial decline across much of the GWNF.

A similar population index for GWNF public land in West Virginia counties (104,861 acres) is not available at this time. The agency's assumption is that the overall trend would be similar due to similarity of forest age structure and management activities on George Washington in the two states.

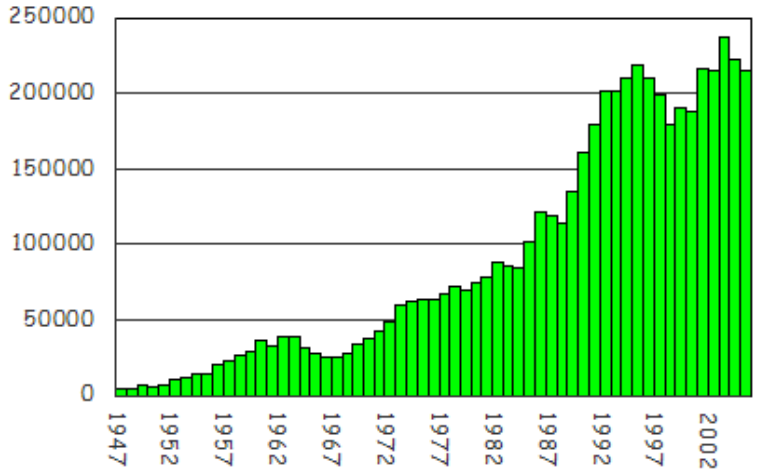
White-tailed Deer Population Index Trend across the GWNF, 1996 to 2005
(Source: VDGIF).

County	Percent GWNF in County	Number of GWNF Acres in County	Ranger Districts Included	*R*[1]	r^2 Value	Status
Allegheny	56	159,359	James River, Warm Springs	-3.23%	0.180	Stable
Amherst	19	57,600	Pedlar	-6.90%	0.762	Decreasing
Augusta	30	186,239	North River, Pedlar	-1.80%	0.168	Stable
Bath	50	170,239	North River, Warm Springs	-4.70%	0.299	Stable
Botetourt	2	5870	James River,	-3.04	0.325	Decreasing
Frederick	2	5,120	Lee	-4.58	0.297	Stable
Highland	5	13,440	North River, Warm Springs	-4.80%	0.269	Stable
Nelson	6	17,920	Pedlar	-4.39%	0.254	Stable
Page	13	25,600	Lee	-0.12%	0.002	Stable
Rockbridge	17	95,999	North River, James River, Pedlar	-3.85%	0.374	Decreasing
Rockingham	25	136,319	North River, Lee,	-5.15%	0.545	Decreasing
Shenandoah	23	75,519	Lee	-1.98%	0.284	Stable
Warren	5	7,040	Lee	2.95%	0.150	Stable

[1] *R* = Percent annual change in population index. Values less than -2.26% and values greater than 2.26% are considered significant (1.0226^{10} = 1.25 or a 25% increase or decrease over the 10-year period).
[2] *p* = Statistical significance level of exponential regression model. Values ($p < 0.10$) are considered significant.

Statewide, VDGIF reports a 3% decrease in total number of deer harvested in 2005 compared to 2004, but the total number harvested was still 4% greater than the 10-year average.

Virginia Deer Harvest, 1947 to 2005



Source: http://www.dgif.state.va.us/wildlife/deer/harvestsummary.asp

In 2000, VDGIF and WVDNR estimated deer populations at 49,418 individuals on the GWNF. Based on evidence of declines in recent years, deer populations for 2005 are estimated to be lower on the GWNF than in 2000. Virginia's newly revised Deer Management Plan has an objective to stabilize deer populations on public land in counties that contain GWJNF lands (Virginia Deer Management Plan: 2006-2015). In addition, the revised Deer Management Plan recommends supporting habitat management objectives on public lands that manipulate vegetation for early successional wildlife and promote restoration, regeneration, and productivity of plant species important to wildlife, particularly those that provide diverse hard and soft mast (e.g., American chestnuts, acorns, grapes, and berries). Active timber

management since 1993 has declined from about 3,000 acres per year to about 800 acres. Conversely, prescribed burning has increased from about 1,000 acres per year to about 7,000 acres. Both of these activities, in addition to natural disturbances and continued maturation of the forest, provide patches of early successional woody habitat, as well as restoring and maintaining open oak, oak/pine, and pine woodlands. Combined with the maintenance of over 80% of forested acres in mature forest condition, the George Washington should be able to provide the mosaic of forest types and ages recommended for white-tailed deer. The white-tailed deer is a game species 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 lower than on private ownership. Overall, however, viability is well sustained for white-tailed deer on the GWJNF. Based on the results of population monitoring and habitat evaluation, this species has the abundance and distribution across the Forest that will provide for its persistence into the foreseeable future. However, without increased management to enhance deer forage on GWNF, it is unlikely that deer populations can be sustained at levels to meet public demands for viewing and hunting without increasing deer damage to plant communities (VDGIF 2007). Without management to increase understory vegetation, even low deer populations can damage plant communities and suppress tree regeneration.

However, caution is warranted as deer populations may be decreasing in certain parts of the national forest in certain counties such as Rockingham, based on hunter contacts and biologists noticing a lack of deer "sign" in the woods (VDGIF 2007).

BLACK BEAR – The Black Bear (*Ursus americanus*) was selected because it is a species commonly hunted and its populations are of public interest (GWNF FEIS Appendix page J-12). It's a species whose habitats may be influenced by management activities. Black Bear are an opportunistic species, thriving in a variety of habitat types. Important habitat elements are habitat continuity, habitat diversity, den site availability, and availability of hard mast (GWNF FEIS, Appendix page J-12). The state agencies of Virginia and West Virginia use a combination of indices derived from harvest, nuisance activity, age structure, and miscellaneous mortalities to monitor status of black bear population. 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). 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.

Virginia's Black Bear Population Trend, 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

In addition, the trend in annual bear hunter harvests reflects the trend in population growth; this can be verified by comparisons of past harvest trends to trends in population reconstruction analyses. During the last 10 years (1995-2005), Virginia's bear harvest has been significantly increasing at an average annual rate of 7.8% per year (95% confidence interval is 4.0% - 11.8%)(D. Steffen, VDGIF Forest Wildlife Program Manager, Pers. Communication, 11/2006).

Based on the current age-class structure of forested land in the GWNF's, 88% of all forest types are mature (71-150+ years). Increased acres of older hardwood stands, sustained hard mast production, and enhanced soft mast production through forest management activities—such as prescribed fire and timber harvest—have contributed to improved black bear habitat on the Forest (VDGIF 2002). The black bear is a game species that is harvested throughout Virginia and West Virginia; therefore, viability is not a concern. Overall, viability is well sustained for black bear on the GWNF. Based on the results of

population monitoring and habitat evaluation, this species has the abundance and distribution across the Forests that will provide for its persistence into the foreseeable future (VDGIF 2002).

WILD TURKEY – The Wild Turkey (*Meleagris gallopavo*) was selected because it is a species commonly hunted and its population is of public interest. It is a species whose habitats may be influenced by management activities (GWNF FEIS Appendix page J-12, JNF Revised Plan FEIS, page 3-138). Wild Turkeys prefer mature forests with open understories and well-dispersed patches of early successional woody and grass/shrub vegetation. Wild turkey population trends are monitored by the Virginia Department of Game and Inland Fisheries (VDGIF) and West Virginia Department of Natural Resources (WVDNR). Population trends, in terms of harvest/square mile, vary over the years, but indicate an overall stable to increasing population trend.

Spring Wild Turkey Harvest Information on GWNF, 1997 To 2006 (Source: http://www.dgif.state.va.us/wildlife/turkey/nationalforestspringturkeyharvest2006.pdf)

County	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Harvest /square mile
Allegheny	102	45	87	74	148	117	112	83	88	88	0.34
Amherst	34	26	30	30	37	43	51	32	40	35	0.39
Augusta	158	93	95	139	158	157	122	86	56	114	0.37
Bath	134	91	153	133	221	164	106	99	66	119	0.44
Botetourt	99	45	41	52	93	84	91	65	58	66	0.54
Frederick	4	6	4		3	3	6	5	6	8	1.04
Highland	26	26	41	47	61	38	32	17	22	36	0.40
Nelson	6	3	6	4	2	12	3	3	2	6	0.20
Page	10	6	6	7	13	5	8	6	9	20	0.47
Rockbridge	43	31	26	24	45	63	35	38	41	50	0.48
Rockingham	125	63	68	57	91	93	92	76	53	92	0.42
Shenandoah	57	41	31	20	48	48	47	60	44	70	0.59
Warren	3	4	3	3	9	5	9	6	3	3	0.31

Wild turkeys use a wide range of habitats, with diversified habitats providing optimum conditions. Timber management since 1993 has declined from about 3,000 acres per year to about 800 acres. Conversely, prescribed fire has increased from about 1,000 acres per year to about 7,000 acres. Timber management and some prescribed fire, in addition to natural disturbances and continued maturation of the forest, provide patches of early successional woody habitat, as well as restoring and maintaining open oak, oak/pine, and pine woodlands. Combined with the maintenance of over 80% of forested acres in mature forest condition, the George Washington should be able to provide the mosaic of forest types and ages recommended for wild turkey. The wild turkey is a game species that is harvested throughout Virginia and West Virginia; therefore, population viability is not a concern. Overall, however, viability is well sustained for wild turkey on the GWJNF. Based on the results of population monitoring and habitat evaluation, this species has the abundance and distribution across the Forest that will provide for its persistence into the foreseeable future.

See also section on vegetation management and prescribed fire for a further discussion on habitat management trends by management area.

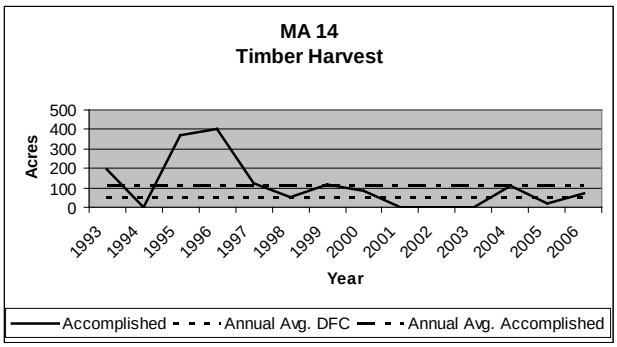
Management Areas 14, 15, and 16 contains 267,000 acres of land suitable for timber production (76% of 350,000 total acres suitable for timber production). Management area 22 has 6,000 acres that are managed intensively for a variety of wildlife species, with each area focusing on a theme such as wildlife viewing, environmental education, small game management, or combinations thereof. These areas are generally small in acreage, have easy

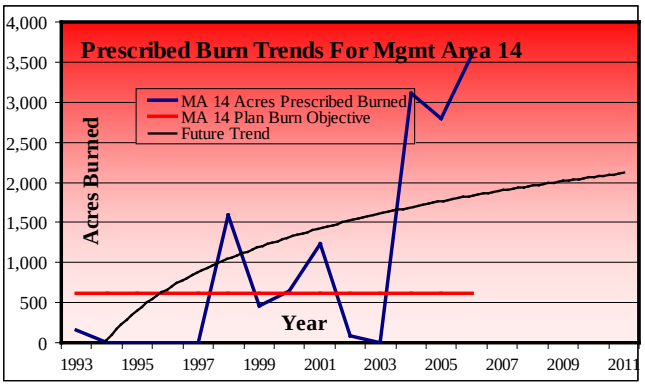
access, and were often at one time farm land. A high proportion of MA 22 is open land that is classified as unsuitable for timber production.

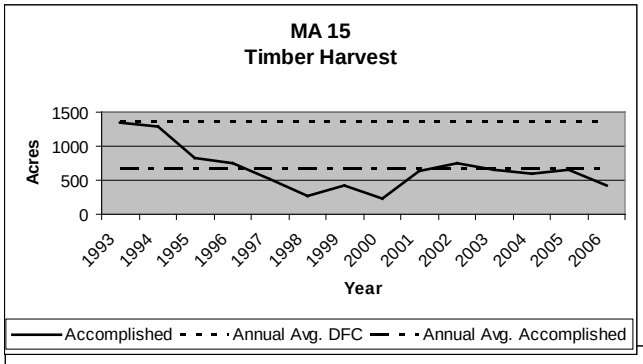
Management Areas 14, 15, and 16 were designed for wildlife management as its major focus and have specific habitat management objectives to meet desired habitat needs for various wildlife species. Other management areas, while benefiting wildlife species, were not designed with wildlife management as their main focus. MAs 14, 15, and 16 have the following desired annual amount of vegetation manipulation (Monitoring and Evaluation reports 1994-2004):

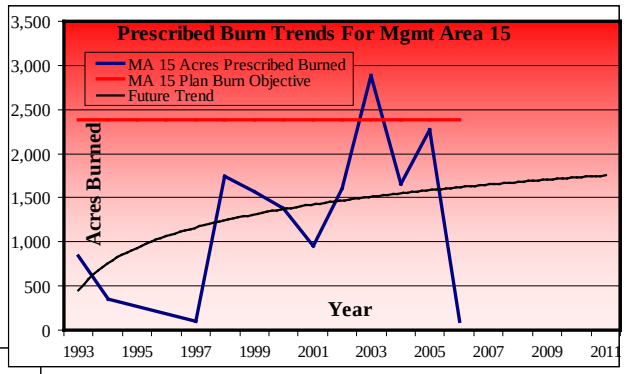
Management Area	Management Area Acres	Average Annual Timber Harvest Objective (Acres)	Percentage of Timber Harvest Acres by Decade	Average Annual Prescribed fire Objective (Acres)	Percentage of Prescribed fire Acres by Decade
14	133,000	52	0.39 %	614	5 %
15	331,000	1,361	4 %	2,386	7 %
16	39,000	217	5.5 %	0	0

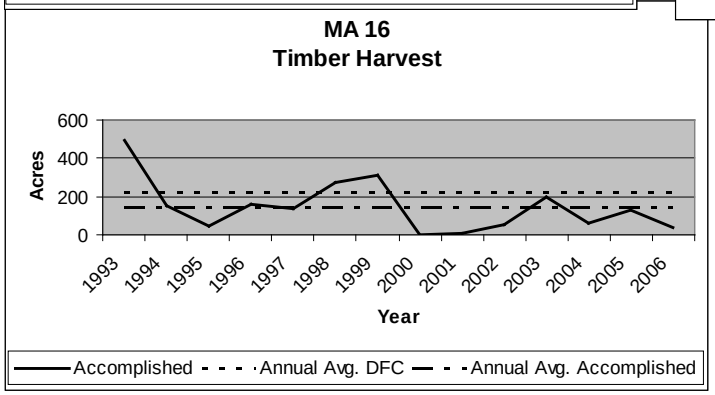
The following graphs show accomplished timber harvest and prescribed fire trends by Management Area from 1993 to 2006.











While timber harvest levels were variable from year to year, total percentage of 0-10 early successional habitat by two 10-year periods, 1993-2003 and 1996-2006 are shown below. Desired percentages of 0-10 early successional habitat were met by Management Areas 14 and 16 in the first 10-year period and only by Management Area 14 in the second 10-year period. Desired percentages of 0-10 early successional habitat were not met in Management Area 15 for either 10-year period. Desired percentages of prescribed fire acres were not met in Management areas 14 or 15 in the first 10-year period, but were exceeded in MA 14 in the second 10-year period.

Categories (1993 to 2006)	Management Area		
	14	15	16
Total Timber Harvest Acres	1,332	7,705	1,840
% Timber Harvest Acres by Decade	1%	2%	5%
Total Timber Harvest Acres	978	4,843	1,376
% Timber Harvest Acres by Decade	0.74%	1.50%	3.50%
Total Prescribed fire Acres	4,182	11,435	N/A
% Prescribed fire Acres by Decade	3%	3.50%	N/A
Total Prescribed fire Acres	13,534	14,263	N/A
% Prescribed fire Acres by Decade	10%	4%	N/A

Forest-wide on the GWNF, over 80% of forested acres is in a mature condition (71-150+ years). As described in the section on interior forest fragmentation and MIS such as black bear, pileated woodpecker, ovenbird and worm-eating warbler, the GWNF has provided large blocks of relatively unfragmented, mature forested habitat and has benefited those species that depend on such habitat. Timber and some fire management, in addition to natural disturbances and continued maturation of the forest, provide patches of early successional woody habitat, as well as restoring and maintaining open oak, oak/pine, and pine woodlands, but has not met specified early successional habitat objectives for management areas 14, 15, and 16. As described in the section on early successional forest fragmentation and MIS such as northern flickers, yellow pine, and white-tailed deer, early successional habitat and open woodland habitat has declined across the GWNF. Open woodland restoration has been identified as a need for change in other sections (see fragmentation, MIS, Endangered species, and fire sections).

As seen in this photo from the North River RD, open woodland habitat retains mature trees and is classified as mature in the overall age-class structure tables, yet provides an understory of native grasses and shrubs that can be maintained as a stable component of this forest type (Grossman 1998).

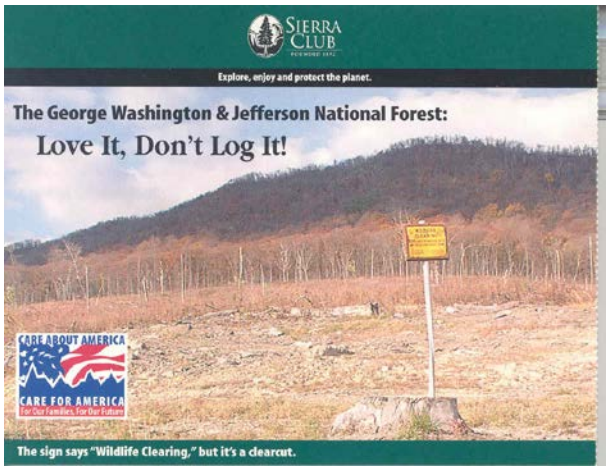
Historically created and maintained with disturbance regimes such as fire, open oak woodland restoration, using active management tools such as prescribed fire and timber treatments, can provide habitat required by many species at some point in their yearly life cycle needs, including white-tailed deer, ruffed grouse, black bear, wild turkeys, Indiana bats, golden-winged warblers, and many 'forest interior' bird species during critical post-breeding, migratory, and wintering life cycles.

In addition, early successional habitat patches created by timber harvests can be used to restore blight resistant American chestnut. Once invaluable as a steady source of hard mast to

many wildlife species, programs such as Virginia Tech's American Chestnut Cooperative are now providing all native chestnut seedlings that show enhanced resistance to the chestnut blight. A chestnut restoration program on the GWNF is now in the planning stages and will need patches of early successional habitat to allow planted seedlings to compete effectively in a mostly forested environment (American Chestnut Cooperators Foundation).

Evick Knob, North River RD, GWNF

This picture of a Sierra Club postcard was of Unit 8 of Panhandle 814 Salvage, a 40 acre salvage treatment completed in September 2000. Per the 1993 Forest Plan, the area is being managed for maintaining or enhancing quality habitat for wild turkey and other species that favor a more mature forested landscape interspersed with small, herbaceous openings (both temporary and permanent) (Forest Plan, pages 2-29 and 3-79). In addition, research is finding that early successional habitats are also important to many 'forest interior' bird species, during the critical time period just after breeding and during migration. These areas provide 'safe havens' for adult and fledgling birds for the following needs: molting, abundant food for the buildup of fat reserves for migration, and protection from predators. Early successional habitat also provides needed breeding habitat for high priority bird species such as prairie warblers and yellow-breasted chats, both of are both present on this site (based on annual monitoring records). These studies strongly recommend conservation strategies that maintain large tracts of mature forest, within which there is a mosaic of different forest types and ages (early and mid-successional forest stands), to provide the habitat requirements needed by migratory birds during all of their life stages here in North America (for more information, please see George Washington and Jefferson Detailed Monitoring and Evaluation Report for Fiscal Year 2004, Appendix G: Population Trends of Management Indicator Species)(http://www.fs.fed.us/r8/gwj/projects_plans/index.shtml).



Time changes how vegetation and active management look. On June, 2006, this is how the same harvested area looked. The 1993 Plan's desired condition is being met today by what appears on the land.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Management activities did move the forest towards the desired future condition described across Management Areas, but did not meet specific objectives in several Management Areas.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? The George Washington and Jefferson National Forests were administratively combined in 1995. The Jefferson Plan was most recently revised (2004). The extent the two plans can be aligned in format and direction would maximize efficiency in administration and management.

c. Tentative Options or Proposed Actions for Change

C-1. Modify the Forest Plan, as appropriate by:

a) Adopting Jefferson Revised Plan Goals 1, 2, 6, 8, 12, 13, 14, 15, and 18.

b) Adopting and modifying Jefferson Revised Plan Objectives 8,01, 12.02, 12.03, 12.04, 12.05, 13.01, 18.01, 18.02, and 18.03.

c) Adopting Jefferson Revised Plan Forestwide standards FW-32, FW-33, and FW-77.

d) Adopting as desired conditions, objectives, and standards and guidelines the Jefferson Revised Plan Management Prescriptions 8A1, 8B, 8C, 8E1, 8E6, and 10B.

e) Increasing the prescribed burn objective.

f) Adding an objective for open woodland restoration, specifically for wildlife purposes.

g) Adding an objective for blight resistant American chestnut restoration.

C-2. Merge GW Management Areas 14, 15, 16, 17, and 22 (Jefferson Prescriptions 8A1, 8B, 8C, 8E1, 8E6, and 10B) into one area and modify the Plan under C-1 options above, as appropriate given the merging.

C-3. Do nothing.

5. What are the Consequences of Not Changing?

Open woodlands were historically present across the GWNF and have declined dramatically since the turn of the previous century, mainly due to fire suppression. Characterized by an open mature tree canopy and a stable understory of native grasses, forbs and shrubs, open woodlands provide habitat needs for an increasing number of species that are declining in population or are already rare across the GWNF. By not emphasizing open woodland restoration, the plan would not be able to provide an important habitat component for these species. American chestnuts were once an important component of the forested landscape on the GWNF and invaluable to many wildlife species as a stable source of food and shelter. With more blight resistant, all native seedlings now available, to not have an American chestnut restoration program on the GWNF would miss an important opportunity to start re-introducing an important species for wildlife.

Proposed Action

Propose Option C2.

6. Recommendations for Plan Revision

See the discussion under Habitat Fragmentation. Incorporate the intent of the identified goals, objectives and standards and guidelines from the Jefferson Revised Plan into the desired conditions, objectives and standards and guidelines of the revised Plan. Desired conditions and standards and guidelines for the current GW Management Areas 14, 15, 16, and 17 will be incorporated into one set of desired conditions and standards and guidelines.

Issue Resource Sustainability

A. Ecosystem Management/Ecological Restoration

1. What was the Plan Striving For?

The 1993 Revised Plan was to provide a variety of resource benefits, including wood, wildlife, fish, range, dispersed recreation, developed recreation, minerals, wilderness and special uses, in a manner that maintained the diversity, productivity and long-term sustainability of ecosystems. Lands and resources were to be managed for a number purposes such as producing, restoring, or sustaining certain ecological conditions; for desired resource uses and products; and for aesthetic, heritage, or spiritual values. These goods and services were to be produced in an environmentally acceptable manner (1993 Forest Plan at page 2-30.)

2. Where is the Plan Now?

The principles of ecosystem management were incorporated into the 1993 Forest Plan and were implemented. An aspect of ecosystem management that needs to be highlighted is restoration.

As part of implementing the USDA Forest Service Strategic Framework's Goal 1 to "Restore, sustain and enhance the Nation's forests and grasslands", restoration is one of the three focus areas under the Region 8 Strategic Framework and has three major objectives:

1. Condition of watersheds is improved. Aquatic organism passage is improved in forest priority watersheds. Watershed condition class is improved in regional priority sub-watersheds.
2. Native vegetation identified in Forest or state plans is restored. Nonnative invasive species are controlled.
3. Rare species are restored. Mid- to high-elevation early-successional habitat acres are increased. Habitats or populations of rare species are stable of improving.

Ecological restoration is defined in Forest Service Manual 2000, Chapter 2020 as *"The process of assisting the recovery of resilience and adaptive capacity of ecosystems that have been degraded, damaged, or destroyed. Restoration focuses on establishing the composition, structure, pattern, and ecological processes necessary to make terrestrial and aquatic ecosystems sustainable, resilient, and healthy under current and future conditions."*

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? The Plan should reflect national and regional strategies for implementing the Forest Service's mission.

The Forest Plan does not discuss restoration of the American Chestnut. The chestnut was a dominant tree in many parts of the Forest ecosystem. Recent advances have resulted in blight-resistant planting stock that should be available for planting in the near future.

Beavers are unique in their ability to create and modify their habitat by building dams. Because they exert such a strong influence on aquatic and riparian communities, the beaver is considered a keystone species (Boyle and Owens, 2007). As such, it is important to highlight beaver populations in restoration goals for the Forest.

c. Tentative Options or Proposed Actions for Change

C-1. Add a new Desired Condition that states: "A blight-resistant American chestnut (*Castanea dentata*) returns to the Forest as a dominant species."

Add plan components addressing the following:

1. Improving the quality of unhealthy stream systems within unhealthy watersheds.
2. Maintenance or enhancement of native ecosystems.

3. Restoration of fire-dependent ecosystems.
4. Restoration of structural and species diversity in forest stands.
5. Controlling nonnative invasive species.
6. Aquatic organism passage.
7. Maintenance or enhancement beaver populations on the Forest.

5. Recommendations for Plan Revision

Use Option C1.

B. Extirpated Animal Species

1. What was the Plan Striving For?

The 1993 Revised Plan did not promote the reintroduction of extirpated animal species. The lead agency on such an action is either the USDI Fish & Wildlife Service or an appropriate agency of Virginia or West Virginia. The Forest Service serves as a coordinating agency when any decision is made to reintroduce an extirpated species (1993 Forest Plan at page 2-31.)

2. Where is the Plan Now?

No extirpated species were reintroduced by USDI Fish & Wildlife Service, any West Virginia State Agency, or any Virginia State. An administrative correction will be done and the discussion will be removed from the plan since the agency has no control over reintroductions. The agency will continue to work with the respective agencies if and when reintroduction of a species is analyzed.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Not Applicable

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? No

b. Why? The reintroduction of extirpated species is not within the statutory authority of the U.S. Forest Service. This issue will not be carried forward.

C. Soil Productivity

1. What was the Plan Striving For?

The Revised Plan contains standards which ensure that management practices are implemented in a manner that maintains or improves the long term productivity of the site. In actively eroding areas where the resources are incurring unacceptable damage as a result of human activities or natural processes, restoration projects are implemented. In any project, soil productivity is protected through the application of mitigation measures as specified in Common Standards. Representative samples of projects are monitored to ensure that soil productivity is maintained.

Watershed improvement projects were to be implemented in actively eroding areas where sediment was affecting a stream's beneficial uses (Plan page 2-31.)

2. Where is the Plan Now?

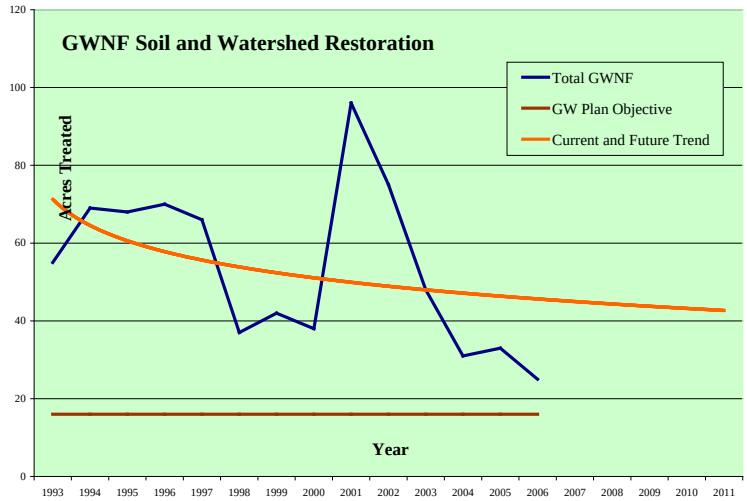
From FY1993 to FY2008 a variety of soil-disturbing activities were monitored for implementation of Best Management Practices. Most were timber sales, including salvage sales, but prescribed burns, wildfires, wildlife clearing development, road construction and maintenance, waterhole rehabilitation, dam construction, trail construction, and pasture fencing also were monitored.

Of 2,460 BMP monitoring elements, 96.5 percent showed that implementation met or exceeded BMP requirements, 3.4 percent showed only minor departures from the intent of the BMP, and 0.2 percent showed major departures from the intent of the BMP. The instances of "departures from the intent of the BMP" show no particular pattern of a particular BMP violation.

The Virginia Department of Forestry conducted water quality monitoring in association with timber harvests from 1989 to 1996 (Virginia Department of Forestry 1998 Conclusions suggested by water quality monitoring near private timber harvests: 1989-1996, an executive summary) At sites in the mountains, Piedmont, and coastal plain, water temperatures were taken at 10-minute intervals, and water samples were collected automatically before, during, and after storm events, both upstream and downstream from logging. Aquatic macroinvertebrates were also sampled periodically. This monitoring showed that, when forestry BMP's are properly implemented, timber harvests can be accomplished without a large or persistent increase in sediment, an increase in stream water temperatures, or a shift in macroinvertebrate species composition. Since the Forests' monitoring indicates that forestry BMP's were properly implemented, it can be concluded that these practices were effective in protecting water quality.

Environmental assessments have estimated soil movement and forested T-factors for timber harvest areas, log landings, and skid trails. We have not done an environmental analysis on the Forest where soil erosion was expected to exceed the forested T-factor for the site. This factor has been used as a way to estimate soil movement on slopes during and after resource management activities on the Forest. The T-factor, which was developed by the Forest Service, is an adaptation of the Universal Soil Loss Equation, which is used on agricultural lands. The T-factor itself is a modeling tool used as a threshold amount of soil which can be "lost" and not reduce long term productivity. Currently we do not typically monitor this factor on projects because it is very variable across project areas and it has not appeared as a problem during the environmental analyses across the Forest. For T-factor analyses completed from FY 2001 through end of FY 2003, the predicted maximum one-year soil loss averaged only 11% of the allowed maximum one-year soil loss, and ranged from 3% to 27%.

Common Standard for the GW Forest #216 (page 3-146) says project environmental analyses for timber harvesting will consider impacts to long term soil productivity. One of the situations listed where long term soil productivity may be impaired is where the soil's erodibility and slope combine to indicate the estimated T-factor to be exceeded.



The trend in watershed improvement activities is shown in the graph. The Plan's objective of 16 acres per year was met. Some backlog remains, mostly the

result of natural events such as flooding, illegal vehicle and trail use and past mining efforts.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes, soil and water improvement work and project environmental analysis have improved or maintained soil productivity on the Forest.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? It is recommended that we not use T-factor estimates in environmental analyses in the GWNF Plan Revision as stated in Common Standard 216, page 3-146 of the current GW Plan. Instead, we will use Region 8 Soil Quality Standards, now in place, as a threshold for protecting soil productivity. The R8 Soil Quality Standard related to maintaining 85% of the project activity area's topsoil and organic layer is a more realistic estimate of the impact of a project on soil productivity and is already contained in the current GW Forest Plan Common Standard 211, page 3-145. This is also a Common Standard for the JNF Forest #5 (page 2-7). We will also include using estimated operating/logging plans to allow for more site specific environmental analysis estimates for displaying the effects to soil productivity from management activities. By using project specific plan estimates for log landings, roads, skid trails and stream crossings we can better estimate impacts to water quality and soil productivity.

Common Standard 215 in the current GWNF Forest Plan, page 3-146, does not allow whole tree harvesting on the Forest. We have learned from research that it is important to protect soils with low buffering capacity to acid deposition from whole tree harvesting due to excessive nutrient removal. We have identified the most susceptible areas on the Forest for low nutrients and acid sensitivity. We will continue to protect soil productivity by not whole tree harvesting in these areas.

There is much evidence now of acidic deposition that has occurred in and near the George Washington National Forest for decades. The Clean Air Act has reduced some components of the deposition in recent years. There is a lag time before these improvements begin to show up in the soils and water affected by this deposition. Some of the geology and soils of the Forest have low buffering capacity against the effects of acid deposition. These areas can be generally mapped using geology, water chemistry, soils and atmospheric deposition spatial and tabular data. These low buffered areas have the greatest risk of becoming increasingly acidic, having greater amounts of aluminum in rooting zones and having stressed ecosystems due to losses of beneficial plant available soil nutrients.

These high risk areas for soil acidification are also areas where whole tree harvesting can have the most impact on soil productivity. Whole tree and biomass removal harvests could be more in demand as bio fuels and other products that require harvesting all biomass growing on a site. This could become a desired use for some of the lower quality sites on the Forest, where total

biomass removal could be more viable than a bole only product. Removal of large amounts of nutrients on these poorer sites through whole tree harvesting (biomass removal) can affect soil productivity according to some research. Soils most susceptible to impacts from whole tree harvesting are characterized by shallow depth to bedrock, low clay content, drier aspects and thin organic layers on the surface. Most likely, low site index (SI) as well.

Whole tree harvesting on more productive sites with more buffering capacity seems to be a lower risk for impacting soil productivity. To protect soil productivity on our higher risk soils, there seems to be good support in literature to not do whole tree (biomass) removal on our poorer sites (Site Index <= 50). Other silvicultural treatments and firewood removal would be acceptable. Whole tree harvest could be allowed on areas suitable areas SI>50. Conserving nutrients on our poorer sites seems to be a good thing to do according to research, especially with acid deposition continuing its effect on the less buffered soils and watersheds.

Evidence of Acid Deposition Impacts:

Driscoll, Charles T., et al., 2001.

- Acidic deposition has accelerated the leaching of base cations from soils, thus delaying the recovery of ANC in lakes and streams from decreased emissions of SO2 (at the Hubbard Brook Experimental Forest the available soil Ca pool appears to have declined 50% over the past 50 years).
- Sulfur and N from atmospheric deposition have accumulated in forest soils across the region, and the slow release of these stored elements from soil has delayed the recovery of lakes and streams after emissions have been reduced.
- Acidic deposition has increased the concentration of toxic forms of Al in soil waters, lakes, and streams deficiencies of Ca2+ and Mg2+ have caused extensive mortality of sugar maple in Pennsylvania, and acidic deposition contributed to the depletion of these cations from soil.

Lovett, G.M., and T.H. Tear. 2008

- Nitrogen contributes to acidic deposition, ground-level ozone, and over-enrichment of soil and surface water. Reduces forest productivity (under high loading). Increases potential vulnerability to pests and pathogens. Causes declines in some sensitive wetland plant populations. Alters plant species composition. Increases algal growth and reduces water clarity in some systems. Contributes to declines in dissolved oxygen and degradation of nursery habitats in estuaries.
- Enhances the mobilization of toxic aluminum from soils to tree roots.
- Increases sulfate and nitrate leaching from soils to surface waters.
- Promotes the loss of important buffering nutrients from soils.
- Reduces ecosystem productivity.

S. W. Bailey,* S. B. Horsley, and R. P. Long, 2005

- At all four sites there were significant decreases in exchangeable. Ca and Mg concentrations and pH at all depths. Exchangeable concentrations increased at all

depths at all sites, however increases were only significant in upper soil horizons. There were long-term decreases in pH, exchangeable Ca, and exchangeable Mg concentrations and increases.in exchangeable Al concentration at all depths between two sampling periods separated by 30 yr.

- Acidic deposition endangers forest health by depleting available calcium in the soil system. Between 1967 and 1997 acidic deposition caused significant decreases in exchangeable soil calcium at all of four study sites on the Allegheny Plateau in Pennsylvania.

Cronan and Schofield, 1979;

- These observations indicate that calcium may become a limiting resource for the growth of forested ecosystems, ultimately predisposing forests to health problems such as increased mortality due to reduced resistance to pests and pathogens

Federer et al., 1989,

- Along with base cation leaching, another consequence of soil acidification is increased solubility and mobility of aluminum in forested ecosystems

Whole Tree Harvesting Effects upon Soil.

Katherine J. Elliott, Jennifer D. Knoepp, 2005.

- Methods that remove excessive amounts of organic material (branches, leaves, tree 17 crowns), such as whole-tree harvesting, have more detrimental effects on nutrient availability than stem-only removal methods that leave more organic material at the harvest site.

United States Department of Agriculture Forest Service Pacific Northwest Research Station General Technical Report, PNW-GTR-222, March 1989.

- In conventional harvesting, where only the bole or stemwood is removed, nutrient losses tend to be low.
- Stemwood and bark of most temperate forest trees account for about 65 to 85 percent of the total biomass but only 25 to 50 percent of the total nitrogen in the trees (Marion 1979).
- Natural inputs of nutrients will often compensate for losses of this magnitude, resulting in no loss of long-term productivity potential.
- On nutrient poor sites having a high percentage of total nutrients stored in the trees, productivity potentials could be lowered.
- Whole-tree harvests can increase average nitrogen-removal rates in some temperate coniferous forests by 100 percent and in some temperate broadleaf forests by as much as 215 percent (Marion 1979). The actual increase in nutrient losses brought on by whole-tree harvesting varies greatly with species, age, and site productivity, but harvest methods removing more than just the stem result in substantially greater nutrient losses (Morrison and Foster 1979).

- The absolute amounts removed are less important than the time required for the site to replace the lost nutrients.
- If revegetation of the site is rapid, the accelerated leaching losses usually last for only a few years. Even with immediate revegetation of the site, however, a lag of at least one year occurs in which more nutrients are mobilized than can be taken up by the vegetation (Bormann and Likens 1979). The nutrients released through decomposition of the forest floor and increased nitrification can enhance the growth of regeneration on the site.

Other whole tree harvest research:

1. Due to low soil Ca content and high Ca content in woody tissues, whole-tree harvesting depleted total ecosystem Ca to a much greater extent than N, P, or K. Soil reserves and atmospheric inputs may be adequate to sustain total N, P, and K supplies with whole-tree harvesting, but soil amendments may be necessary to sustain Ca supplies.
2. Regardless of the intensity of forest harvest, the quantity of nutrients lost from the site by soil erosion or rainwater leaching was small compared to amounts removed in harvested wood. Nutrients removed in harvested wood were potentially large enough to reduce subsequent forest growth at some sites.
3. The combination of leaching loss and whole-tree harvest at short (40-year) rotations apparently could remove roughly 50% of biomass and soil Ca in only 120 years.
4. Calcium and Mg concentrations at the clearcut site were 88 and 75% higher than the levels at the whole-tree site 5 years after harvest. The increased soil fertility observed could provide a valuable nutrient supply to the succeeding forest stand, but net nutrient outputs through harvest and burning could also eventually reduce the already low productivity of these sites.
5. Full tree harvesting removes substantially more nutrients from the site than tree length harvest methods due to the high concentration of nutrients in the branches and foliage (Maliondo et al. 1990). The possible effects of this nutrient removal include a decline in soil fertility (Wells and Jorgensen 1979, Perala and Alban 1982, Silkworth and Grigal 1982), loss of organic matter and a potential increase in site acidification (Maliondo et al. 1990).
6. The decomposition of logging slash is an important source of N for the next tree crop, especially on nutrient poor sites. With full tree harvesting there is often very little remaining debris (Gordon 1983), and this may lead to a N deficiency.
7. Theoretically, site acidification is thought to result from the removal of positive ions or cations (K, Ca, Mg and sodium (Na)) normally present in the branches and foliage of trees (Foster and Morrison 1987, Maliondo 1988). These cations normally buffer acid inputs from precipitation and from the decomposition of organic matter (Maliondo 1988).
8. Organic matter decomposition releases organic and inorganic acids as well as cations and may be accelerated after full tree harvesting due to increased soil temperature and moisture availability (Maliondo 1988).

Review of the combined issues in research.

- These observations indicate that calcium may become a limiting resource for the growth of forested ecosystems, ultimately predisposing forests to health problems such as increased mortality due to reduced resistance to pests and pathogens (Federer et al., 1989; Huntington et al., 2000; Adams, 1999)
- Whole-tree harvests can increase average nitrogen-removal rates in some temperate coniferous forests by 100 percent and in some temperate broadleaf forests by as much as 215 percent (Marion 1979). The actual increase in nutrient losses brought on by whole-tree harvesting varies greatly with species, age, and site productivity, but harvest methods removing more than just the stem result in substantially greater nutrient losses (Morrison and Foster 1979).
- Due to low soil Ca content and high Ca content in woody tissues, whole-tree harvesting depleted total ecosystem Ca to a much greater extent than N, P, or K. Soil reserves and atmospheric inputs may be adequate to sustain total N, P, and K supplies with whole-tree harvesting, but soil amendments may be necessary to sustain Ca supplies.
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- Theoretically, site acidification is thought to result from the removal of positive ions or cations (K, Ca, Mg and sodium (Na)) normally present in the branches and foliage of trees (Foster and Morrison 1987, Maliondo 1988). These cations normally buffer acid inputs from precipitation and from the decomposition of organic matter (Maliondo 1988).

Indicators of risk:

- The calcium/aluminum (Ca/Al) molar ratio of the soil solution provides a valuable measurement endpoint or ecological indicator for identification of approximate thresholds beyond which the risk of forest damage from Al stress and nutrient imbalances increases. The Ca/Al ratio can also be used as an indicator to assess forest ecosystem changes over time in response to acidic deposition, forest harvesting, or other processes contributing to acid soil infertility.
- Based on a critical review of literature on Al stress, we estimate that there is a 50:50 risk of adverse impacts on tree growth or nutrition when the soil solution Ca/Al ratio is as low as 1.0, a 75% risk when the soil solution ratio is as low as 0.5, and nearly a 100% risk when the soil solution Ca/Al molar ratio is as low as 0.2.
- The Ca:Al ratio of soils can be used to guide the location of soil disturbing activities and determine harvest method and rotation length.
- According to White and Harvey (1979), timber harvesting should be avoided on sites with very shallow to bedrock soils and marginal fertility. A significant proportion of the

nutrients are contained in the above ground biomass and the limited productivity of the site is maintained by the nutrient cycle.

- Sites sensitive to nutrient depletion as a result of full tree harvesting include those with medium to coarse textured soils and little humus, and sites with shallow soils.
- Bailey et al. 2004, 2005 propose that calcium levels below 2% in the B horizon is a threshold below which forest health will become susceptible to decline.
- Because of these biological responses to changes in the soil system, aluminum contents in biomass can be used to classify the health of forested ecosystems (Cronan and Grigal, 1995; Johnson et al., 1982)
- Forests on deeper soils are generally less susceptible to nutrient depletion from full tree harvesting than stands on shallow soils (Timmer et al. 1983). This is, in part, related to the absolute soil volume differences between the two soil depths and the associated differences in aeration, water retention and movement. On poor quality sites, in which a large proportion of the nutrient capital of the site is contained in the crown components, full tree harvesting may be more detrimental to long-term productivity.

Proposed management strategy and mitigations for the National Forest.

- Soil pH increased after fire and thinning+fire
- Timber harvesting practices may be modified in areas with low pH and low Ca:Al ratios because harvest methods can differentially affect nutrient cycling of the forest floor.
- As much as possible, all organic material should be left after any harvesting method to maximize the potential for re-supplying nutrients to the soil. Rather than clearing or removing downed trees, standing dead trees, and debris for firewood, it would be better to leave this material on the ground to decompose.
- Whole-tree harvesting after leaf fall reduced the potential drains of N, P, K, and Ca by 7, 7, 23, and 5%, respectively, compared with potential removal by harvesting during the growing season.
- Three measures are possible to mitigate Ca depletion reduction of acid deposition to preindustrial levels, restrictions on short-rotation whole-tree harvesting, and liming of vast forest areas on a scale similar to liming agricultural crops. Large-scale liming, perhaps at the same time as harvest, may be required if forest productivity is to be maintained at present levels.
- Full tree harvesting of hardwoods after leaf fall will remove less nutrients and in different proportions than harvesting when the trees are in full leaf. Removal of N, P and K would be halved, and most of the Ca and Mg would remain on the site (Freedman 1990) owing to the nutrient resorption characteristics of some hardwood species.

In other, more productive, soils on the Forest we suggest there is not conclusive evidence that whole tree harvest will affect soil productivity over our harvesting timelines. In response to possible increases in demand for alternative fuel sources during this planning period, we will allow whole tree harvesting on soils with higher buffering capacity and nutrient content. If research discovers that there are impacts from whole tree harvesting to less sensitive soils,

then project environmental analysis will show unacceptable reductions to soil productivity and design mitigations or alternatives to protect against these reductions.

c. Tentative Options or Proposed Actions for Change

C-1. Modify the Forest Plan by deleting George Washington NF Plan Common Standard 216 and modifying current GWNF Common Standard 211, page 3-145 by adopting Jefferson National Forest Plan forestwide standard FW-5 that says: "On all soils dedicated to growing vegetation, the organic layers, topsoil and root mat should be left in place over at least 85% of the activity area and revegetation should be accomplished within 5 years." Also, modify the current GWNF Common Standard 215, page 3-146, to allow whole tree harvesting in stands identified as having moderate to low risk of nutrient depletion and acidification.

C-2. Modify Common Standards 216 and 211 and do nothing to Common Standard 215.

C-3. Do nothing.

5. What are the Consequences of Not Changing?

The Forests will lose an opportunity to more closely align the two Forest Plans regarding the issue of soil productivity on the Forest. It will limit our ability to provide alternative fuel sources to help offset U.S. dependence on foreign energy supplies.

Proposed Action

Propose Option C1.

6. Recommendations for Plan Revision

Modify the standards described above in revised Plan.

D. Water Quality

1. What was the Plan Striving For?

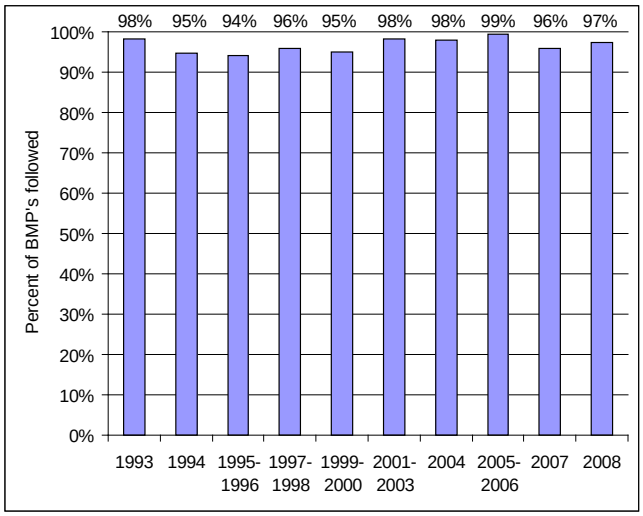
The Plan sought to maintain or improve water quality to meet demands for beneficial uses of water, both within and adjacent to the National Forest. To accomplish this goal the following measures were specified: In any project, water quality is protected from nonpoint source pollution through the use of standards that meet or exceed best management practices. On-site implementation of standards is monitored, as is their effectiveness in protecting water quality and maintaining the biological condition of streams. Results of monitoring are evaluated and practices adjusted as needed to protect beneficial uses. Watershed improvement projects are implemented in actively eroding areas where sediment is adversely affecting beneficial uses.

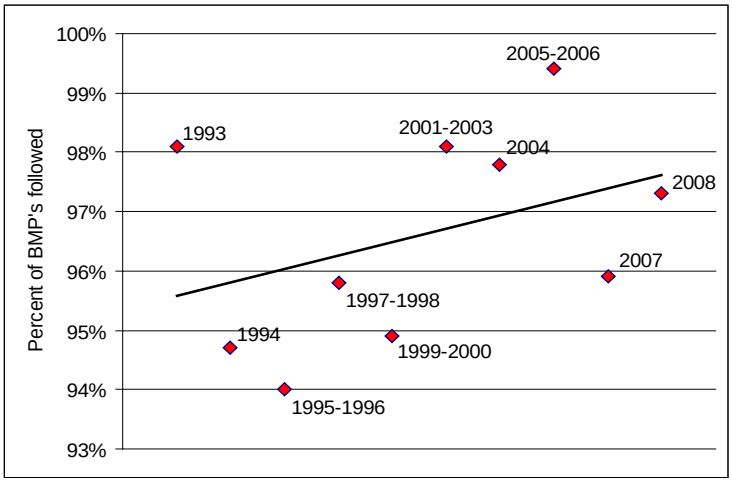
Specific objectives were: sedimentation rates are in equilibrium with the watershed and stabilize or improve the biological condition of the stream (EPA's Rapid Bioassessment Protocol II).

The Plan recognized that acid deposition, derived from off-Forest sources, was causing a decrease in alkalinities and a reduction in fish and aquatic insects in acid-sensitive streams. The Plan provided for mitigation through liming and other means on a very limited basis.

2. Where is the Plan Now?

Implementation Monitoring – Monitoring from 1993 to 2008 indicates that BMP implementation met or exceeded requirements 96.5 percent of the time.





Effectiveness Monitoring – Trends for aquatic macroinvertebrates were fully documented in Chapter 2 (Management Area 18) of the annual M&E reports since the 1997-1998 report.

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. 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. Only samples collected from March through the first week in June were compared to minimize seasonal variability in structure of macroinvertebrate communities. 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 below).

Paired samples t-test on pre and post MAIS scores from 18 different timber sales

Mean MAIS pre	16
Mean MAIS post	15
95% CI	-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 below).

Paired samples t-test on pre and post MAIS scores from 7 different prescribed burns

Mean MAIS pre	16
Mean MAIS post	16
95% CI	-1.098 to 1.669
P value	0.631

Chemical Water Quality Monitoring – Water quality in streams is a priority on the National Forest. Since 1988, almost 6,000 water samples have been analyzed from George Washington and Jefferson National Forest streams. Some streams have been part of a long term monitoring program and are sampled quarterly; others have had only one or two samples taken to characterize their chemical habitat. In response to concerns over the quality of water from the George Washington National Forest related to drinking water, Virginia water quality standards (State Water Control Board 2008) were compared to 5,532 water samples collected from streams on the national forest. To get a complete picture related to the public water supply water quality standards, measurements from both the George Washington and Jefferson National Forests, during all seasons, and all years were included in the analysis.

There are three chemical parameters listed in the Virginia water quality standards (VA WQS) that have been sampled consistently across the Forests; they are chloride, nitrate, and sulfate. A box and whisker plot was developed for each of these parameters from the National Forest dataset; in addition, the VA WQS was shown as a red horizontal bar in the charts. The top and bottom of the boxes in the plots represent the 25th and 75th percentiles (50% of all values fall within the box), the bar in the center of the box represents the median, whiskers represent the 10th and 90th percentiles (80% of all values fall within the whiskers), and closed circles represent the entire range of the data.

As seen in Charts 1-3, none of the 5,532 samples exceeded VA water quality standards for public water supply. In fact, as shown by the box, 90% of the samples are far below the water quality standard threshold.

Chart 1. Chloride measurements from 5,532 stream water samples taken on the GWJ National Forest related to the VA water quality standards for public water supply.

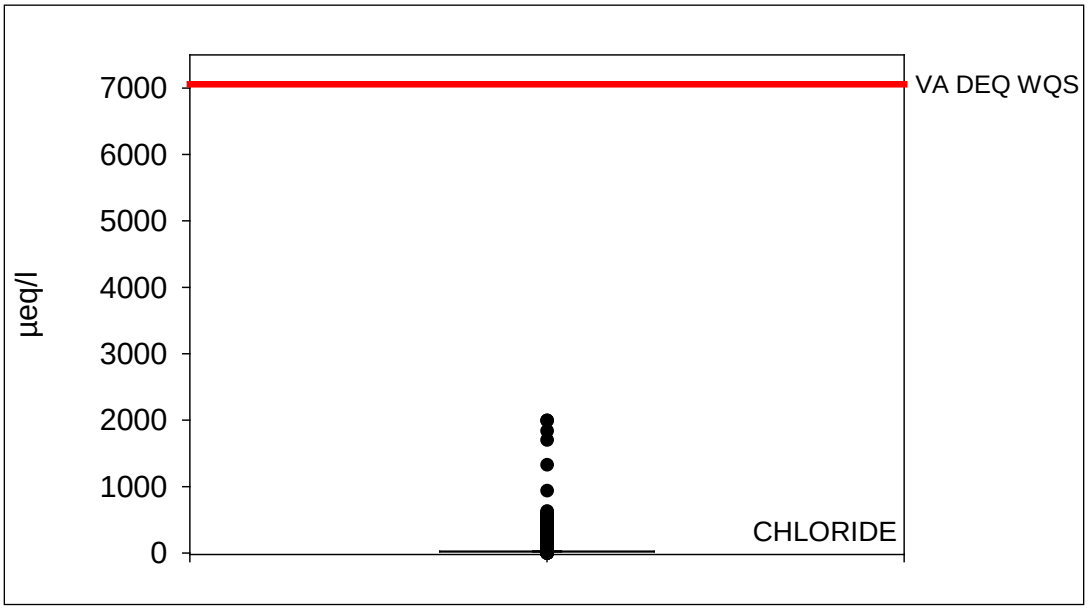


Chart 2. Nitrate measurements from 5,532 stream water samples taken on the GWJ National Forest related to the VA water quality standards for public water supply.

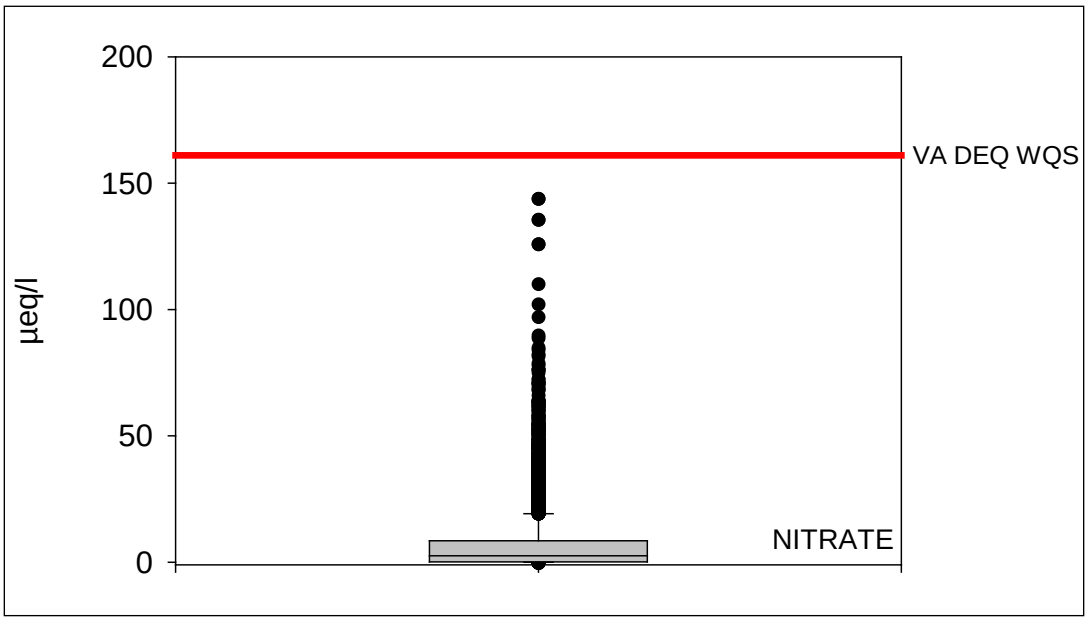
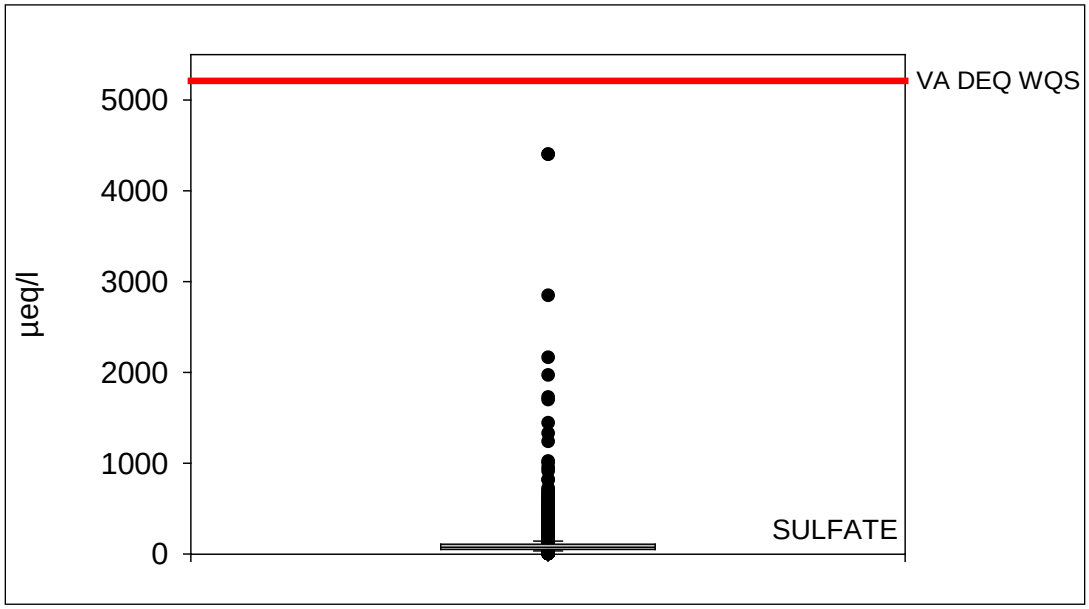


Chart 3. Sulfate measurements from 5,532 stream water samples taken on the GWJ National Forest related to the VA water quality standards for public water supply.



Reference:
2008. STATE WATER CONTROL BOARD. 9 VAC 25-260 Virginia Water Quality Standards. Statutory Authority: § 62.1-44.15 3a of the Code of Virginia. WITH AMENDMENTS EFFECTIVE October 2008

Impaired Streams – The 2008 303d reports for Virginia and West Virginia list 53 streams and 4 reservoirs on the Forest as being impaired. The sources of these impairments are off-Forest (including acid deposition), or are described as "natural." None of the impairments can be attributed to Forest management activities.

Impaired waters on the George Washington National Forest

Water Name	Cat.	Use	Impairment	Source
Pedlar River	5A	Recreation	E. coli	Non-point source
Cub Run [10th Leg. quad]	4A	Recreation	Fecal coliform, E. coli	Agriculture, NPS, wildlife
Big Run	5A	Recreation	E. coli	Agriculture, NPS, wildlife
North River	5A	Aquatic Life	pH	Atmospheric deposition
Thorny Branch	4A	Recreation	Fecal coliform	Non-point source
Briery Branch	5C	Aquatic Life	pH	Natural conditions
Narrow Passage Creek	5A	Recreation	Fecal coliform	Agriculture, NPS, wildlife
Cedar Creek	5A	Aquatic Life	Benthic macro bioassessments	Unknown
Loves Run	5A	Aquatic Life	pH	Atmospheric deposition
Pine Run	4A	Recreation	E. coli	NPS, wildlife
Back Creek	5A	Aquatic Life	Benthic macro bioassessments	Unknown
South Fork Shenandoah R	5A	Fish Consumption	Mercury in fish tissue	Contaminated sediments

Water Name	Cat.	Use	Impairment	Source
Falls Hollow	4C	Aquatic Life	Benthic macro bioassessments	Drought-related impacts
Tunnel Hollow x-trib	4C	Aquatic Life	Benthic macro bioassessments	Drought-related impacts
Beaver Creek	4A	Recreation	Fecal coliform	NPS, wildlife
Beaver Creek	4C	Aquatic Life	Temperature	Natural conditions
Rocky Run	5A	Aquatic Life	pH	Atmospheric deposition
Union Spring Run	5A	Aquatic Life	pH	Atmospheric deposition
Wolf Run	5A	Aquatic Life	Benthic macro bioassessments	Atmospheric deposition
Wolf Run	5A	Aquatic Life	pH	Atmospheric deposition
Dry River	5A	Aquatic Life	pH	Atmospheric deposition
Skidmore Fork	4C	Aquatic Life	Benthic macro bioassessments	Drought-related impacts
Coles Run	5A	Aquatic Life	pH	Atmospheric deposition
Johns Run	5A	Aquatic Life	pH	Atmospheric deposition
Kennedy Creek	5A	Aquatic Life	pH	Atmospheric deposition
Mills Creek	5A	Aquatic Life	Benthic macro bioassessments	Atmospheric deposition
Orebank Creek	5A	Aquatic Life	pH	Atmospheric deposition
Toms Branch	4C	Aquatic Life	Benthic macro bioassessments	Drought-related impacts
Cub Run [Elkton W quad]	5A	Recreation	Fecal coliform, E. coli	Agriculture, NPS, wildlife
Boone Run	5A	Recreation	Fecal coliform	NPS, wildlife
Little Dry River	4A	Recreation	Fecal coliform	NPS, wildlife
Little Dry River	5A	Aquatic Life	pH	Atmospheric deposition
Fridley Run	5A	Aquatic Life	Benthic macro bioassessments	Atmospheric deposition
Fridley Run	5A	Aquatic Life	pH	Atmospheric deposition
Mountain Run	4A	Recreation	Fecal coliform, E. coli	Agriculture, NPS, wildlife
Mountain Run	5A	Aquatic Life	Benthic macro bioassessments	Atmospheric deposition
Mill Creek [R'ham Co.]	4A	Recreation	Fecal coliform	Agriculture, NPS, wildlife
Mill Creek [R'ham Co.]	4A	Aquatic Life	Benthic macro bioassessments	Unknown
Laurel Run [Shen Co.]	5A	Aquatic Life	Benthic macro bioassessments	Atmospheric deposition
Little Stony Creek	5A	Aquatic Life	Benthic macro bioassessments	Atmospheric deposition
Stony Creek	4A	Recreation	Fecal coliform	Agriculture, NPS, wildlife
Stony Creek	5A	Aquatic Life	Benthic macro bioassessments	Agriculture, NPS, wildlife
Stony Creek	5A	Aquatic Life	Temperature	Unknown
Passage Creek	5A	Recreation	Fecal coliform	Agriculture, NPS, wildlife
Tye River	5A	Aquatic Life	Temperature	Unknown
Tye River South Fork	5A	Aquatic Life	Temperature	Unknown
Jackson River	5C	Aquatic Life	Temperature	Natural conditions
Jackson River	5A	Recreation	E. coli	NPS, wildlife
Laurel Run [Bath Co.]	5A	Aquatic Life	pH	Atmospheric deposition
Panther Run	4C	Aquatic Life	Benthic macro bioassessments	Drought-related
Pheasanty Run	4A	Aquatic Life	Benthic macro bioassessments	Aquaculture (permitted)
Porters Mill Creek	5A	Aquatic Life	pH	Atmospheric deposition
South Fork Pads Creek	4C	Aquatic Life	Benthic macro bioassessments	Drought-related
Calfpasture River	5A	Recreation	E. coli	Agriculture, NPS, wildlife
Mill Creek [Bath Co.]	5A	Recreation	Fecal coliform, E. coli	Agriculture, NPS, wildlife
Little Calfpasture River	5A	Recreation	Fecal coliform	NPS, wildlife
Saint Marys River	5A	Aquatic Life	pH	Atmospheric deposition
Wilson Creek	5C	Aquatic Life	Temperature	Drought-related impacts; unknown
Potts Creek	5A	Recreation	E. coli	Livestock, septic systems, wildlife
Potts Creek	5C	Aquatic Life	pH (> 9.00)	Unknown
Coles Run Reservoir	5A	Aquatic Life	pH	Atmospheric deposition

Water Name	Cat.	Use	Impairment	Source
Elkhorn Lake	5A	Aquatic Life	pH	Atmospheric deposition
Staunton Dam Lake	5A	Aquatic Life	pH	Atmospheric deposition
Switzer Lake	5A	Aquatic Life	pH	Atmospheric deposition
Switzer Lake	5A	Aquatic Life	Temperature	Unknown
Capon Run	5		Biological	Unknown
Hawes Run	5		Biological	Unknown
Miller Run	5		Biological	Unknown

Category 4A - water is impaired or threatened for one or more designated uses; TMDL has been completed.
Category 4C - impairment is not caused by a pollutant and/or is caused by natural conditions; no TMDL is required.
Category 5A - water is impaired or threatened for one or more uses by a pollutant(s); TMDL is required.
Category 5C - water quality standard is not attained due to "suspected" natural conditions; may require a TMDL; WQ Standard may be reevaluated due to the presence of natural conditions.
Category 5 – water is impaired, and a TMDL is needed (West Virginia).

The 2008 Water Quality Assessment for Virginia lists 54 impairments on the Forest, affecting 50 streams and four reservoirs. For 11 of the stream impairments, the cause is a natural condition, and no Total Maximum Daily Load (TMDL) allocation is required; or the cause is a "suspected" natural condition, and a TMDL may or may not be required. For another 21 stream impairments, the source is atmospheric deposition.

For all the other 28 stream impairments, much more of the stream's length is on private land than on Forest Service land, and almost all the samples on which these impairments were based were collected miles downstream from Forest Service land. The predominant sources for these impairments are agriculture, nonpoint sources, and wildlife. For seven impairments, the source is listed as unknown.

TMDL reports have been completed for five of the impairments. One deals with aquaculture. The other four, which are for bacteria, identify agriculture as the main source of pollution, with wildlife as a secondary source. None of these TMDL reports identify activities related to forest management as a significant source.

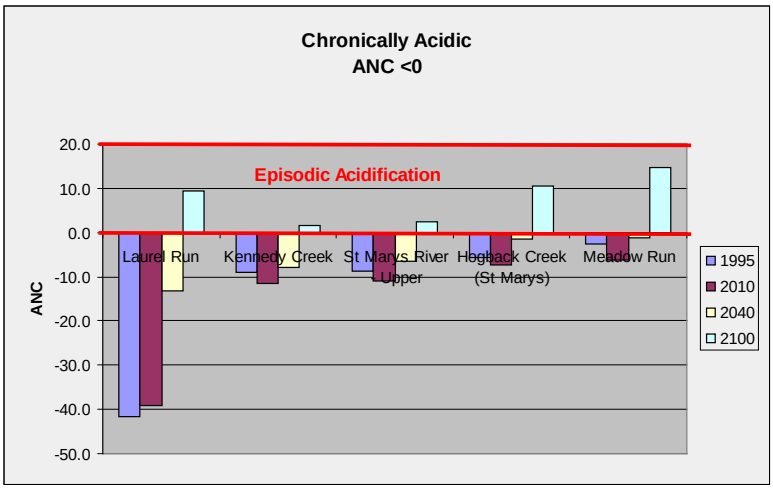
In summary, none of the stream impairments can be attributed to Forest management activities.

For Coles Run Reservoir, Elkhorn Lake, Staunton Dam Lake, and Switzer Lake, the impairment is low pH, due to atmospheric deposition. Switzer Lake is also listed with a temperature impairment, with the source being unknown. Again, none of the impairments can be attributed to Forest management activities.

The 2008 West Virginia Integrated Water Quality Monitoring and Assessment Report lists three impaired streams that are on the Forest: Capon Run, Hawes Run, and Miller Run. For all of these streams, the criterion affected is biological, the source is unknown, and a TMDL is needed. For each of these, most of the stream's length is on private land, and the impairment cannot be attributed to Forest management activities.

Acid Deposition– Water quality has been systematically monitored on Forest streams since 1987. 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 project the future chemical 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. Modeling conducted by the Southern Appalachian Mountain Initiative (SAMI) and reported in their 2002 publication on acid deposition showed that even with the sulfate deposition declining considerably, as new air regulations are implemented, stream recovery will be slow or non-existent over the next 100 years. Chronically acidic streams may improve slightly and be only episodically acidic by 2100, but they will still be marginal for brook trout.

Due to the lengthy recovery time anticipated for acidified streams on the Forest, selective liming to improve water chemistry will continue to be considered.

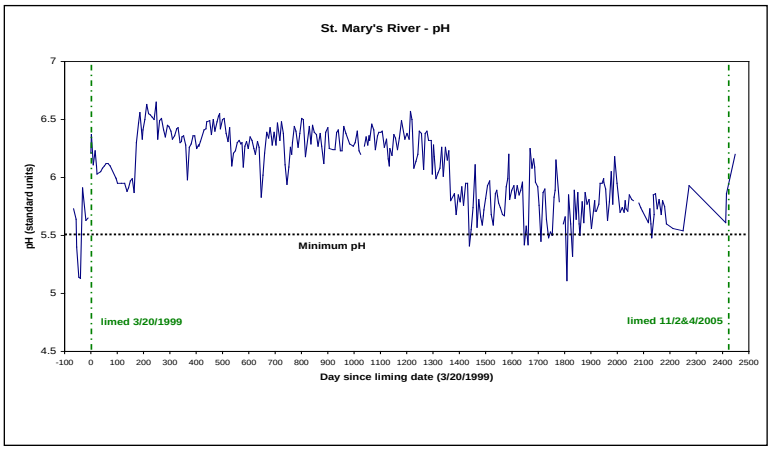


The following streams have been limed on the GW Forest since 1989:

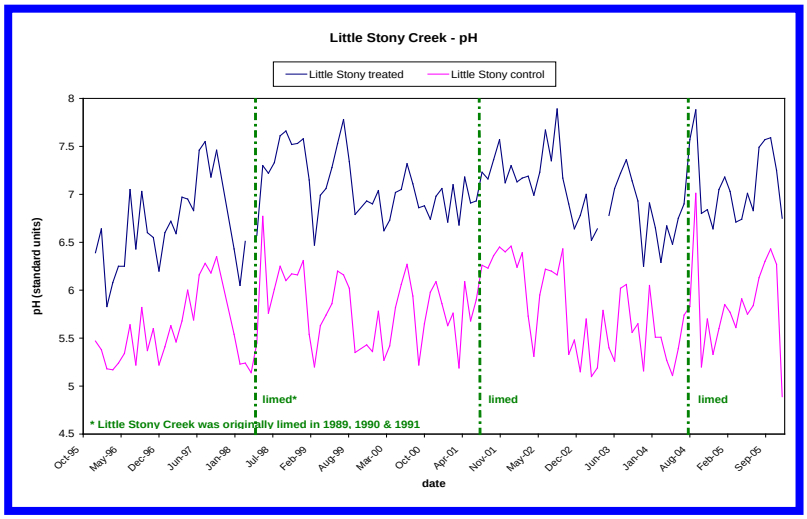
George Washington National Forest Stream and Lake Liming

Date	Stream	County
1990, 1997	Cedar Creek	Shenandoah
1993, 1994, 1997	Laurel Run	Shenandoah
1997, 2000, 2003, 2006	Little Passage Creek	Shenandoah
1989, 1990,1991, 1998, 2001, 2004, 2007	Little Stony Creek	Shenandoah
1990, 1998, 2001, 2007	Mill Creek	Shenandoah
1993,1997, 1999, 2002, 2005, 2008	Mountain Run	Rockingham
1999	St. Mary's River & 5 tribs	Augusta
2005	St. Mary's River & 6 tribs	Augusta
1995, 1996, 1997, 1998, 1999	Trout Pond Run	Hampshire, WV

Trends in pH for several of the limed streams are shown below.



Additional trend information on the effects of acidification and liming is documented in Appendix G, Brook Trout and Wild Trout section, of the annual M&E reports since the 1997-1998 report.



Reference watershed – There are no reference watersheds designated in the Forest Plan. Reference watersheds would be representative of those watersheds in which existing water quality conditions are considered to be the "best attainable" for the ecological sub-section under relatively undisturbed, natural conditions. Monitoring of water quality and other stream characteristics would provide reference conditions against which other watersheds could be compared. Reference watersheds for high gradient Forest streams would complement reference watersheds for low gradient streams that are being monitored by the Virginia Department of Forestry. The following criteria were used to evaluate potential reference watersheds:

- Perennial flow – based on fisheries designations in the "streams" GIS layer
- Management Areas that maintain relatively undisturbed conditions, with a low level of human intervention or impact

- Past monitoring – preferably with Virginia Trout Stream Sensitivity Study (VTSSS) sites
- Good water quality
- Accessibility
- A range across ranger districts and physiographic provinces

Based on the above criteria, the following is a list of potential watersheds on the north half and south half of the GWNF. All of these have VTSSS monitoring sites.

- North Fork Simpson Creek – James River RD
- Little Cove Creek – Glenwood/Pedlar RD
- Morgan Run – Lee RD
- Ramseys Draft – North River RD
- Lost Run – Warm Springs RD

Morgan Run and North Fork Simpson Creek, however, have some low pH and ANC measurements. Possible alternatives to Morgan Run on the Lee RD are Browns Run and upper Boone Run; but upper Boone Run has no past monitoring and has 79 acres of private land.

On the James River RD, an alternative to North Fork Simpson Creek might be Dolly Ann Hollow, but there has been little monitoring there, and the geology and preliminary sampling indicate that it might have similar problems with pH and ANC.

Other potential reference watersheds might be Jerkemtight Branch and Little River on the North River RD. Jerkemtight Branch watershed includes 563 acres of currently suitable timberland in MA 15. The 1949 flood caused debris flows in the Little River watershed, and the stream channels may not be fully stabilized.

None of the alternative watersheds have VTSSS monitoring sites.

Potential Reference Watersheds
By Management Area and Timber Suitability

Potential Reference Watershed	4A	4E	5B	6	7B	8	9B	14A	14C	15A	15C	16D	21B	21C	21D	Total
Land Suitable for Timber Production	No	No	No	No	Yes	No	No	No	Yes	No	Yes	Yes	No	No	No	
Browns Run*	1,084		3					159	9		26					1,281
Lost Run													592			592
Morgan Run							817									817
Boones Run*			79				1,497									1,576
Ramseys Draft						6,290	8									6,298
Jerkemtight Branch							1,649			1	563					2,213
North Fork Simpson Creek						1,883	17									1,900
Dolly Ann Hollow	1,072				1		242									1,315
Little Cove Creek				194										673		867
Little River		36										6			9,970	10,012
Totals	2,156	36	82	194	1	8,173	4,230	159	9	1	589	6	592	673	9,970	26,871
For Boones Run, all 79 acres of 5B are private; for Browns Run, 13 acres of 4A are private and 7 acres of 14A are private.									Total Suitable Timber Land Acres Potentially Affected is 605							

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes. Monitoring indicates that the Plan is protecting water quality during management activities. Additionally, several streams were limed to improve water chemistry in acidified streams. Restoration projects were implemented in a number of areas where active erosion was affecting water quality.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? Designation of reference watersheds is desirable to facilitate the collection of water quality data that can be used as a reference data set.

Other changes (beyond those suggested under Riparian Areas) are not needed. Monitoring indicates that the Plan is protecting water quality during management activities. Sources of stream acidification are beyond the Forest's control. The Plan provides for mitigation of stream acidification through liming.

c. Tentative Options or Proposed Actions for Change

C-1. Designate reference watersheds and establish as separate management areas the following five locations so that there is one per Ranger District: North Fork Simpson Creek, Little Cove Creek, Morgan Run, Ramseys Draft, and Lost Run.

C-2. Designate the same locations above as reference watersheds; acknowledging they lie beneath other existing and compatible Plan management areas (as in the Jefferson Forest Plan).

5. What are the Consequences of Not Changing?

Without reference watersheds, there will be a lack of reference water quality data that can be compared to data from watersheds with more disturbances or management such as those watersheds that have been prescribed burned. Reference watersheds are included in the Jefferson Forest Plan, but these are not representative of all ecological sub-sections on the GW. Coordination with the Department of Forestry in water quality monitoring will be less complete.

Proposed Action

Propose Option C2.

6. Recommendations for Plan Revision

Identify the locations of the reference watersheds in the revised Plan.

G. Fire

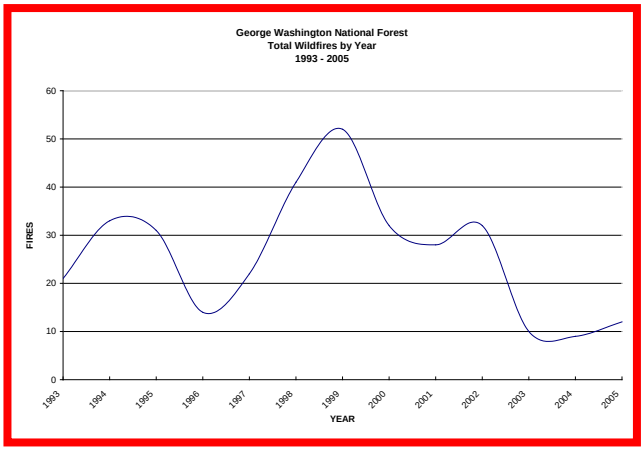
1. What was the Plan Striving For?

The 1993 GW Plan addressed wildland fire suppression by stating that, "Wildfires are suppressed (either through confinement, containment or immediate control) using the least cost methods commensurate with the resource values at risk, the potential for human injury, the management area suppression objectives and the availability of manpower and equipment" (Plan page 2-32.)

Prescribed fire was addressed to achieve specific management objectives. A burning program of approximately 3,000 acres per year was to improve fire-dependent ecosystems and wildlife habitat, maintains open areas along the Appalachian Trail, and restore and maintain some threatened, endangered, and sensitive species habitats (Plan page 2-32).

2. Where is the Plan Now?

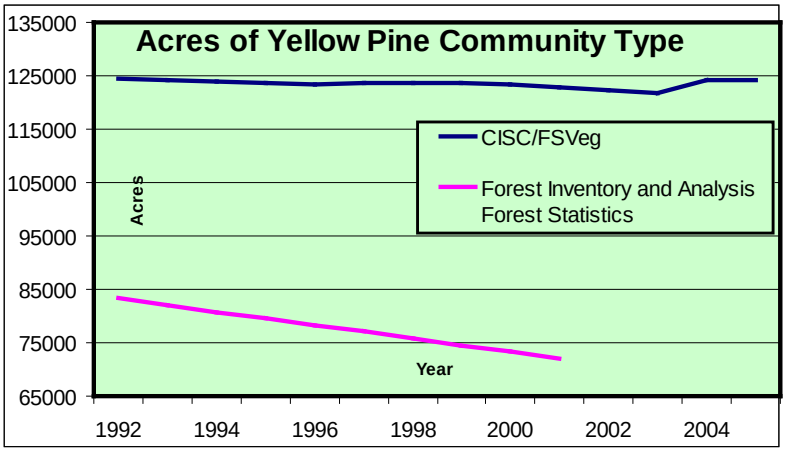
Managing unplanned ignitions for resource benefits was not discussed because it was not a fire management option in 1993.



Wildland fire occurrences vary greatly from year-to-year. Annual variations and cycles in weather have an effect on fuels and lightning caused ignitions and hence the number of fire starts and eventual size. Analysis of climatic fluctuations shows that dry (sometimes drought) conditions occur about every 5-6 years which lead to periods of sustained high fire danger and subsequent high fire occurrence. Typically, it is during these years that the George Washington National Forest has experienced its largest fires. Between these dry years wetter conditions exist that lead to fewer wildland fires, but in turn create opportunities for increased prescribed fire activities. Conversely the Forest's years of higher wildland fires are also the years where a limited number of prescribed fire acres are typically accomplished.

YELLOW PINE COMMUNITY - The Yellow Pine Forest Community (combined forest types dominated by yellow pine tree species) was selected as a Management Indicator Species 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 and woodlands. This community is dependent on recurrent fire for maintenance and regeneration.

To track the yellow pine community the GWNF CISC/FSVeg database and Forest Inventory data on forest types and acres was used. Based on CISC/FSVeg information the number of acres of yellow pine forest types across the GWNF has been decreasing to stable over the past 13 years. Forest Inventory data from 1982 to 2001 shows a more dramatic decrease in the number of acres of the yellow Pine Community. 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.



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 and woodlands. This community is dependent on recurrent fire for maintenance and regeneration.

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, makes 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 (USDA 1996, Williams 1988). 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 the lack of disturbance in the absence of fire and those management activities associated with prescribed fire. Disturbance events that affect this community but are not necessarily direct management activities include episodes of bark beetle infestations and wildland fire occurrences of human or lightning origin.

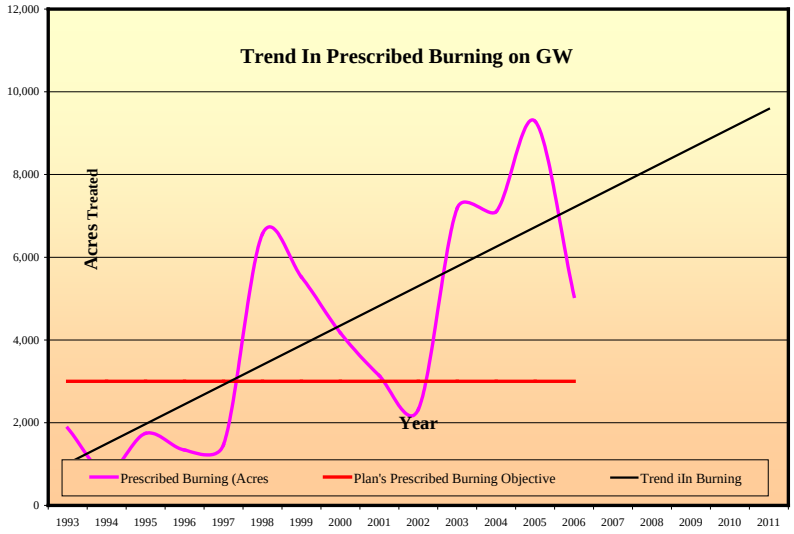
To track the yellow pine community the GWNF CISC database and Forest Inventory data on forest types and acres was used. Based on CISC information the number of acres of yellow pine forest types across the GWNF has been decreasing to stable over the past 12 years. The changes may be greater than indicated 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. More than 85% of the yellow pine stands on the GWNF are over 80 years old. As these pine dominated 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 3% 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.

Agency management activities are limited to prescribe 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 fire have increased in recent years 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 fire 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.

Recommendations in revising the GW Plan include implementation of more prescribed fire and unplanned ignitions managed for resource benefits in those areas with a yellow pine component.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes. Prescribed fire exceeded the Forest's yearly objective of 3,000 acres per year. Prescribed fire is any fire intentionally ignited to meet specific land management objectives, such as to reduce accumulated flammable fuels, or restore ecosystem health. Prescribed fire is a management tool that when used under specifically controlled conditions helps land stewards manage forests for multiple uses.



Prescribed fires are used on public lands in order to improve forest health, and reduce large wildfires. Prescribed fire is used only under appropriate conditions and in appropriate sites. Fire plays an important and critical role in influencing vegetation and the lifecycles of trees and plant communities. Many species are dependent on fire. Prescribed fire helps the Forest Service achieve improved forest health and will help reduce the threat of large fire events. Prescribed fire allows the Forest Service to control the effects of fire, its location and intensity. Prescribed fires are used to reduce the intensity and magnitude of bigger wildfires by reducing the accumulation of flammable fuels.

Current estimates indicate that at least 90% of the GW is in Condition Class 3 which is highly departed from natural vegetation-fuel composition and fire frequency severity.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? The National Fire Plan (NFP) was developed in August 2000, following a landmark wildland fire season, with the intent of actively responding to severe wildland fires and their impacts to communities while ensuring sufficient firefighting capacity for the future. The NFP addresses five key points: firefighting, rehabilitation, hazardous fuels reduction, community assistance, and accountability.

Subsequently, in January 2001 a list of communities at risk was issued in the Federal Register. This notice provides an initial list of urban wildland interface communities in the vicinity of Federal lands that are at high risk from wildfire. Using only Virginia Department of Forestry data that continues to evolve from the initial Federal Register notice, about 66 woodland communities are within ½ mile of the National Forest System boundary while an additional 33 are within 1 ½ miles.

The National Fire Plan spawned the 10-Year Comprehensive Strategy issued in August 2001. This strategy reflects the views of a broad cross-section of governmental and nongovernmental stakeholders. It outlines a comprehensive approach to the management of wildland fire, hazardous fuels, and ecosystem restoration and rehabilitation on Federal and adjacent State, tribal and private forest and range lands in the United States. This strategy emphasizes measures to reduce the risk to communities and the environment and provides an effective framework for collaboration.

The primary goals of the 10-Year Comprehensive Strategy are:

1. Improve Prevention and Suppression
2. Reduce Hazardous Fuels
3. Restore Fire Adapted Ecosystems
4. Promote Community Assistance

Furthermore, the Healthy Forests Initiative (HFI) was launched in August, 2002 with the intent to reduce the risks severe wildfires pose to people, communities, and the environment. By protecting forests, woodlands, shrub lands, and grasslands from unnaturally intensive and destructive fires, HFI helps improve the condition of public lands, increases firefighter safety, and conserves landscape attributes valued by society.

In addition, the incentive for communities to engage in comprehensive forest planning and prioritization was given new and unprecedented impetus with the enactment of the Healthy Forests Restoration Act (HFRA) in January 2003. This landmark legislation includes the first meaningful statutory incentives for the US Forest Service (USFS) and the Bureau of Land Management (BLM) to give consideration to the priorities of local communities as they develop and implement forest management and hazardous fuel reduction projects. In order for a community to take full advantage of this new opportunity, it must first prepare a Community Wildfire Protection Plan (CWPP). Community Wildfire Protection Plans may address issues such as wildfire response, hazard mitigation, community preparedness, or structure protection—or all of the above.

The National Fire Plan and all its accompanying policies and acts have set forth a process where the Federal Agencies and local communities discuss issues like wildland fire response, hazard mitigation, community preparedness, and structure protection then develop a Community Wildfire Protection Plan (CWPP). The agencies would then give consideration to prioritize fuels treatments where these CWPP were developed.

In January 2001, the Federal Wildland Fire Management Policy was implemented and is further clarified by the 'Guidance for Implementation of Federal Wildland Fire Management Policy' issued in February 2009. In part, this policy allowed for wildland fire to be recognized as an essential ecological process and natural change agent that can be used to protect, maintain and enhance resources. Managing unplanned ignitions for resource benefits is designed to allow naturally (i.e. lightning) ignited wildland fires to burn in a natural state providing resource benefits to the ecosystem, based on objectives established in the Forest Plan.

Finally, an important need for change is the recognition of the role and extent that fire historically played in shaping Appalachian ecosystems and the myriad of plant and animal species they support. Recent research across the GWJNF using dendrochronology and fire-scarred trees show that from the early 1700's until the 1930's 75% of fires occurred in areas dominated by yellow pine, yellow pine-oak, and oak-yellow pine at a lower and upper level of 1 – 9 years. These were typically low

intensity understory fires but more intense stand replacement fires occurred approximately 75 to 100 years, likely during times of very dry fuel conditions. Fires occurring at approximately this level of frequency would shift what is now a closed canopy, dense midstory forest with numerous shade tolerant and fire-intolerant trees such as red maple and white pine towards a more open woodland with many canopy gaps and an open midstory and favor trees, shrubs and grasses such as oaks, blueberries, huckleberries, and bluestems that are adapted to increased levels of sunlight.

Land management agencies have done a tremendous job educating the public about the dangers of wildland fire and reducing the number of human caused fires. However, it is important to realize that not all fire is bad. In fact, many of GWNF ecosystems are dependent on fire.

1. Fire historically crept through these areas with low intensity.
2. Every 5 to 9 years, fire regenerated the forest and cleansed the under story of potential hazardous fuels. These historic fires were not the devastating wildfires of recent years. Frequent cool fires acted as a natural agent reducing surface fuels and all but eliminated large, stand replacing, fire events that have become too frequent during the last three decades.
3. Open woodlands supported many plants and animals now rare or of public interest such as table mountain pine, golden-wing warblers, turkeys, blueberries, and whitetail deer. The Bird Conservancy has identified eastern deciduous forests of early successional habitat as one of the most threatened bird habitats in the United States.

The Forest Service has made it a priority to reintroduce fire into fire dependent ecosystems to help promote ecosystem health. Prescribed fire is viewed by the land management agencies as an agent of change that helps return an ecosystem to its historic range.

Fire has been a natural part of this forest's ecosystem for a very long time. Throughout time wildfires ignited and burned naturally throughout the forest. Some were caused by lightning and some were intentionally started by Native Americans. These low intensity fires in the past kept the forest floor free from the natural annual build up of tree needles, dead grass, thick brush, and dead trees. As a result, fire has shaped vegetation patterns and wildlife distributions in the National Forest (Lynch 1999, Brown 2000, Brown 2004, Patterson).

The absence of wildland fire has allowed unnatural amounts of forest fuels to accumulate, what once were open woodlands to become closed forests, and allow some invasive plant species to move into areas and disrupt ecosystem diversity and functioning. The emphasis should be to return the Forest to its natural biodiversity which will improve forest health and lower the risk of catastrophic high intensity fires. Managing unplanned ignitions for resource benefits is one means to restore and maintain that biodiversity.

By increasing the Forest's prescribed fire objective, the forest can begin to move towards a Condition Class 2 and eventually Condition Class 1 where we are within the natural or historic range of vegetation and fuel composition as the result of more frequent and lower severity fires. An increased objective on using prescribed fire, particularly in those

areas where the current ecosystem condition has departed markedly (Fire Regime Condition Class 3) from historic reference conditions (FRCC I) and where Wildland Urban Interface (WUI) meets National Forest managed lands.

c. Tentative Options or Proposed Actions for Change

C-1. Modify the Forest Plan by:

a) Identifying that unplanned ignitions may be managed for resource benefits is a suitable use everywhere on the George Washington National Forest, acknowledging that the safety of firefighters and general public and the protection of life and property are the highest priorities: and if a lightning fire breaks out, procedures in the *Wildland Fire Use Implementation Procedures Reference Guide* http://www.nifc.gov/fire_policy/pdf/wildland_fire_use_guide.pdf will be used.

b) Increasing the prescribed fire objective to an annual program of 10,000 to 15,000 acres on the GW.

c) Identifying a forestwide desired condition by adopting Jefferson Forest Plan goal #18 that says "Fire regimes are within their historical range as defined by Condition Class 1. Condition class is a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, stand structure, successional stage, stand age, and canopy closure. Fire regimes in Fire Condition Class 1 are within historical ranges. Vegetation composition and structure are intact. The risk of losing key ecosystem components from the occurrence of wildland fire remains relatively low."

d) Increasing the prescribed fire objective on the Forest to begin to restore the Yellow Pine Community Type.

C-2. Do nothing. Maintain current prescribe burning objective of 3,000 acres per year.

5. What are the Consequences of Not Changing?

The GW National Forest uses prescribed fire and mechanical treatments to reduce the risk of unwanted wildland fire, improve wildlife habitat, and increase oak regeneration in the Central Appalachian Mountains. The historic suppression of fire has resulted in a lack of periodic, lower intensity fire in the forest. The absence of these low intensity fires has increased the risk of large fire events and, we believe, has negatively impacted the health of the forests.

Due to successful prevention and suppression efforts, fire patterns were markedly altered during the past century. In the absence of fire, massive insect and disease epidemics and various other forest health problems have proliferated and can continue.

Unmanaged wildfires threaten public safety, impair forest and ecosystem health, and degrade air quality. The absence of periodic, low intensity fires have increased the risk of large fire events and has negatively impacted the health of the GWNF forests.

Unmanaged wildfires can pose serious threats to public health and safety, as well as to air quality. Because the fires are uncontrolled, they pose significant threats to the safety of firefighters and general public and destroy property. The intense or extended periods of smoke associated with uncontrolled fires can also cause serious health problems and significantly decrease visibility.

Fire exclusion practices have resulted in forests being plagued with a variety of problems, including overcrowding resulting from encroachment of species normally eliminated by fire; vulnerability of trees to insects and disease; and inadequate reproduction of fire resistant species. In addition, heavy accumulation of fuel -- dead vegetation of forest floors-- can cause catastrophic fires, threaten public safety, impair forests and ecosystem health, and degrade air quality.

In summary, the consequences of limiting prescribed fire and managing unplanned ignitions is that greater concentrations of hazardous fuels, continued decline in forest health, increased risk of smoke pollutants, and the increased risk to the Wildland Urban Interface.

Proposed Action

Propose Option C1.

6. Recommendations for Plan Revision

Define and identify fire's role, including unplanned ignitions, in the ecosystem. Include the intent of Jefferson Forest Plan goal #18 in the desired condition for the revised Plan. Also acknowledge that some of the Forest will be suitable for the use of unplanned ignitions to restore and maintain desired ecological conditions and that safety of firefighters and general public and the protection of life and property are the highest priorities. Define the values to be protected from and/or enhanced by managing unplanned ignitions. Increase the objective for planned wildfire to meet restoration and maintenance needs for the yellow pine community and other vegetative communities across the Forest. As a strategy continue work with partners including The Nature Conservancy to improve understanding of the need for managing wildfire and to manage unplanned ignitions for resource benefits across the landscape.

H. Air

1. What was the Plan Striving For?

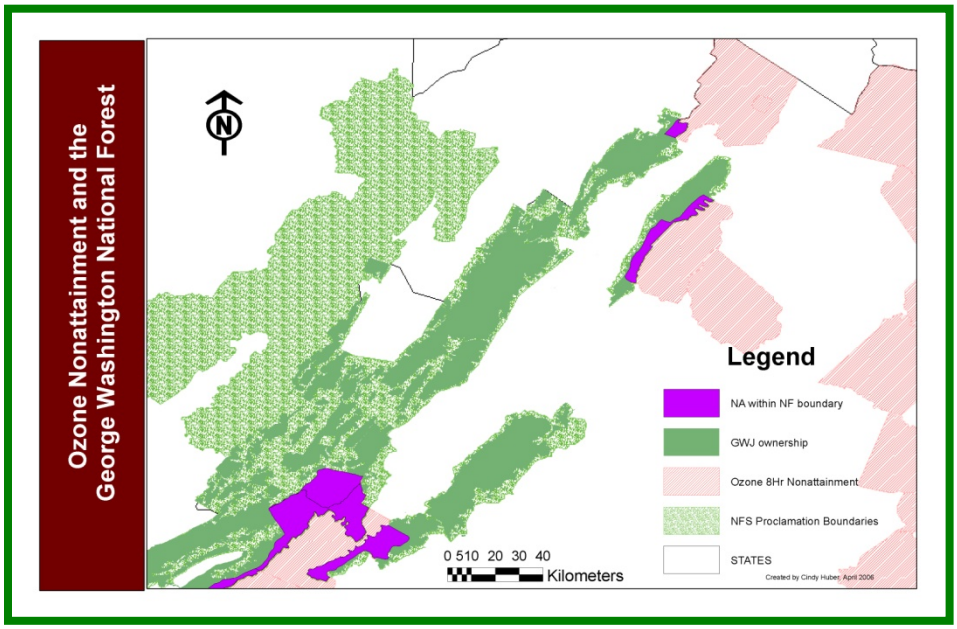
The Plan recognized that regional sources of air pollution outside the control of the Forest, such as acid deposition, were affecting forest resources. The Plan outlined a process for determining air pollution effects to resources and transmitting those to the appropriate air regulatory agencies for consideration as air quality policies and regulations are developed.

The Plan also recognized that State air quality laws become the boundaries for Federal actions, and that all activities, including permitted activities, must be conducted in a manner compliant with the State Implementation Plan.

2. Where is the Plan Now?

The Forest, with the help of partners, is working well with state and federal agencies charged with environmental protection (VDEQ, EPA) to incorporate information on air

pollution effects into new policies and regulations. These are discussed further under the resource sustainability issues of water quality and soil productivity.



Since the Plan was written, new air quality policies and regulations have been promulgated that could affect forest management. EPA has promulgated the Regional Haze Rule, issued an Air Quality Policy on Wildland and Prescribed Fire, and designated new ozone and fine particulate nonattainment areas. These actions have implications for fire management on the Forest.

The new Wildland Fire Air Quality Policy increases the need for rigorous smoke management and consideration of alternative fuel treatments. The Regional Haze Rule has resulted in scrutiny of all emission sources that could contribute to visibility impairment, including wildland fire. And where nonattainment areas coincide with national forest land, forest activities are subject to the general conformity regulations of the Clean Air Act. The General Conformity Rule states that federally funded actions must conform to state air quality laws and especially not impede the state's progress toward attainment of National Ambient Air Quality Standards. This means the Forest must make a conformity determination prior to implementing projects that fall within areas designated as nonattainment (not attaining the national ambient air quality standards) or maintenance (previous nonattainment areas). The Forest, working with the Regional Planning Organization VISTAS, has improved current and predicted future wildland fire emissions estimates in state inventories used to develop strategies for improving visibility in Class I areas as well as attainment of national ambient air quality standards. This is important and beneficial for the fire management program, because it will make future conformity determinations simpler. The conformity determination will still require additional time and effort during project planning. Under the current designations, this directly affects the Lee District.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes.

b. Why? Minor changes to the existing standards are warranted to clarify Forest Service actions under the current and projected air quality situation and regulations. Air quality standards are becoming more stringent. At the same time, the Forest is increasing the use of fire as a management tool. It is important that the Plan is clear in how the Forest will manage smoke as air regulations change.

c. Tentative Options or Proposed Actions for Change

C-1. Modify the Forest Plan by:

a) Making administrative changes to some existing standards and eliminate those that are already addressed in laws, regulations, or policy.

b) Adopting as standards and guidelines the following Jefferson Plan standards:

1. Adopt Jefferson Plan Standard FW-142 that states: "Best available smoke management practices should be used to minimize the unfavorable effects on public health, public safety and visibility in Class I areas (James River Face Wilderness and Shenandoah National Park) from prescribed fire. *(FSM 5144 and Region 8 Supplement)"*
2. Adopt Jefferson Plan StandardFW-143 that states: "Prescribed burning should be conducted only when meteorological conditions indicate that smoke can be carried away from non-attainment areas with a forecasted Air Quality Index (AQI) of Code Orange or higher. Prescribed burning should not be conducted in any area that is forecasted with an AQI of Code Red or higher."

C-2. Do nothing.

5. What are the Consequences of Not Changing?

There will be a lack of clarity in the air quality section of the Plan.

Proposed Action

Propose Option C1.

6. Recommendations for Plan Revision

Include the standards and guidelines as described above.

I. Groundwater, Caves and Karst

1. What was the Plan Striving For?

The Forest Plan addresses groundwater through its discussion of water quality. The Forest Plan strove to recognize the importance of producing abundant clean water for the uses on the Forest and of responding to the increasing public and resource needs in watersheds draining from the Forest. The Forest Plan emphasized maintaining or improving water quality to meet demands for beneficial uses of water, both within and adjacent to the National Forest. Furthermore, in any project, water quality was to be protected from nonpoint source pollution through the use of standards and guidelines that met or exceeded best management practices. (Forest Plan, page 2-31).

Forestwide standard # 124 states that "Aquifers and public water sources are identified and protected by consulting with States to ensure compliance with their ground water protection strategies." This standard is applied when herbicides are being contemplated. Additional information is in the Water Quality section of the report.

Groundwater aquifers most susceptible to contamination from human sources are limestone and dolomite (carbonate geologic formations). Over geologic time, limestone and dolomite dissolve in surface and ground water, and often develop karst terrain characterized by sinkholes, caves, underground drainage, and sinking streams. In karst terrain, surface waters can sink rapidly into the underground and enter the ground water with little or no filtering.

2. Where is the Plan Now?

The recognition of these resources has increased as part of Plan implementation.

The Forest Plan did not provide standards specific to sinkholes or other karst features. Karst areas on the Forest are limited, but interesting geologic features. Since approval of the Forest Plan in 1993, the sinkhole activity at the Trout Pond Recreation Area in West Virginia has been very active, particularly during and after intense rainstorms. The sinkhole activity affects recreation activities and infrastructure.

Likewise, drinking water from springs, wells and bottled water is a groundwater use on the Forest. A few special uses extract water for commercial and residential use.

Some karst areas, such as Maple flats, were protected as Special Interest Areas – Biologic in the Forest Plan. See the Plan's Management Area 4 discussion (Plan pages 3-4 to 3-8.)

Limestone geology is known for its karst features. Many Virginia counties are concerned about groundwater, particularly in karst topography. Counties are attempting to avoid, regulate, or discourage development within areas characterized by karst topography so as to minimize groundwater pollution, thereby protecting long term groundwater quality.

An increase in development and groundwater use near the Forest is a potential impact to karst and groundwater. Interbasin transfer of surface water and groundwater on private land is another emerging situation with potential to affect the Forest.

Geological inventories conducted for existing or proposed management activities help to identify and protect karst and groundwater.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes. Water quality and riparian area standards have protected groundwater. The Water Quality section of the report discusses monitoring that shows water quality of stream flow has been protected. Stream flow is predominantly fed by groundwater flow. Thus the monitoring that shows stream water quality has been protected also indicates groundwater quality has been protected. Four caves were gated to protect karst resources. On the other hand, it has been difficult to keep ATV use out of sinkholes in the Maple Flats area.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? In 2006 the Forest Service Washington Office established direction for ground water resource management, with an objective (FSM 2882.02) to: Protect, manage, and improve ground water and ground-water dependent ecosystems, recognizing their unique values, while implementing land management activities. New agency direction is also provided for caves and karst resources, including direction for inventory and analysis. This new direction and emphasis on groundwater and its dependent ecosystems, and on caves and karst, did not exist in 1993 when the GWNF Forest Plan was first revised.

Ground Water-dependent Ecosystems (GDEs) are communities of plants, animals, and other organisms whose extent and life processes are dependent on access to or discharge of ground water.

- Springs, seeps and wetlands
- Ground water-fed streams/lakes and associated riparian areas
- Shallow water table areas
- Cave and karst systems

c. Tentative Options or Proposed Actions for Change

C-1. Develop Desired Conditions for groundwater and karst

C-2. Develop Standards and guidelines for groundwater and karst

C-3. Modify the Forest Plan by rewording GW forestwide standard #15 to a forestwide standard that says "Significant and potentially significant caves on the Forest are managed in accordance with the Cave Resources Protection Act of 1988 (16 U.S.C. 4301-4309) to protect them through regulating their use, requiring permits for removal of their resources, and prohibiting destructive acts. Caves entrances are natural or naturally appearing".

C-4. Do Nothing.

5. What are the Consequences of Not Changing?

See also discussion in Water Quality section. Groundwater and karst areas would continue to be identified as appropriate and protected as necessary by following the riparian and water quality direction in the Forest Plan, however the 2006 WO direction for groundwater management may receive less emphasis due to lack of visibility in the Plan.

Proposed Action

Propose Option C1, C2, and C3.

Additional Information

The Virginia Department of Conservation and Recreation Natural Heritage Program has identified 19 cave conservation sites on the Forest.

Two of these sites are within Special Biological Areas, two are within Indiana bat protection areas and one is in wilderness. All of these areas need to be part of the desired conditions to protect karst areas and need guidelines to assure protection of the groundwater, karst and cave attributes of the areas.

6. Recommendations for Plan Revision

Include desired conditions and standards and guidelines to protect karst areas and caves including the areas identified by the Commonwealth of Virginia.

J. Geologic Hazards

1. What was the Plan Striving For?

The 1993 Forest Plan provided direction for only one geologic hazard: flooding. Forest-wide Standards 189-194 (page 3-143, 3-144) require identification of flood hazards areas and use of this hazard information in the siting and design of management activities, including facilities and land exchanges/acquisitions.

2. Where is the Plan Now?

In regard to geologic hazards, the Forest Plan remains the same as in 1993 and provides direction for only one geologic hazard: flooding. The Forest Plan includes direction regarding "erosion" but it is focused on water quality (page 2-31) and Forest-wide Standard 199 (3-144)].

3. Did Management Activities Move the Forest towards the Desired Future condition?

Not completely because only flooding was considered as a geologic hazard at that time. The Forest Plan does not provide specific direction on landslides, which are often catastrophic events with major effects on ecosystems, riparian areas, aquatic habitat, soils, flooding, infrastructure, and public safety on and off the Forest.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? Geologic hazards on the National Forests affect public safety and property on the Forest and off the Forest in adjacent communities (Collins, T.K. July/August 2005. Geologic Hazards on National Forests. Geo-Strata. p31-34). The Nation-wide trend of more people building homes and communities next to the National Forest creates an emerging issue for affected Forests like the George Washington National Forest. The increase in population and infrastructure next to the Forest increases the risks to public safety from geologic hazards associated with the Forest and with adjacent private land. This is an emerging issue.

The Forest Plan provided direction for flooding but not for other geologic hazards that are present on the George Washington National Forest and that may affect or be affected by management activities. These geologic hazards include:

1. Landslides (including debris slides/debris flows, rockfalls, rockslides, road cut-slope and/or fill slope failures, log landing failures).
2. Sinkholes (karst hazards including ground collapse and ground water pollution).
3. Abandoned mines (including physical hazards and ground collapse).
4. Debris floods.
5. Failure of temporary dams created by landslides or debris floods.
6. Alluvial fan hazards.

Geologic hazards are geologic processes or conditions (naturally occurring or altered by humans) that present a risk or potential danger to life and property. Geologic hazards

may affect or be affected by Forest management activities. For example, landslides are geologic hazards. Natural landslides can damage or destroy Forest Service facilities, and injure or kill Forest visitors and employees. Different geologic settings have different geologic hazards. If siting, design, and maintenance of Forest management activities does not consider the geologic setting and potential geologic hazards, then the public investment, public infrastructure, and public safety may be inadvertently and unnecessarily put at risk.

In addition to natural landslides, some landslides are caused or influenced by human activities. For example, excavation for road construction on a steep slope can undercut and remove some support from the hillside. In some geologic settings (adverse bedrock structures or weak surficial materials), this undercut and removal of support may lead to failure of the road cut-slope. Again, if siting, design, and maintenance of Forest management activities does not consider the geologic setting and potential geologic hazards, then the public investment, public infrastructure, and public safety may be inadvertently and unnecessarily put at risk.

The following are some examples of geologic hazards that suggest the need to add direction on geologic hazards in the Revised Plan.

1. Landslides

The June 27, 1995 rain storm triggered more that 40 landslides on the Pedlar Ranger District between Buena Vista and Glasgow on the Westside of the Blue Ridge. These landslides were a particularly dangerous type of landslide, called a "debris flow". These debris flows typically originate high on a mountainside as a debris slide that gouges down the mountainside (scraping off the soil and trees) and snowballs into a much larger landslide; as this mass sweeps downslope it transforms into a highly destructive debris flow that can travel hundreds or thousands of feet downslope and downstream from its source area. These June 27, 1995 landslides originated on the steep slopes of the National Forest, swept down Belle Cove and other drainages, and discharged destructive "debris flows" onto private lands and various roads, including State Highway 501.

The June 27, 1995 rain storm also illustrates another key point: storm damage attributed to "flooding" is sometimes due to "landslides", particularly debris flows. Research in the Appalachian region (Jacobson et al. 1989) indicates that the most catastrophic of geomorphic events will be "those in which conditions simultaneously promote landslides and high flood discharges." (Jacobson, R.B., A.J. Miller, and J.A., Smith. 1989. The role of catastrophic geomorphic events in central Appalachian landscape evolution. Geomorphology 2:257-284.)

The June 27, 1995 rain storm triggered similar debris flows in the Shenandoah National Park and private lands on the eastside of the Blue Ridge in Madison County, Virginia. The U.S. Geologic Survey (USGS) conducted field investigations and produced a series of scientific reports to understand the conditions that cause debris flows and to suggest methods to mitigate future events. For example, one of the USGS reports states: "Zoning and grading ordinances to avoid building in areas of potential hazard or to regulate construction to minimize potential for landsliding is one non-structural method to reduce the likely consequences of debris flows."
("Debris-Flow Hazards in Areas Affected by the June 27, 1995 Storm in Madison County, Virginia", 1997, Morgan, B.A., Wieczorek, G.F., Campbell, R.H., and Gori, P.L., USGS OPEN FILE REPORT 97-438)

The USGS also produced a Fact Sheet (FS 159-96) "Debris-Flow Hazards in the Blue Ridge of Virginia". The information in the Fact Sheet can help the public and government officials understand and plan for debris flow hazards.

One of the purposes for this major scientific effort by the USGS is to help government officials at all levels (federal, state, and local) in Virginia and other parts of the Appalachians understand the important role that land-use planning can have in avoiding or mitigating landslide hazards. This best available science provides a timely alert for the Plan Revision to consider a need for change: adding Plan direction for landslides and other geologic hazards.

2. Sinkholes

In 1995 the Lee Ranger District asked the Forest geologist to help develop interpretative information for a planned trail near the sinkholes at the highly developed, heavily-used Trout Pond Recreation Area. The Forest geologist examined the sinkholes, found evidence of recent and continuing sinkhole activity (ground collapse, ground settlement), and determined that the sinkholes are a geologic hazard that should be investigated and monitored. In order to provide the Lee RD with more detailed information and hazard assessment to help in management of the Recreation Area, the Forest geologist developed a partnership with the West Virginia Geological and Economic Survey (WVGES). The WVGES mapped the sinkholes, and, in 1997, provided the Lee RD with an assessment of geologic hazards and mitigating measures to consider in management of the Recreation Area.

Since then, Forest Plan monitoring has reported on sinkhole activity at Trout Pond Recreation Area. In 2002 sinkhole activity led to temporary closure order of Trout Pond and the surrounding loop trail. In 2003 a sinkhole opened under a paved road near the entrance hut to Trout Pond Recreation Area; road repair costs were about $7,000. An examination of the Trout Pond area in April 2006 found new sinkhole activity and substantial expansion that is a potential threat to a power line and access road to the sewage treatment lagoon.

Furthermore, geologic investigations were requested and conducted for the first two sites proposed for a new Lee Ranger District office. These two sites were dropped from further consideration based on non-geologic reasons. A geologic investigation was not requested for the third site. This site was selected as the new office site. A design/build contract was let. During the early stage of the contract in 2005, Forest personnel noticed what appeared to be a sinkhole on the site. The Forest geologist examined the site and determined there was active sinkhole activity on part of the site as well as an older sinkhole in another part of the site. The Forest geologist recommended subsurface investigation of site, and consideration of the sinkholes in the siting and design of the facilities. A subsurface investigation (estimated cost: $20,000) was conducted, and various siting and design changes were made in the design/build process.

Finally, the NFMA states that the implementing regulations shall "provide for methods to identify special conditions or situations involving hazards to the various resources and their relationship to alternative activities" (16 U.S.C. 1604(g)(2)(C)).

c. Tentative Options or Proposed Actions for Change

C-1. Modify the Forest Plan by:

a) Modifying to a Desired Condition the intent of Revised Jefferson Forest Plan Goal 31 (page 2-53) that states "Manage geologic resources to provide multiple public benefits. Manage geologic hazards to protect public safety and facilities while integrating the keystone role of these natural disturbances in riparian and watershed management. Integrate geologic components (processes, structures, and materials) in management of riparian areas, watersheds and ecosystems."

b) Adopting the Revised Jefferson Forest Plan Forest-wide Standard FW-216 (p. 2-53) that states: "Trails, roads, other facilities, and activities should be located and designed to avoid, minimize, or mitigate potential geologic hazards."

C-2. Do Nothing.

5. What are the Consequences of Not Changing?

The consequences of not changing are that:

1) The environmental analyses for Forest management activities and infrastructure are not likely to provide Line Officers with the geologic science information needed a) to recognize geologic hazards in projects areas, b) to assess how geologic hazards may affect or be affected by management activities, c) to develop alternatives and mitigating measures based on geologic science to deal with geologic hazards, d) to make informed decisions about geologic hazards that affect public investments, public infrastructure, and public safety.

2) The siting, design, and maintenance of Forest management activities and infrastructure are not likely to include the geologic science information needed to identify and manage geologic hazards, thus placing public investment, public infrastructure, and public safety at risks that are foreseeable and preventable.

Proposed Action

Propose Option C1.

6. Recommendations for Plan Revision

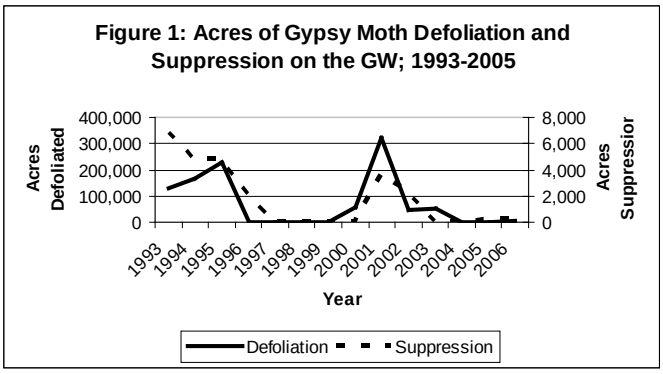
Include desired conditions for karst and caves as described.

Issue Forest Pests and Invasive Species

A. Population Control

1. What was the Plan Striving For?

The Forest Plan strove to provide a forest environment where damage to natural resources from forest pest organisms, especially gypsy moth, is minimized when such damage prevents the attainment of other natural resource objectives. The

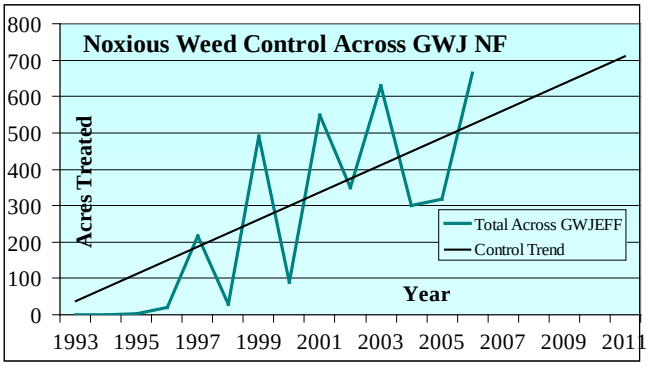


Forest was to manage insect and disease populations by utilizing the principles of integrated pest management." (Revised Plan, 2-35)

2. Where is the Plan Now?

Figure 1 indicates that trends in gypsy moth population suppression and corresponding trends in gypsy moth defoliation.

The graph at right shows the amount and trend of noxious weed control across both Forests. Data just for the GW is not available.



3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes. Gypsy moth population control responded to increasing populations, focusing on those areas where defoliation impaired other resource objectives; primarily in recreation areas and high value timber stands.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? No

b. Why? We are attempting to control populations when and where needed.

B. Intervention Treatments

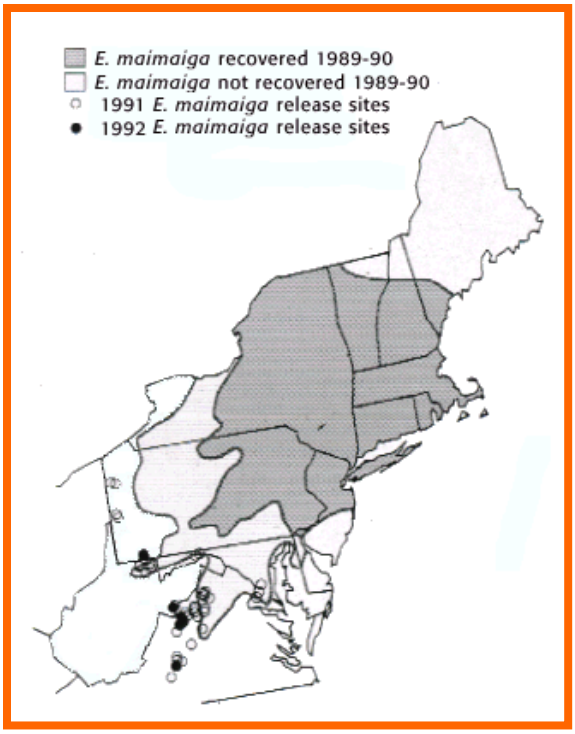
1. What was the Plan Striving For?

The Forest was to have limited treatments to defoliating populations of gypsy moth be based on sound forest health evaluations. We were to utilize natural enemies where appropriate (Plan pages 2-35 and 2-36).

2. Where is the Plan Now?

A forest health evaluation was performed, typically by the Southern Research Station, for gypsy moth suppression projects. Suppression efforts have focused on recreation areas, existing timber sales where an investment in management has already been made, or in high value stands where future harvests were planned. Therefore the treatments have been economically justified and the costs and benefits of treatment fully considered. Natural enemies have been utilized. *Bacillus thuringiensis* var. *kurstaki* (Btk), a naturally occurring bacterial pathogen of moths and butterflies, is the primary treatment method for suppression. *Entomophaga maimaiga*, a fungal pathogen, has also been released at selected sites on the Forest.

The figure at right displays release sites of a fungal pathogen of the gypsy moth (Hajek, 1996).



However, the gypsy moth is not the ONLY pest and perhaps not the even the most important at this time. The hemlock woolly adelgid has spread throughout the entire Forest and threatens to seriously impact hemlock forests and some of the riparian values associated with hemlocks. Populations of southern pine beetle have exploded and caused pine mortality in portions of the Forest. The Forest's concern has greatly increased regarding non-native invasive species of all kingdoms (plants and animals) which threaten the integrity of many different ecosystems.

Hemlock Woolly Adelgid (Courtesy: Northeastern Area)

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes: a forest health evaluation has been performed for gypsy moth suppression projects, thus, cost/benefit analyses have been performed, and we have utilized biological agents in combating the gypsy moth.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? The text in this section is focused on gypsy moth intervention alone. There are a myriad of forest pests that threaten the natural resources. We are currently engaged in intervention treatments for the hemlock woolly adelgid. We have attempted suppression of southern pine beetle outbreaks in the past. Incidence of oak decline is expected to increase as the GWNF forest ages. There certainly could be new pests in the future on the Forest that we are only vaguely aware of existing or pests that we are totally unaware of at this time.

Additionally, NonNative Invasive Species (NNIS) pose a threat to forest health. NNIS have become a focus for the Forest Service since the 1993 Forest Plan. Exotic plants can have serious localized impacts on forestry (SAA, 1996). The Chief of the Forest Service has identified NNIS as a threat to our Forests.

We need to broaden the focus of the Revised Forest Plan to all forest pests, not just the gypsy moth.

c. Tentative Options or Proposed Actions for Change

C-1. Do nothing

C-2. Modify the Forest Plan by:

a) Making an administrative change to the heading of this issue to read "Forest Pests" and globally, throughout the Plan, substitute "forest pests" for "gypsy moth".

b) Establishing a Forestwide Desired Condition that states: "A forest environment is provided where damage to natural resources from forest pests (any non-native invasive species including plants, animals, insects, and/or diseases) are minimized when such damage prevents the attainment of other natural resource objectives.

c) Establish an Objective for treating NNIS on the GWNF.

d) Develop a Forest Strategy for managing NNIS. This strategy would address prevention and public education, focus species, inventory protocols, and treatment methods.

5. What are the Consequences of Not Changing?

Generally minor in nature. Common Standards already exist to utilize Integrated Pest Management techniques. A site-specific analysis and decision on a catastrophic non-native invasive plant, animal, insect and/or disease threat might be unnecessarily complicated by a Forest Plan Amendment; resulting in more time and effort.

Proposed Action

Propose Option C2.

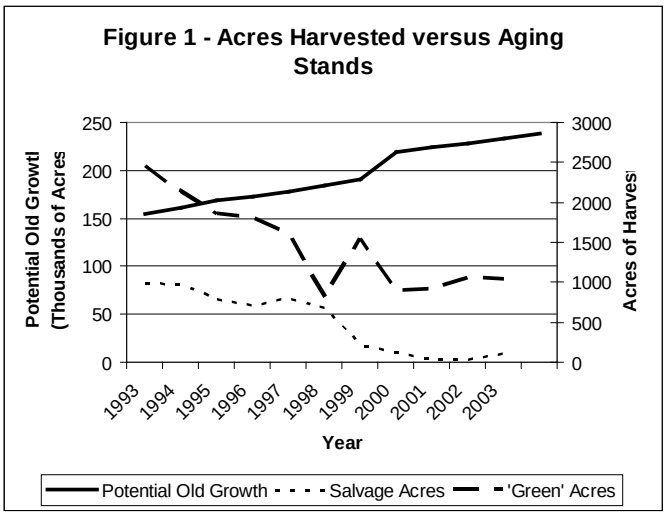
6. Recommendations for Plan Revision

Include the desired condition and expand the program direction to other pests.

C. Silvicultural Practices

1. What was the Plan Striving For?

Silvicultural practices are considered as a means for reducing damage caused by pests. High gypsy moth mortality stands receive priority on scheduling regeneration harvests.



2. Where is the Plan Now?

Figure 1 indicates that as stands have aged, harvest levels have

declined. Aging stands are more vulnerable to gypsy moth and many other insects and disease.

Conclusion: Harvesting cannot be meaningfully used to reduce vulnerability given present harvesting levels. We may not be prioritizing harvests based on vulnerability but there is not enough data. However, the DFC as stated in the plan is a sound and worthy one. It is the agency's ability to achieve it that is difficult.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes, we have moved toward the DFC. But that movement is relatively small in relation to the increasing vulnerability of the Forest.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? Gypsy moth is not the only pest that can be treated silviculturally (Gottschalk 1993, Mason 1989). Southern Pine Beetles are controlled effectively through silviculture (Thatcher 1980; Belanger 1980; Swain 1981; Boyle 2004). Oak decline risk can be reduced through regeneration harvests (Oak 2004 and Oak 1991). The focus needs to be on any and all forest pests as appropriate; not just gypsy moth.

c. Tentative Options or Proposed Actions for Change

C-1. Do nothing.

C-2. Make administrative corrections by broadening titles and appropriated standards and guidelines that refer only to gypsy moth to refer to pests and diseases.

5. What are the Consequences of Not Changing?

There would be little consequences to the plan. Common Standards on pages 3-130-133 provide a “blanket” IPM standard which includes silvicultural treatments. There could be continued difficulty in forming a strong P&N as guided by Forest Plan DFC’s, especially with regards to oak decline and perhaps any future unknown forest pests. Difficulty in responding to expected increase in oak decline incidence due to lack of DFC related to harvesting and forest pests. Response to a truly catastrophic insect and disease threat might be unnecessarily complicated by a Forest Plan Amendment; resulting in more time and effort.

Proposed Action

Propose Option C2.

6. Recommendations for Plan Revision

Expand the program direction to other pests.

D. Non-Native Invasive Plants

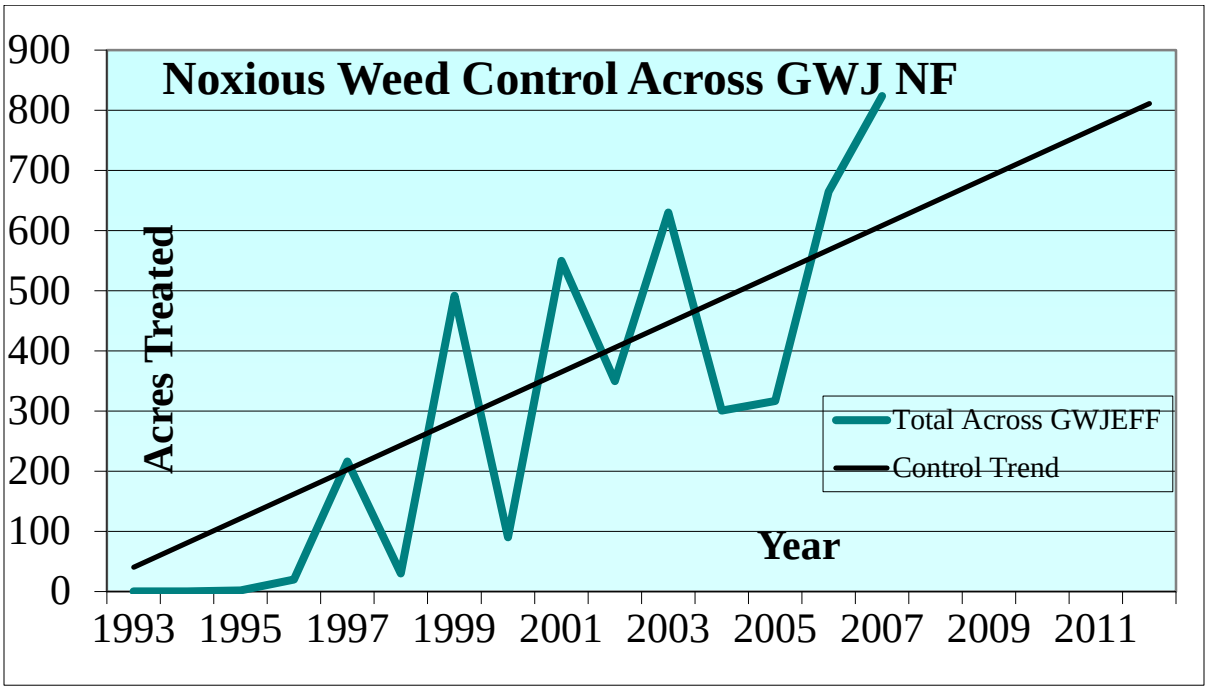
Plants that are not native to the Forest’s ecosystems and are likely to cause economic or environmental harm are considered to be non-native invasive species. The introduction and spread of these species has been a growing concern by the public and by the Forest Service. The main species currently of concern on the Forest include: Tree of Heaven

Ailanthus altissima, Multiflora rose *Rosa multflora,* Autumn olive *Elaeagnus umbellata*, *Kudzu Pueraria Montana*, Mile-a-minute *Polygonum perfoliatum*, and Garlic mustard *Alliaria petiolata.* Others include: Empress or princess tree *Paulownia tomentosa*, Bicolor lespedeza *Lespedeza bicolor*, Japanese privet *Ligustrum japonicum*, Chinese privet *Ligustrum sinense*, Common privet *Ligustrum vulgare*, Oriental bittersweet *Celastrus orbiculatus*, Japanese grass or stiltgrass *Microstegium vimineum*, Tall fescue *Fescue elatior*, Japanese knotweed Polygonum cuspidatum, Purple loosestrife *Lythrum salicaria*, Sericea or Chinese lespedeza *Lespedeza cuneat*, and Spotted knapweed *Centaurea maculosa.*

Trends in non-native invasive species include:

Treatment of "noxious weeds" had historically been focused on grazing allotments and hay fields. Since 1998 treatment has expanded to roadsides, wildlife openings, timber harvest areas and other occurrences around the Forest.

Chart of acres treated



The Forest has begun inventory and monitoring of populations of non-native invasive species, but this effort is still in the early stages of implementation.

Recommendations for Plan Revision

Include desired conditions to reflect the desire to have ecosystems without non-native invasive plants and include guidelines and strategies to prevent and control the spread of non-native invasive species.

CHAPTER 4. SOCIAL AND ECONOMIC CONDITIONS AND TRENDS

Introduction

The 1993 Revision of the GW Plan focused on a number of significant issues. These issues were developed through an extensive public involvement effort. The issues were used to 1) develop the environmental analysis; 2) evaluate the alternatives considered; and 3) help define the desired condition of the Forest. Due to the importance of the issues in defining the current George Washington Forest Plan, the issues were used as a starting point to evaluate how well the plan has been implemented and where changes may be needed. New issues, information from our public collaborative efforts and additional analysis of science were used to refine and expand the issues.

Issue Timber Program

A. Efficiency of Timber Sale Program

The below cost issue centered on concerns that the cost of the Forest's timber management program was greater than the revenues generated from the sale of timber. At the time of the Plan revision, the Forest Service was working through a number of ways to calculate the cost and benefits from the timber sale program. The Timber Sale Program Information Reporting System (TSPIRS) was used for several years. The magnitude of this issue diminished sharply through the years. The timber program on this Forest is used as one of the primary tools to manage wildlife habitat. The achievement of the wildlife habitat goals along with the benefits of producing timber from the Forest has program costs. While the sale of timber offsets some of these costs, it does not generally offset all of the costs. It is not a goal of the Forest that this revenue offset the total costs. The overall benefits in wildlife management, forest health and timber production require the expenditure of funds just as the management of other resources like recreation and watershed.

Since TSPIRS was abandoned we have no longer specifically tracked the costs and benefits of the timber management program in a formal manner. The following chart identifies the costs and revenues of the Forest's revenue generating programs over the past 15 years:

Annual Expenditure and Revenues for George Washington and Jefferson National Forests

	1993	1994	1995	1996*	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Annual Expenditures (Thousand dollars)															
Recreation	$3,012	$1,887	$2,096	$3,583	$4,885	$4,392	$4,577	$5,336	$5,573	$4,987	$3,406	$4,780	$3,730	$4,029	$4,327
Range	$19	$23	$10	$111	$248	$165	$186	$56	$75	$56	$43	$74	$52	$45	$41
Timber	$2,003	$1,291	$1,482	$2,816	$2,866	$2,434	$3,858	$3,429	$3,419	$3,253	$2,330	$3,481	$1,691	$1,575	$1,672
Minerals	$72	$36	$32	$159	$141	$150	$359	$331	$467	$581	$425	$653	$475	$385	$379
Lands	$801	$570	$419	$1,177	$817	$864	$989	$980	$978	$849	$992	$1,062	$510	$611	$572
Annual Revenue (Thousand dollars)															
Recreation	$327	$270	$298	$319	$444	$219	$124	$7		$18	$17	$22	$9	$0	$0
Range	$0	$8	$4	$5	$19	$20	$3	$0		$17	$15	$21	$9	$5	$5
Timber	$1,292	$2,112	$2,275	$1,838	$2,832	$2,980	$1,493	$1,193		$1,390	$1,247	$1,618	$1,971	$1,191	$1,581
Minerals	$1	$1	$1	$1	$3	$3	$2	$2		$3	$3	$3	$3	$3	$4
Lands	$53	$55	$73	$56	$107	$112	$63	$58		$128	$123	$135	$148	$137	$115
Revenue as % of Expenditure															
Recreation	11%	14%	14%	9%	9%	5%	3%	0%		0%	0%	0%	0%	0%	0%
Range	0%	32%	41%	4%	8%	12%	2%	0%		31%	35%	28%	18%	12%	11%
Timber	64%	164%	153%	65%	99%	122%	39%	35%		43%	54%	46%	117%	76%	95%
Minerals	2%	3%	4%	1%	2%	2%	1%	1%		1%	1%	0%	1%	1%	1%
Lands	7%	10%	17%	5%	13%	13%	6%	6%		15%	12%	13%	29%	22%	20%

*Combined Forests in 1996

B. Rural Development

1. What was the Plan Striving For?

The 1993 George Washington National Forest Plan continued the Forest contributions to the economic and social vitality of its neighbors (Plan page 2-13). The Forest was to work with neighboring people and communities in developing natural-resource-based opportunities and enterprises within the capabilities of the resource. Rural Development considerations were to be included in Forest decisions to assist communities in achieving long-term economic development. The Forest was to actively seek partnerships that promote development activities (Plan page 2-3).

The 1993 Forest Plan did not address or focus on bio-fuels. The economic and social conditions have changed with respect to energy. There is a national desire to move toward energy independence which includes many sources of energy, including bio-fuels.

2. Where is the Plan Now?

See economic and social sustainability analysis in an appendix to this report.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes, insofar as those conditions were described.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes. In terms of the Rural Development as discussed in the current plan, we are just changing the focus.

b. Why? Rural Development was a focus item for the Agency with the implementation of the 1990 Farm Bill and grants associated with it to communities. The grants focused communities to find alternative ways to sustain their economies and to become less natural-resource dependent. This program has ceased.

The current focus for the Agency in relationship to communities is on developing partnerships. There is a national partnership taskforce and legislation has been written to assist the Forest Service in managing partnerships more efficiently. The partnership program provides the framework for the Forest Service to work with communities on projects that jointly benefit both entities separate from direction in a Forest Plan. This partnership direction is currently in place and does not need to be in the Forest Plan.

In terms of bio-fuels we believe we need to include a Desired Condition as it relates to bio-fuels which may include biomass for burning to generate power and/or heat, biomass for the distillation of various combustible compounds, or any as yet unknown technology whereby biomass can be utilized to create an energy source.

C. Tentative Options for Proposed Actions or Change:

C-1 Develop a forestwide Desired Condition statement such as: The Forest contributes to the production of desired social and economic goods and services. People depend on the GWNF directly and indirectly to provide goods and services generated by natural, built, and human capital. These goods and services are provided

in many forms. In the vegetation arena they may include timber of a range of qualities from low quality tie logs and posts to high quality furniture and flooring, pulpwood for all grades of paper manufacturing, fuel ranging from firewood for the individual household to large scale biomass fuels. The forest also provides mineral related goods and services which may range from oil and gas leasing to small scale hardrock permits for gathering building materials. The forest provides services related to myriad forms of recreation and tourism that range from dispersed recreation activities such as driving, hiking, birding, horse-back riding, hunting and fishing, to developed recreation facilities and these services provide secondary economic benefits to local communities. A sufficient mix of resource uses to meet the demand for most users is provided

The Forest produces renewable goods and services as a sustainable flow within the regenerative capabilities of the ecosystem. The flow of wood-products in general has been decreasing since 1993 from about 30 MMBF to 12 MMBF and is far below the long term sustained yield. Many members of local communities have expressed a desire that the forest provide more wood products than has occurred in recent history, while others believe the Forest should refrain from providing wood products and focus on goods and service not provided on private lands such as recreation and tourism. In the spirit of multiple-use and balancing the “sufficient mix” of the demands for goods and services, the forest may produce from 20 to 30 MMBF of wood products and still allow for ample supply of the minerals, recreation, and tourism related goods and services.

C. Suitability (Review)

Forest Plan Appendix A defines “Lands Blocked by Physical Barriers” as "...lands which cannot be logged even with cable logging equipment. Timber harvest and access are blocked by rock ledges, cliffs and other physical barriers." Based on a literal interpretation of the NFMA Regulations, these lands were eliminated from suitability in 1993 (within the category “Irreversible Damage Likely to Occur” when they should not have been because technology existed then in the form of helicopters to successfully manage timber. (1993 Process Paper first identified this error).

Therefore, in this initial suitability analysis, these lands have been identified as being in the standard forest land base. Given that the Forest has utilized helicopter logging successfully since 1993, the timber inventory data was reviewed and corrected where high site index stands (Site Index greater than or equal to 70) had previously been identified as inaccessible due to physical barriers, such as rock outcrops are in the way to getting to that stand with a road (Land Class Code = 826) as now being accessible for helicopter logging. High site index was chosen because of the economic value of the timber (high sites = better timber) would justify the expense of

helicopter logging. Therefore, they were coded as standard forest land on steep slopes (Land Class Code = 540).

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes. Lands suitable for timber production may change due to improved technology or due to changes in how the new planning regulations address lands across the Forest, or in how desired conditions might change.

b. Why? The current planning regulations recognize two categories of suitable uses as it relates to timber; suitable for timber production and suitable for timber harvest. It is envisioned at this time that a majority of the acres currently identified as suitable for timber production will become lands suitable for timber harvest in the Revised Forest Plan under the current planning regulations (e.g. those suitable lands in current MA's 14, 15, and 16). As described above, some lands were erroneously identified as unsuitable for timber production in 1993 due to a lack of access and those lands should now be considered for suitability of timber production or harvest. Finally, changes in other allocations (e.g. recommended wilderness areas or Special Biological Areas) may reduce the acres suitable for timber management. However, we caution that loss of land regulated for sustained timber production and/or harvest reduces the areas where timber harvest can be used as a tool to meet wildlife habitat needs efficiently. It also reduces Long-term Sustained Yield and yearly ability to produce timber.

c. Tentative Options or Proposed Actions for Change

C-1. a) Strive to maintain at least the existing amount of forest suitable for timber production or suitable for timber harvest between 350,000 to 370,000 acres so as to maintain some capability to meet wildlife habitat, forest health, and the economic status of local community needs.

b) Identify all of those NFS lands currently within MA 17 (Timber Production) but outside of any other special areas and otherwise consistent with timber suitability requirements as Suitable for Timber Production.

c) Identify all of those NFS lands currently within other MA's but outside of any other special areas and otherwise consistent with timber suitability requirements as Suitable for Timber Harvest.

C-2. Do Nothing.

Proposed Action

Propose Option C1.

5. Recommendations for Plan Revision

Areas identified as suitable for timber production are not all available for harvest. When site specific analysis is done for a project, many factors are evaluated and many areas are found to be unavailable either permanently or for the current proposal. These factors include topography, riparian protection areas, visual concerns, wildlife needs,

current markets for the product and activities on nearby lands. Based on past efforts at assembling project proposals, the acres of forest suitable for timber production should be similar to the acres that have been available under the current plan. This should allow for the needed flexibility to implement the plan and achieve the wildlife and timber objectives of the revised Plan.

D. Allowable Sale Quantity

1. What was the Plan Striving For?

The GW 1993 Revised Plan contained an objective to achieve an allowable sale quantity (ASQ) of 330 million board feet (mmbf) for the first decade (Revised Plan, page 2-15). In essence, the Forest wished to offer or sell an average of about 33 mmbf of timber per year. The ASQ is an estimate of the quantity of timber that may be sold from the area of suitable land covered by the forest plan for a time period specified by the plan (36 CFR 219.3 and FSM 1900, prior to amendment). ASQ is closely related to Long Term Sustained Yield (LTSY), described below and can be thought of as a "ceiling" for timber production (Brown 1993) This ASQ was consistent with achieving an amount of vegetation manipulation to achieve wildlife and other multiple-use objectives. The 2006 planning directives changed the term ASQ to "Timber Sale Program Quantity" (TSPQ).

Likewise, the GW 1993 Revised Plan provided an estimate of the Long-term sustained yield of timber that could be removed annually in perpetuity on a sustained yield basis from lands suitable for timber production once the forest was entirely regulated. LTSY was estimated at 93 mmbf annually for the GW 1993 Revised Plan.

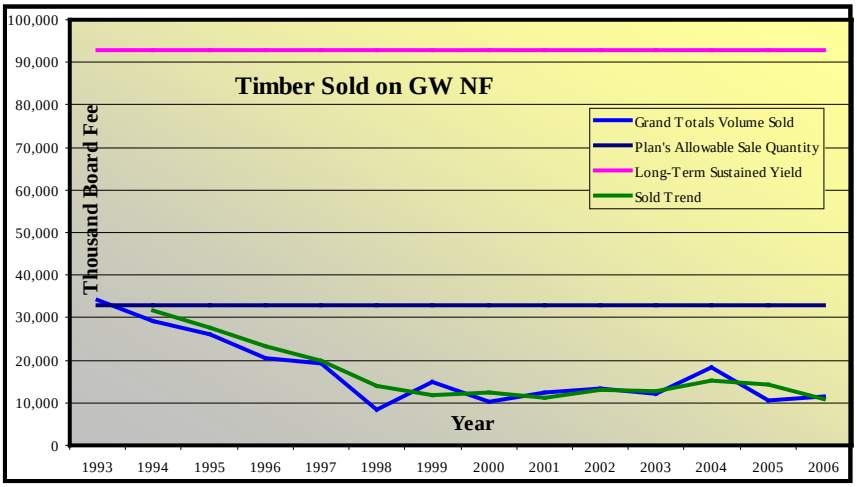
The 1993 Revised Plan also allowed for a combination of even-aged and uneven-aged regeneration harvest methods (Revised Plan page 2-27 and 2-28). Under all even-aged methods, about 2,300 acres were to be treated annually (Revised Plan FEIS, page 3-119 for alternative 8A). Uneven-aged harvest was to occur on about 800 acres annually or 80 acres annually of actual group selection with intermediate thinnings in between the groups across the rest of the acres.

Modified shelterwood harvest was to be the primary even-aged timber harvest method employed and was to have occurred on about 1,600 acres annually. Clearcutting was to be used only after site-specific, project-level analysis determined that other regeneration harvest methods would not achieve the desired future condition of the management area. The clearcutting objective in the 1993 Plan was for about 300 acres annually. For instance, (1) Clearcutting would be the only method that would be reasonable following wildfire damage; or (2) clearcutting could be the only method that can achieve the desired wildlife habitat conditions for a particular species (such as grouse) that requires high stem density(Revised Plan page 2-27 and 2-28).

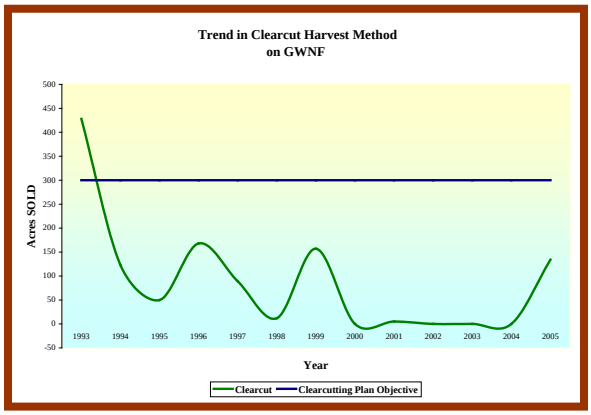
All vegetation management, including timber harvesting, was to be accomplished in a manner that maintains the diversity, productivity, and long-term sustainability of ecosystems.

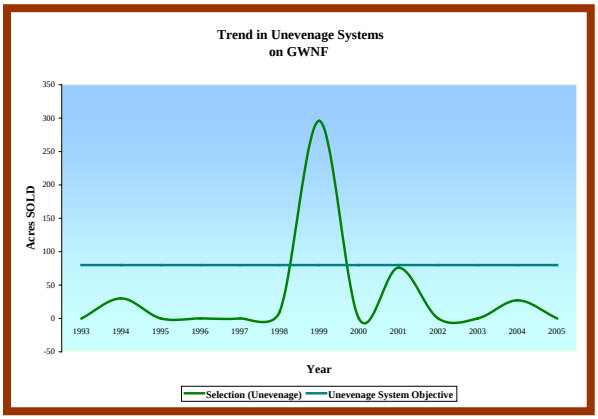
2. Where is the Plan Now?

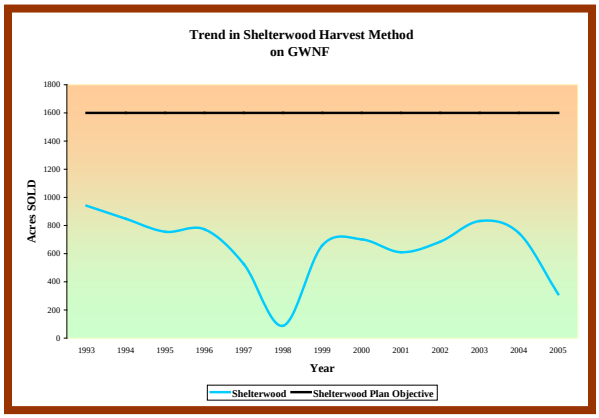
The following graph shows the trend in volume sold since 1993 compared to the average annual ASQ of the 1993 Forest Plan. Long-Term Sustained Yield (LTSY) volume is also displayed for the 1993 Forest Plan. Sold volumes have dropped well below the ASQ. Volume sold has trended downward since 1993. The average volume sold since 1993 has been about 16.3 mmbf, about half of the desired ASQ and less than 20% of the LTSY.

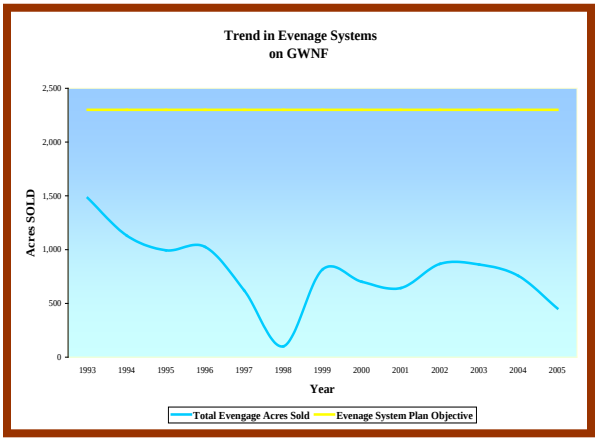


The following graphs present the trends in the type of silvicultural systems that were accomplished versus the Plan objectives. The acreages shown in these graphs represent what was sold through commercial timber sales.









3. Did Management Activities Move the Forest towards the Desired Future condition?

Management activities did not move towards maintenance of diversity of wildlife and/or wildlife habitat. Early seral habitat as created by commercial timber harvest decreased both in terms of acres harvested and failure to achieve the ASQ. Meanwhile, forests continue to age and provide an abundance of late seral stage habitat.

Sustainability and productivity were maintained as management activities have averaged less than 20% of the LTSY.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? We will need to reevaluate within the context of changes made in the desired condition, objectives and standards of the revised Plan.

c. Tentative Options or Proposed Actions for Change

C-1. Modify the Forest Plan by updating the analysis.

C-2. Do Nothing.

5. What are the Consequences of Not Changing?

We would not be addressing plan requirements.

Proposed Action

Propose Option C1.

6. Recommendations for Plan Revision

Complete the required analyses.

E. Salvage

1. What was the Plan Striving For?

The Plan strove to provide a forest environment where the ecological processes of the forest were balanced against social and economic uses (Rose 2001). It recognized that dying, dead and damaged trees were an important part of the ecosystems of the Forest and did not permit salvage harvesting in certain areas. Correspondingly, it also recognized that after an event such as that associated with insects or disease, dying, dead, and damaged trees were also a resource that can be used for fuelwood by the public or sawtimber if removed prior to deterioration (Plan pages 2-15 and 2-16).

2. Where is the Plan Now?

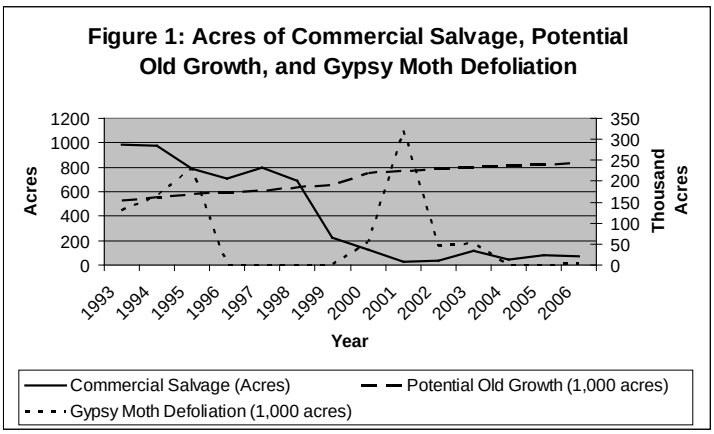


Figure 1 shows the trend in commercial salvage. Note that for the years of 1993 – 2001 volumes were converted from Thousand Board Feet to Hundred Cubic Feet using the Regional Conversion factor of 1.82 MBF per CCF.

The data suggests that: acres treated by commercial salvage sales have declined significantly despite an aging forest, two separate gypsy moth events, and projected increases in oak decline impacts. (Figure 1 and SAA, 1996) It is strongly indicated that in most cases high-value products are not salvaged before that value is lost. It also suggests that commercial salvage was not strongly tied to gypsy moth damage during the population explosion in the early part of this century (Figure 1).

Figure 2 displays estimation from a Forest Vegetation Simulator computer program using the Oak Decline Event Monitor and all Forest Inventory and Analysis 1992 Re-measurements on the George Washington National Forest. This shows that as the forest continues to age we can expect increasing mortality, especially as a result of oak decline (Oak 1991, Oak 2004).

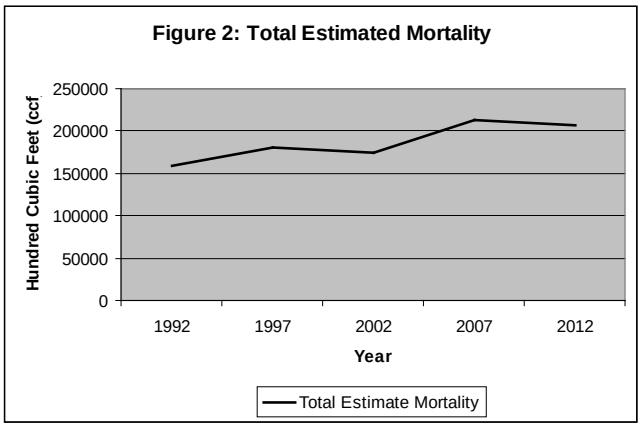
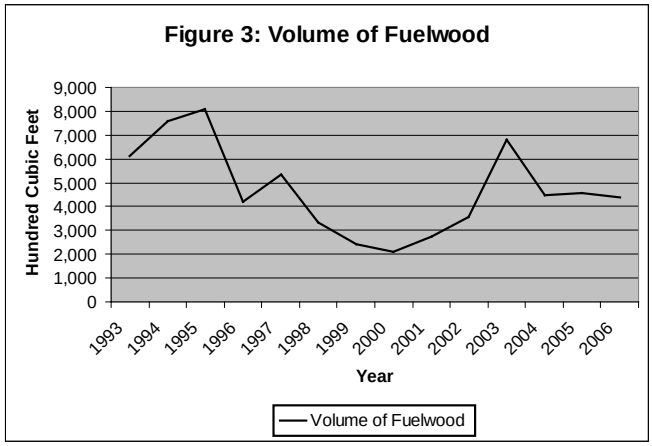


Figure 3 shows that although fuelwood uses have fluctuated, recent trends indicate increasing fuelwood use since 2000.



3. Did Management Activities Move the Forest towards the Desired Future condition?

No. We believe there is no readily apparent "balance" between ecological processes and social and economic uses related to the commercial salvage program. Mortality has increased from 1992 to 2001 and is expected to increase in the future (Rose 2001, Oak et al. 2004). Acres treated by commercial salvage sales have declined precipitously despite an aging forest, two separate gypsy moth events, and projected increases in oak decline impacts. The commercial salvage program does not appear to be balancing

ecological processes with social and economic benefits, since high value products may not be salvaged prior to loss of value in those areas where salvage is permissable.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? Increasing acres of mature and over-mature forests will result in increased incidence of oak decline (Figure 2 Oak 1991; Oak et al., 2004; SAA, 1996). The occurrence of gypsy moth is also expected to increase the incidence of oak decline. Heavy oak mortality has occurred over large areas of the Southern Appalachians. Major losses will probably be most common on national forests and in Virginia (SAA, 1996). The same condition results in increased vulnerability/susceptibility to many other insects and diseases such as red oak borer and gypsy moth. There is a need to revise certain guidelines to allow increased flexibility in utilizing salvage to achieve the stated desired condition.

c. Tentative Options or Proposed Actions for Change

C-1. Modify the Forest Plan by revising or adding standards and guidelines similar to the following to appropriate forest or special area direction:

- Special Biological Area (Old GW MA 4-58): Where salvage would maintain or enhance the unique attributes of a specific Special Biological Area as determined on a case by case basis, the following activities could occur. Ground-based systems could be used for the salvage of dead, dying, or damaged trees along open road systems. For that part of the area not accessible by existing roads, salvage activities should only accomplished by helicopter with no new road or landing construction.
- Scenic Corridor or Viewshed (Old GW MA 7-14): Salvage of dead, dying and damaged trees can occur to provide for scenic rehabilitation and public safety using ground based or helicopter logging.
- Remote Backcountry Area (Old GW MA 9-12): Where salvage would not significantly impair the remote experience, salvage of dead, dying, or damaged trees can occur from perimeter roads using helicopter logging with no new permanent or temporary road or landing construction within the area. Salvage and firewood gathering from system interior roads can occur using ground based methods without additional road construction. Landings can be provided adjacent to existing roads.

C-2. Do Nothing.

5. What are the Consequences of Not Changing?

The Plan would not facilitate achieving the Desired Condition of balancing ecological processes with social and economic benefits in the face of an aging forest and projected increase in oak decline. Plan direction would inhibit the agency's ability to respond to future unpredictable insect, disease, and catastrophic weather events that may occur in many areas of the Forest.

Proposed Action

Propose Option C1.

6. Recommendations for Plan Revision

The recent increase in gypsy moth activity has revived the need to consider salvage harvest guidance. Include desired conditions and standards and guidelines that allow salvage in:

1) Special Biologic Areas as long as the biologic entity is not impaired by the salvage;
2) Scenic corridors as long as the scenic objectives are met; and
3) Remote backcountry recreation areas as long as there is no road construction and the remote character is not impaired.

Issue Forest Access

A1. System Roads in Wildlife Management Areas

1. What was the Plan Striving For?

The 1993 Revised Plan recognized that the desire for motorized access to the Forest must be balanced against conflicting desires of providing for certain types of wildlife habitat and non-motorized recreation use (Plan, page 2-17). Under the Revised Plan, a road system is to be maintained to serve the public, meet management needs, and protect resources in a cost-effective manner (Plan, page 2-17). Decisions that determine whether individual roads are open or closed to public vehicular use are to be made on a case by case (road by road) basis. Existing roads may be closed under one of the certain conditions, including meeting open road densities in Management Areas (MA) 14 or 15. (Plan, page 2-18 as corrected)

MA 14's desired condition is to maintain or enhance quality habitat for black bear and other disturbance-sensitive species (Forest Plan, page 2-29). The Desired Condition (DC) of MA 14 is to have motorized public vehicle access be restricted to provide suitable conditions for disturbance-sensitive species such as black bear (Forest Plan page 3-74 and 3-76).

MA 15's desired condition is to maintain or enhance quality habitat for wild turkey and other species that favor a more mature forest environment with small, herbaceous clearings (both temporary and permanent (Forest Plan, pages 2-29 and 3-79).

Both MAs have objectives to limit open interior road densities. For MA 14, the objective is to limit open interior road densities to no more than one-quarter mile of open road per 1,000 acres (Plan, Standard 14-7, page 3-75). For MA 15, the objective is to limit open interior road densities to no more than one mile of open road per 1,000 acres (Plan, Standard 15-5, page 3-81).

2. Where is the Plan Now?

During project-level analysis, the Forest knows of no roads that have been closed or were strived to be closed to meet this Plan objective for MA 14 and 15, even though in 1994, a GIS analysis was conducted to determine the number of areas where interior open road densities exceeded the objectives set for Management Areas 14 and 15. At that

time North half and south half maps were also produced to show where Plan road management objectives for managing black bear and wild turkey, exceeded on-the-ground conditions. The analysis shows that 26 Management Area polygons (37% of total) exceed the open road density standards within Management Areas 14 and 15. In contrast, 44 polygons (63% of total) do not exceed the road density standards. There are 23 unique Management area 14 polygons with 11 exceeding Plan standard 14-7. There are 47 unique Management area 15 polygons with 15 exceeding Plan standard 15-5.

Black bear and wild turkey are Management Indicator Species under the 1993 Revised Plan. While road closures have been thought to be the way to increase populations of these species, monitoring of these species shows that their populations continue to increase even though no attempts were made to close roads to meet certain open road density objectives within certain management areas. However, the agency recognizes that roads may or may not be a critical indicator of why populations have increased. Populations may have increased due to other factors such as game regulation changes, weather affecting hunter's success, or even the number of hunters VDGIF 2002).

Monitoring of black bear by Virginia Department of Game and Inland Fisheries shows the following increasing trend in populations from 1989 to 1998. In 2000, VDGIF and WVDNR estimated bear populations at 1,175 individuals on the GWNF (2004 Monitoring Report at page 96.)

Virginia's Black Bear Population Trend, 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

Monitoring of wild turkey shows the following. The data suggests that total harvest numbers vary across years, but indicate an overall stable to slightly increasing population trend. In 2000, VDGIF and WVDNR estimated turkey populations at 4,149 individuals on the GWNF.

Spring Wild Turkey Harvest Information on GWNF, 1997 To 2006 (Source: http://www.dgif.state.va.us/wildlife/turkey/nationalforestspringturkeyharvest2006.pdf)

County	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Harvest /square mile
Allegheny	102	45	87	74	148	117	112	83	88	88	0.34
Amherst	34	26	30	30	37	43	51	32	40	35	0.39
Augusta	158	93	95	139	158	157	122	86	56	114	0.37
Bath	134	91	153	133	221	164	106	99	66	119	0.44
Botetourt	99	45	41	52	93	84	91	65	58	66	0.54
Frederick	4	6	4		3	3	6	5	6	8	1.04
Highland	26	26	41	47	61	38	32	17	22	36	0.40
Nelson	6	3	6	4	2	12	3	3	2	6	0.20
Page	10	6	6	7	13	5	8	6	9	20	0.47
Rockbridge	43	31	26	24	45	63	35	38	41	50	0.48

County	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Harvest /square mile
Rockingham	125	63	68	57	91	93	92	76	53	92	0.42
Shenandoah	57	41	31	20	48	48	47	60	44	70	0.59
Warren	3	4	3	3	9	5	9	6	3	3	0.31

(Source: http://www.dgif.virginia.gov/hunting/va_game_wildlife/national_forests_spring_turkey_2004.pdf).

For black bear, the 2004 revised Jefferson Forest Plan objectives 8.01 and 8C-OBJ4 are to provide areas where open road density is less than 0.8 miles per square mile (Jefferson Plan, page 2-13; Management Prescription 8C, objective 8C-OBJ 4, page 3-122.) (1.25 miles per 1,000 acres) Likewise, for old growth forest communities associated with disturbance, objective 6C-OBJ2 says to maintain an open road density at or below .8 miles per square mile (Jefferson Plan, page 3-82 errata #1.)

For species such as wild turkey, the 2004 revised Jefferson Forest Plan objectives 8A1-OBJ4 and 8B-OBJ3 are to maintain an open road density at or below 1.25 miles per square mile (See Management Prescription 8A1 and 8B, objective 8A1-OBJ4, page 3-114; objective 8B-OBJ3, page 3-118 2.0 miles per 1,000 acres). The table compares the 1993 Revised Plan with the 2004 Jefferson Plan for open road density direction in wildlife areas.

Comparison of Open Road Densities between Forest Plans

Area	**Open Road Mileage per 1,000 Acres**	
	George Washington Forest Plan	**Jefferson Forest Plan**
Remote Habitat For Wildlife	0.25	1.25
Mix of Successional Habitats	1.00	2.00

Socially, the agency has had public pressure from the environmental community to close roads that are currently open seasonally or year-round to the public. Conversely, we've had public pressure from certain hunting associations to open roads that are currently closed year-round.

3. Did Management Activities Move the Forest towards the Desired Future condition?

The Forest did not meet any of its objectives of closing roads to public motorized use year-round where open road densities exceed desired densities in wildlife-emphasized management areas. However, black bear and wild turkey populations are stable to increasing.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? Black bear and wild turkey populations are stable to increasing even though GW Forest Plan road density objectives were not met. Furthermore, road density objectives are different between the GW and Jefferson Forest Plans. Thus, the Forest believes

there is no need to close roads for the sole purpose of providing wildlife habitat for black bear and wild turkey.

c. Tentative Options or Proposed Actions for Change (If the Revised Plan identifies distinct wildlife emphasis areas like MA 14 and MA 15)

C-1. Adopt as George Washington Plan objectives the Jefferson Plan standard.

C-2. Reallocate the eleven MA 14 polygons that exceed Plan standard 14-7 to Management Areas that have no open road density objectives. Reallocate the fifteen MA 15 polygons that exceed Plan standard 15-5 to Management Areas that have no open road density objectives.

C-3. Remove the existing standards 14-7 and 15-5 and adopt the language from the Revised Jefferson Plan that says "existing open public roads are maintained at current density levels to provide for public access and safety."

C-4. Reassign GW standards 14-7 and 15-5 as objectives in MA 14 and MA 15 and leave the road density figures alone.

C-5. Remove the existing standards 14-7 and 15-5 and create standard that roads should be closed during nesting and brooding rearing seasons and then can be opened during fall hunting seasons. (See also Wildlife discussion at the end of this report.)

5. What are the Consequences of Not Changing?

This is more a social value than a significant environmental effect on bear and turkey habitat and populations. Some environmental groups will criticize the Forest for not attempting to close roads; while some sportsman groups will criticize the Forest for not opening more roads, especially during all hunting seasons.

Proposed Action

Propose Option C5.

6. Recommendations for Plan Revision

In the revised Plan we will not have different management areas for remote wildlife, early successional habitat species, timber management and mosaics of habitat. Instead, we will have desired conditions for the portion of the forest where we want a diversity of habitat and production of wood products. However, to meet the desire to retain areas where road density is low, we will have an objective to not increase the miles of open road on the Forest. We will also continue to work closely with the State game agencies in establishing seasons when roads should be closed to benefit wildlife species.

A2. System Roads across the Forest

1. What was the Plan Striving For?

The 1993 Revised GW Plan continued the existing management direction of identifying and evaluating open roads. Roads that serve a legitimate access need, are consistent with the management area direction and meet standards in the Revised Plan were to remain open to public use. When they did not meet these requirements, these routes were to be permanently closed or improved, as funding permitted (Plan, page 2-18).

Decisions that determine whether individual roads are open or closed to public vehicular use are to be made on a case by case (road by road) basis. Existing roads may be closed under certain conditions, besides meeting open road densities in Management Areas (MA) 14 or 15. Fundamentally, existing roads may be closed if they are causing resource damage to soil and water functions. These conditions also include a) roads that will not be needed again (by placing physical barriers and ripping and seeding road), b) roads that will not be needed for several years (by placing a physical barrier such as large boulders at the entrance, and c) roads only needed for administrative purposes (by placing a locked gate at the entrance (Plan, page 2-18).

Under the Revised Plan, a road system was to be maintained to serve the public, meet management needs, and protect resources in a cost-effective manner. New roads were to be constructed as needed and to the standard to meet the desired future condition identified in each management area. The decision to construct any additional roads was and continues to be made when projects are selected and supported by appropriate site-specific analysis and documentation (Plan, page 2-17). The 1993 Revised Plan estimated that between 5 to 8 miles of roads would be constructed yearly (Plan, page 2-17).

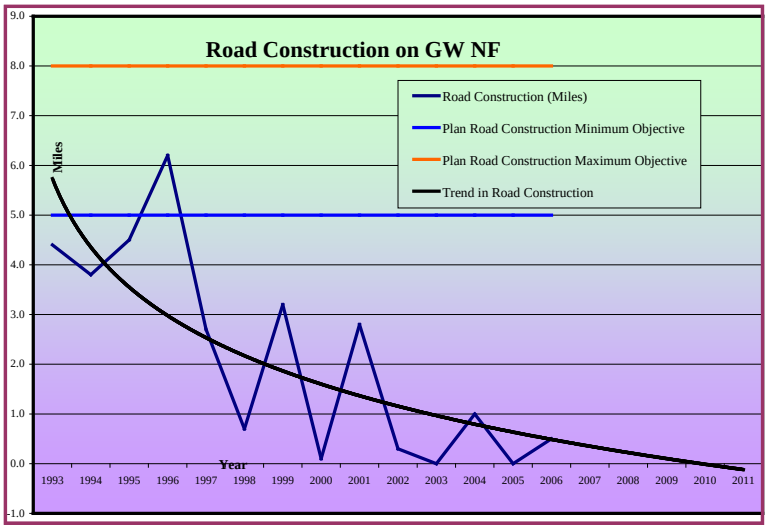
2. Where is the Plan Now?

The percentage of roads open to the public decreased slightly with the implementation of the Revised Plan, but has since remained stable. The Forest has decommissioned one mile or less of existing roads per year. The transportation system management trend across the Forest is shown in the table below. It should be noted that it appears road mileage is significantly up in 2006. This discrepancy is due to the fact that in previous years, the miles of Forest roads was pulled from the Infrastructure database and the 2006 data was extracted from the Forest's GIS roads layer. The GIS data more accurately depicts what exists on the ground; therefore the lengths of roads are closer to actual than the estimated lengths recorded in the Infrastructure database. Infrastructure road lengths may have been erroneous due to the fact that not all roads on the Forest have been located by GPS.

Year	Total Forest	Open Year-round Or Seasonally		Closed Year-round	
	(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
2004	1,798	973	54	825	46
2006	1,872	1007	54	865	46
2007*				237	

*See Motor Vehicle Use Map document at http://www.fs.fed.us/r8/gwj/maps_brochures/mvum.shtml

The Forest has focused road funding on maintenance activities instead of construction and reconstruction. The trend in miles of construction of new roads has steadily declined, as depicted in the following graph.



3. Did Management Activities Move the Forest towards the Desired Future condition?

No.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? Road construction objective was not met. Road construction is a function of a project's purpose. Road management across the George Washington NF has followed the direction in the 1993 Revised Plan with no real conflicts or detours from guidelines. The review and evaluation of current information, including the Roads Analysis Report for the GWNF completed in 2003, and the Revised Jefferson NF Plan lead to the recommendation there is nothing new to incorporate into the Revised GW Plan. However, the forest will be completing a Transportation Analysis Process (TAP) in 2010 that will further refine the roads analysis done in 2003.

c. Tentative Options or Proposed Actions for Change

C-1. Delete road construction as an objective of the Plan.

C-2. Do nothing. The existing road construction objective remains.

C-3. Review the TAP results as soon as available before making a recommendation but for now delete road construction as an objective of the Plan.

5. What are the Consequences of Not Changing?

An erroneous objective related to road construction would be displayed in the plan, but would have little effect on actual need to construct roads. The consequences of not changing the current plan direction and management of roads on the Forest would be that emphasis on road maintenance, reconstruction and decommissioning would continue with very little construction of new roads. This management is consistent with historical road funding received on the Forest.

Proposed Action

Propose Option C3.

6. Recommendations for Plan Revision

It does not appear that there is a need for an objective for permanent road construction. However, scoping may identify changes. Since old unclassified roads continue to be identified and other roads are identified that no longer meet access needs, taking into consideration the issues identified, benefits and risks analyzed and the recommendations for a minimum road system contained in the 2010 Transportation Analysis Process, there will be an objective to decommission roads.

B. Licensed OHV Use

1. What was the Plan Striving For?

The Plan recognized the spectrum of areas that are highly roaded (greater than 3 miles per 1000 acres) to essentially unroaded with less than .25 miles per 1000 acres (Plan page 2-17). There is a stated recognition of the need to balance the public desire for motorized access to the national forest with the often conflicting goals of providing certain wildlife habitat and non-motorized, backcountry recreational opportunities.

In the area of licensed OHV use (full sized four wheel drive vehicles- not ATV's or motorcycles), the planning effort produced a total of 157 miles of featured open roads allocated to OHV use and identified an additional 60 miles of roads suitable, at least seasonally, for such use. There was a clear recognition that the demand existed for this use in the early 1990's and by allocating certain roads in Management Area 11 there was a desire to retain these roads as much as possible in their rough and challenging condition to meet this demand. Without this allocation these roads would have been susceptible to either upgrading to a higher level or closure, either choice precluding the OHV opportunity. There was also a prediction in the Plan EIS that the OHV road mileage would need to more than double to meet the anticipated demand by 2000.

2. Where is the Plan Now?

The existing allocated OHV road network is largely intact. There has been some repair on a few roads over the past 15 years to correct erosion problems contributing to watershed impacts. Three roads initially listed in the Plan have been closed either by nature or through site-specific decisions: A decision was made in 1998 to close Jerkemtight road, while floods from 1995 through 1997 closed Cashew Road. Poplar Cove road was also closed after a site-specific analysis. A few of the MA 11 roads are classified as TSL D. No additional roads have been added to the MA 11 allocation. A review of INFRA indicates there are currently a total of 244 miles of roads having an objective Maintenance Level of 2 – High Clearance.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? ? Executive Order 11644, Use of Off-Road Vehicles on the Public Lands, required public land agencies to administratively designate specific areas and trails on public lands on which the use of off-road vehicles may be permitted, and areas in which they are not permitted. The process to designate roads and trails as open or seasonally open to motorized use, and whether that motorized use is limited to highway legal vehicles only or to all vehicles, was in accordance with the following criteria and are displayed on a set of Motor Vehicle Use Maps for the Forest:

- Minimize damage to soil, watershed, vegetation, or other resources;
- Minimize harassment of wildlife or significant disruption of wildlife habitats;
- Minimize conflicts between off-road vehicle use and other existing or proposed recreational uses of the same or neighboring public lands, and to ensure the compatibility of such uses with existing conditions in populated areas, taking into account noise and other factors;
- Avoid designated Wilderness Areas or Primitive Areas.

5. Recommendations for Plan Revision

Do not provide designated OHV routes or areas in the Forest Plan. The roads and trails open or seasonally open to OHVs are included on the 2008 Motor Vehicle Use Maps.

C. Non-Motorized Trails

1. What was the Plan Striving For?

The current GW plan is striving for a non-motorized trail system providing for a mix of uses including hiking, horseback riding, mountain biking, and backpacking in which the “Share the Trail” concept is promoted. Emphasis is placed on multi-use trails wherever feasible. This concept minimizes the provision of single use trails and thereby better controls total trail mileage, environmental effects, and maintenance costs. The 1993 non-motorized trail mileage was about 950 miles, including two National Recreation Trails (Lion’s Tale and Wild Oak) and about 60 miles of the Appalachian National Scenic Trail. The plan identifies approximately 300 miles of potential trail to be constructed and 92 miles reconstructed over the course of the planning period if funding allows. The Appalachian Trail has a discreet Management Area (MA6) in the GW plan indicating the emphasis placed upon this nationally prominent trail resource.

2. Where is the Plan Now?

Approximately 18 identified trail reconstruction projects from the current plan, totaling about 38 miles have been completed. Approximately 28 identified construction projects totaling about 75 miles have been completed. A few trail construction and reconstruction projects in addition to those identified were also completed since 1993 and some trails were removed from the system. Most of the trails are multi-use, having more than one managed use. Based on INFRA, current non-motorized trail mileage on the GW is 1066 miles. This represents a net 12% increase since 1993. Some of this increase is due to more accurate mileage measurements.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? No

b. Why? . The current trails emphasis in the GW plan on non-motorized trails seems to be consistent with prevailing social attitudes. The Public Survey report, Southern Appalachian National Forests, 2002 (Cordell) identifies day hiking, mountain biking, backpacking, and horseback riding, as respectively the 5th, 13th, 18, and 19th most popular recreational activities on the GW. Almost 34% of respondents hiked on the GW at least once that year. The other non-motorized uses were substantially lower but there is no statistical evidence or surveys indicating that demand for non-motorized use is declining. Based on qualitative evidence from public contacts and volunteerism, equestrian and mountain bike use and interest is continuing to increase. Hiking and backpacking use fluctuates considerably based on seasonal weather conditions but appears to be remaining steady to increasing slightly. This is based on A.T. ridgerunner sampling between 2002 and 2004 for hikers and backpackers passing through the Tye River section of the A.T.

An administrative change is necessary to show the existing AT corridor due to several minor relocations which have taken place since 1993. For instance, the A.T.s crossing of the James River on the AT pedestrian bridge is not depicted properly. This is shown on the attached map where the corridor needs to be properly identified and the old corridor reassigned to an adjoining management area direction. Construction of portions of the Alleghany Highlands Trail System on the James River and Warm Springs Districts has been completed by the Boy Scouts of America Order of the Arrow (ArrowCorps 5) in 2008 and Student Conservation Association trail teams in 2010.

5. Recommendations for Plan Revision

Public input emphasized the large demand for and enjoyment of the expansive trail system on the Forest. The Forest has the largest mileage of trails among the National Forests in the Southern Region. Given the large number of trail miles, we do not believe that we can expand. We will have an objective to retain current levels or slightly decrease trail miles. There may be limited additional trails, but some trails with low use may be abandoned so that new opportunities can be achieved.

We received public input with concerns related to use of trails for wiland fire and prescribed fire lines. We will add standards and guidelines to assure that when existing trails are used as firelines, they are maintained in, or returned to, the character desired by the users. We will also look for opportunities to improve trailhead parking for users of the trails.

D. Access for Persons with Disabilities

Sherando Lake Fishing Pier

1. What was the Plan Striving For?

The 1993 Revised Forest Plan addressed access for persons with disabilities with the following statement, "*The Revised Plan encourages the continued exploration of methods to provide access to persons with disabilities in accordance with the Americans with Disabilities Act and other applicable legislation. The Forest Service intends to continue to seek such opportunities as the Revised Plan is implemented.*" Under Issue 13, The Mix of Goods and Services, the plan states, "*In accordance with the Americans with Disabilities Act (ADA) and other applicable legislation, most developed recreation facilities are made accessible as funding allows.*" The Plan did not have any objectives related to access for persons with disabilities.

2. Where is the Plan Now?

The intent of providing access to persons with disabilities is still valid, and indeed, there has been considerable progress made and many new and reconstructed developed recreation facilities are now accessible.

Likewise, the Forest Service nationally has better defined direction for providing accessibility. It is the Architectural Barriers Act of 1968 (ABA) and Section 504 of the Rehabilitation Act of 1973 that apply to the Forest Service. The applicable document for all new construction and alteration of Forest Service facilities under these laws is the *Architectural Barriers Act Accessibility Standards* (ABAAS). Chapter 10 of the ABAAS addresses some recreation facilities but not camping and picnicking areas, outdoor recreation access routes, beach access routes, and pedestrian trails. These recreation facilities are addressed in the *Forest Service Outdoor Recreation Accessibility Guidelines* (FSORAG) and the *Forest Service Trail Accessibility Guidelines* (FSTAG). On May 22, 2006, the Forest Service published, in the *Federal Register*, notice of the final directive that requires compliance with the FSORAG, effective on that date.

The 1993 Revised Forest Plan utilizes inaccurate terminology and limited itself in how it deals with the accessibility issues to developed recreation and disabled hunters.

The Plan inaccurately refers to *The Americans with Disabilities Act of 1990* (ADA), which does not apply to Federal Agencies with the exception of Title V, Section 507c that defines a wheelchair and states that wheelchairs may be used in Wilderness.

The 1993 plan implied that access for persons with disabilities was just for developed recreation areas and disabled hunters. Thus it is limited because access for persons with disabilities is to be provided to all programs and activities as well as all new and altered facilities on the Forest. Facilities are the physical features that are provided such as toilets, picnic tables, interpretive centers, and water fountains. Programs and activities are the things people do such as picnicking, camping, watching wildlife, hiking, listening to interpretive programs, etc. With funding constraints and construction limitations, as well as allowed exceptions, some facilities at some locations may not be accessible, but accessible opportunities will be provided in all program areas.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes, The Forest has made great strides in providing universal access at developed recreation facilities. In 2001 a programmatic transition plan was completed for the George Washington and Jefferson National Forests as required by 7 CFR 15e, the USDA implementation of Section 504 of the Rehabilitation Act of 1973. This transition plan shows that most programs on the Forest are accessible. There is now the opportunity for persons with disabilities to participate in all or most program activities.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes.

b. Why? Plan direction should incorporate current Forest Service policy of universal design (FSM 2330), by reference, to provide universal access to facilities and programs of the George Washington National Forest. Legal requirements should be corrected and clarified. Reference to the ADA is in error. c. Tentative Options or Proposed Actions for Change

C-1. Modify the Forest Plan by:

a) Adding a standard or guideline that references Forest Service policy (FSM 2330) on universal access and use of the FSORAG and FSTAG when designing or rehabilitating recreation facilities..

b) Making administrative corrections by adding legal references to American Barriers Act of 1968 and the Rehabilitation Act of 1973, removing the Americans with Disabilities Act reference and outdated terminology such as the word "handicap" and all its variations.

C-2. Do nothing.

5. What are the Consequences of Not Changing?

Regardless of what the Forest plan says, the requirements exist to provide access at all newly constructed or altered facilities in accordance with the referenced laws. It isn't necessary to include anything about access for persons with disabilities in the forest plan,because there are laws that require it. However, inclusion will keep the laws in the open and ensure that managers remain aware that there is still work to be done.

Proposed Action

Propose Option C1.

6. Recommendations for Plan Revision

The appropriate standards and guidelines will be included in the revised Plan.

Issue All-Terrain Vehicle (ATV) Use

1. What was the Plan Striving For?

The GW Plan was striving to accommodate this use but limit it to specific areas where the impacts could be feasibly mitigated and monitored. ATV's are allowed only on designated routes. Otherwise the forest is closed to off road and off-trail motorized use. The 1993 planning effort produced a total of 50 miles of designated ATV (unlicensed ATV's and motorcycles) routes in three areas: Taskers Gap/Peters Mill Run on the Lee District, Rocky Run on the Dry River District, and South Pedlar on the Pedlar District. It also called for an additional 15-mile system to be established on the Deerfield District if ATV organizations expressed interest and sponsorship for the project. The forest worked with several ATV organizations to identify potential areas where trail systems could be developed. Only a quarter of the potential areas were deemed suitable based upon environmental affects and the degree of conflict with other uses and services. The Plan EIS included an estimate that an additional 331 miles of ATV routes would be needed to meet the anticipated demand by 2000.

2. Where is the Plan Now?

Current total ATV route mileage for the three active areas is about 60 miles. The Rocky Run Area received significant flood damage in 1996 (Hurricane Fran) to the lower Rocky Run Trailhead and access trail. This access has been closed since that time and a final decision has not been made on its reestablishment. The proposed system on the Deerfield District did not become established due primarily to the lack of sponsorship from any ATV organizations. The Taskers Gap/Peters Mill Run and South Pedlar Areas continue to function and are popular trails. Both areas require frequent maintenance which is typically beyond the capability of the forest trail maintenance funding level and has been done through special regional and national allocations and Virginia Recreation Trails Fund grants.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? No

b. Why? Cordell's study, discussed under the Licensed OHV issue, does not differentiate ATV and motorcycle users from the sample so it is difficult to say how that data pertains to the unlicensed motorized users. However, it is pertinent that Cordell's study showed that a relatively low percentage of all GW respondents (12.1%) supported the objective of expanding access for motorized off highway vehicles.

There are no statistics to indicate that the demand for ATV trail mileage has increased as dramatically as predicted in the 1993 Plan but ATV and off-road motorcycle sales have increased substantially. However, based upon the expected use of the Jefferson Plan's Appendix H "Screening Criteria for New OHV Areas", it is doubtful that any new areas can be found to be suitable, including the Archer area on the Deerfield District, proposed in the 1993 Plan. The forest is very likely at the limit of its ability to support ATV use due to the relatively substantial environmental impacts and high costs of maintaining these systems.

5. Recommendations for Plan Revision

The Forest will retain the existing ATV areas, but not add any more.

Issue Roadless Area Management

A. Existing Inventoried Roadless Areas

1. What was the Plan Striving For?

The GW Plan EIS evaluated 27 inventoried roadless areas totaling more than 260,000 acres. The Plan allocated the roadless areas among the various Management Areas. Three areas, totaling about 12,000 acres were recommended for Wilderness Study (MA 8): The St. Mary's Addition, Three Ridges, and the Priest. The vast majority of the remaining acreage was allocated to Remote Highlands (121,000 acres), Special Management Areas (60,000 acres), and Special Interest Areas (32,000 acres). The Special Management Areas included Big Schloss, Little River, Laurel Fork, and Mt. Pleasant, each with its own Desired Future Condition and standards. According to the Plan, 89% of the roadless acreage is allocated to management areas which would preserve the roadless character. On the remaining 11%, approved projects could alter the roadless nature of a given area.

2. Where is the Plan Now?

During the mid 1990's there were a few projects within roadless areas, including three small timber sales affecting four roadless areas. There has also been some prescribed fire and minor trail relocation and construction in a few areas. However, these projects did not disqualify any area from the roadless inventory based upon FSH Handbook definitions. In 1994, the Mount Pleasant area was designated a National Scenic Area by Congress. The Plan was amended slightly based upon the provisions in the law. In 2000, the Priest and Three Ridges areas were designated as wilderness by Congress.

On January 12, 2001 the Department of Agriculture promulgated the Roadless Conservation Rule. That 2001 rule:

1. Prohibited new road construction and reconstruction in inventoried roadless areas on National Forest System lands, except:
   - To protect health and safety in cases of an imminent threat of flood, fire, or other catastrophic event that, without intervention, would cause the loss of life or property.
   - To conduct environmental clean up required by federal law.
   - To allow for reserved or outstanding rights provided for by statute or treaty.

- To prevent irreparable resource damage by an existing road.
- To rectify existing hazardous road conditions.
- Where a road is part of a Federal Aid Highway project.
- Where a road is needed in conjunction with the continuation, extension, or renewal of a mineral lease on lands that are under lease, or for new leases issued immediately upon expiration of an existing lease.

2. Prohibited cutting, sale, and removal of timber in inventoried roadless areas, except:
   - For the cutting, sale, or removal of generally small diameter trees which maintains or improves roadless characteristics and:
   - •To improve habitat for threatened, endangered, proposed, or sensitive species, or
   - •To maintain or restore ecosystem composition and structure, such as reducing the risk of uncharacteristic wildfire effects.
   - When incidental to the accomplishment of a management activity not otherwise prohibited by the rule.
   - For personal or administrative use.
   - Where roadless characteristics have been substantially altered in a portion of an inventoried roadless area due to the construction of a classified road and subsequent timber harvest occurring after the area was designated an inventoried roadless area and prior to the publication date of the rule.

The 2001 roadless rule was the subject of nine lawsuits in Federal district courts. On July 14, 2003, the U.S. District Court for the District of Wyoming found the roadless rule to be unlawful and ordered that the rule ``be permanently enjoined.'' The Department of Agriculture revised the Roadless Area Conservation Rule on May 5, 2005 by adopting a new rule that established a State petitioning process that allowed State-specific consideration of the needs of these areas as an appropriate solution to address the challenges of inventoried roadless area management on National Forest System (NFS) lands.

On November 29, 2006 a federal judge in California set aside the State Petitions Rule and reinstated the 2001 Roadless Rule enjoining the Forest Service “from taking any further action contrary to the Roadless Rule without undertaking environmental analysis consistent with this opinion.”

In an August 12, 2008 ruling, the Federal District Court for the District of Wyoming again held that the 2001 Roadless Area Conservation Rule was unlawfully promulgated in violation of the National Environmental Policy Act and the Wilderness Act. The Wyoming court declared that "the roadless rule must be set aside" and that '[t]herefore, the Court ORDERS that the 2001 Roadless Rule, be permanently enjoined for the second time"

With conflicting rulings in the California and Wyoming Federal Courts, the California judge clarified her opinion in a December 2, 2008 ruling. “Therefore, in the spirit of comity, the Court partially stays its injunction as to states outside the Ninth Circuit and New Mexico, pursuant to Rule 62(c). The injunction remains in full effect in all other respects.”

The George Washington National Forest Plan does not have guidelines that require that all inventoried roadless areas retain their roadless characteristics, yet the management prescribed for the areas accomplishes nearly the same result. Ninety-five percent of the roadless areas are classified as unsuitable for timber production. There are very limited provisions for the harvest of dead or dying trees along the perimeters of some of these areas. In the George Washington Plan, road construction is prohibited on 88 percent of the areas with some exceptions to provide for site specific needs. Examples of these exceptions where new road construction could be allowed include: 1) to access approved mineral activities; (2) where the new road is the only prudent alternative to serve resource needs in adjacent management areas and it will minimally impact this management area; (3) to relocate existing roads; (4) to provide access to trailheads or (5) to provide access to private land if no other route is feasible.

Inventoried Roadless Areas of National Forest System Land:

National Forest	Roadless Areas (Number)	West Virginia (Acres)	Kentucky (Acres)	Virginia (Acres)	Grand Totals (Acres)
George Washington*	27*	17,331	0	243,902	261,233
Jefferson**	37	4,818	0	147,772**	152,590
Total Both Forests	52	22,149	0	391,674	413,823

* Total from 1993 Revised Forest Plan: However the Priest (5,726 roadless ac.) and Three Ridges (4,702 roadless ac.) were designated Wildernesses by Congress in 2000. Mt. Pleasant (8,905 roadless ac.) was designated a National Scenic Area in 1994.
** Includes Beaverdam Creek, London Bridge Branch, and Rogers Ridge which predominately lie on the Cherokee National Forest in Tennessee.

Permanent Road Construction Not Allowed within Inventoried Roadless Areas:

National Forest	Permanent Road Construction Not Allowed (Acres)			
	West Virginia	Virginia	Total	%
George Washington**	13,524	217,421	230,945	88%
Jefferson	4,818	147,772	152,590	100%
Total	18,342	365,193	383,535	93%

* Based on land management allocations in revised Forest Plans
** GW Management Areas 4, 6, 8, 9, and 21.

Timber Harvesting within Inventoried Roadless Areas:

National Forest	Timber Harvesting Allowed for Stewardship Purposes* (Acres)				Timber Harvest Not Allowed Except for Salvage of Dead, Dying, or Damaged Trees (Acres)			
	West Virginia	Virginia	Total	%	West Virginia	Virginia	Total	%
George Washington**	1,149	13,034	14,183	5%	16,182	230,868	247,050	95%
Jefferson	2,931	32,004	34,935	23%	1,887	115,768	117,655	77%
Total	4,080	45,038	49,118	12%	18,069	346,636	364,705	88%

* Stewardship Purposes Include:

- Improving or Maintaining Wildlife Habitat
- Reducing the Risk of Wildfire, Insects, or Diseases
- Restoring Ecological Structure, Function, Processes, or Composition
- Enhancing or Rehabilitating Scenery
- Salvage of Dead, Dying, or Damaged Trees

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes. No management activity disqualified an areas' suitability for Congressional wilderness designation. A roadless area's characteristics remain intact.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? There is a need to update the existing inventory to remove the areas designated wilderness and national scenic area. There may also be a need for change revised national direction on inventory criteria, new terminology (potential wilderness areas) and roadless area management.

c. Tentative Options or Proposed Actions for Change

Under all following options The Priest (5,726 roadless ac.), Three Ridges (4,702 roadless ac.) and Mt. Pleasant (8,905 roadless ac.) should be dropped from the roadless inventory because these areas are now congressionally designated areas. Therefore there are now 24 inventoried roadless areas.

C-1. Adopt the 2001 Roadless Rule as a standard; yet leave the existing management area allocations as identified and delineated in the 1993 GW Forest Plan.

C-2. a) Remove the three Special areas designations (Laurel Fork, Little River, and Big Schloss) and assign them to existing GW Remote Highlands (Management Area 9 or Jefferson Prescription 12B – Remote Backcountry); b) assign the remaining 21 roadless areas to existing GW Remote Highlands Area 9. c.) Add a standard that the inventoried roadless areas be managed under the 2001 Roadless Conservation Rule or whatever roadless rule is in effect.

C-3. Modify the Forest Plan by:

h) Identifying Remote Backcountry areas that include: a) the three special area designations (Laurel Fork, Little River, and Big Schloss); b) the existing GW

Remote Highlands area (Management Area 9); and C) the portions of the 21 inventoried roadless areas not currently in GW Remote Highlands area.

i) Adding a standard that inventoried roadless areas will be managed under the current agency roadless policy and direction.

j) Adding a standard that where conflicts occur between management of inventoried roadless areas and known locations of special botanical – zoological areas, the biological values will be addressed first.

C-4. Allocate the roadless areas that allow road construction and timber harvesting to management area direction that avoid new road construction and reconstruction and cutting, sale, and removal of timber as per the table discussed above. See table on following pages. The areas proposed for change are also highlighted on the linked map.

5. What are the Consequences of Not Changing?

The Forest must update to reflect congressional designations. The Forest must also comply with any national rules on management of inventoried roadless areas.

Proposed Action

Propose Option C3.

6. Recommendations for Plan Revision

There is currently no roadless rule in place for the Forest. There was support for continuing to manage all of the inventoried roadless areas under the restrictions of the 2001 Roadless Conservation Rule. There was also interest in returning some of these areas to active management. The portions of the areas that were managed as Remote Highlands will be identified as remote backcountry areas. These will continue to be managed as unsuitable for timber production and with a prohibition for road construction (with limited exceptions). Salvage harvest will be allowed as described in the salvage section. Many of the remote backcountry recreation areas will be expanded to include the entire Inventoried Roadless Area. However, there was a common theme among many workshop attendees that we should continue to manage where we have good road access and reduce management in areas where there is poor road access. To respond to this concern, we will leave the roaded portions of a number of the Inventoried Roadless Areas in active management if they are currently in actively managed Management Areas (14, 15, 16, 17).

The following table displays these changes. A number of the remote backcountry areas contain special biological areas within them. Kelley Mountain is entirely a Special Biological Areas.

Roadless Area	W&S Rivers	Special Biological Areas	Mosaics of Wildlife Habitat	Dispersed Recreation	Remote Backcountry Recreation Acres	Total Roadless Area Acres
Adams Peak					7,282	7,282
Beards Mountain		x			7,504 - x	7,504
Big Schloss		x			20,811 - x	20,811
Crawford Mountain			1,000		8,852	9,852
Dolly Ann		2,068	800		4,998	7,866
Dry River (WV)		3,497	500		3,257	7,254
Elliott Knob		945	200		8,246	9,391
Gum Run		4,300			8,320	12,620
Jerkemtight		1,230	800		14,819	16,849
Kelley Mountain		7,742				7,742
Laurel Fork		10,053				10,053
Little Alleghany		x - Ibat	700		10,207-700-x	10,207
Little River	100	3,293	300	735	22,752	27,180
Mill Mountain		435	3,331		7,153	10,919
Mount Pleasant			735			735
Northern Massanutten					9,459	9,459
Oak Knob		2,975	800		7,077	10,852
Oliver Mountain					13,089	13,089
Ramseys Draft Add.		2,447			10,367	12,814
Rough Mtn Add.					1,154	1,154
Saint Mary's Add.					1,478	1,478
Skidmore		3,823			1,794	5,617
Southern Massanutten					12,080	12,080
The Friars					2,051	2,051
The Priest	Remove From Inventory – now Wilderness					
Three Ridges	Remove From Inventory now Wilderness					
Three Sisters					8,154	8,154

In addition, some of these areas may be considered for recommendation as wilderness.

B. New Potential Wilderness Area Inventory

The first step in the evaluation of potential wilderness is to identify and inventory all areas within the National Forest System that satisfy the definition of wilderness. For areas in the Eastern United States east of the 100th Meridian), the agency's evaluation yields one of the two following options: a) Manage the area for multiple uses other than wilderness; or b) Administratively recommend the area as a Wilderness Study Area to the United States Congress. Congress would then determine whether they want the agency to study any area further.

Final agency guidance (Forest Service Handbook (FSH) 1909.12 Chapter 70) on identifying potential areas was released on January 31, 2007.

The methodology used to identify the Potential Wilderness Areas is described in *Guidance on How to Conduct the "Potential Wilderness Area Inventory" for the George Washington National Forest Plan*. Another document, *Areas Not Included in the Potential Wilderness Inventory*, describes rationale for why some areas were not included in the Inventory. A number of other areas were also identified for consideration by members of the public, including a publication by the Wilderness Society, *Virginia Mountain Treasures: The Unprotected Wildlands of the George Washington National Forest*. They are discussed in the document *Review of the Wilderness Society's "Virginia Mountain Treasures: The Unprotected Wildlands of the George Washington National Forest*.

The Forest identified the following 37 areas as Potential Wilderness Areas.

Potential Wilderness Name	Total GWJEFF Acres	Jeff NF Acres
Adams Peak	8,226	0
Archer Knob	7,110	0
Beards Mountain	10,152	0
Beech Lick Knob	14,087	0
Big Schloss	28,347	0
Crawford Knob	14,851	0
Dolly Ann	9,524	0
Duncan Knob	5,973	0
Elliott Knob	11,070	0
Galford Gap	6,689	0
Gum Run	14,547	0
High Knob	18,447	0
Jerkemtight	27,314	0
Kelley Mountain	12,892	0

Potential Wilderness Name	Total GWJEFF Acres	Jeff NF Acres
Laurel Fork	10,236	0
Little Alleghany	15,395	0
Little Mare Mountain	11,918	0
Little River	30,227	0
Massanutten North	16,530	0
Oak Knob - Hone Quarry Ridge	16,343	0
Oliver Mountain	13,049	0
Paddy Knob	5,987	0
Potts Mountain	7,863	844
Ramseys Draft Addition	19,072	0
Rich Hole Addition	12,165	0
Rich Patch	5,625	4,754
Rough Mountain Addition	2,063	0
Saint Mary's North	3,006	0
Saint Mary's South	1,651	0
Saint Mary's West	278	0
Shaws Ridge	7,268	0
Shawvers Run Addition	84	0
Three Ridges Addition North	83	0
Three Ridges Addition South	187	0
Three Ridges Addition Southwest	9	0
Three Ridges Addition West	90	0
Three Sisters	9,871	0
TOTAL GWJEFF ACRES	378,229	5,598
TOTAL GW ACRES ONLY	372,631	

The evaluation of each of these areas is described in *Potential Wilderness Area Evaluation*. The Forest Plan will identify those areas forwarded to the Agency for recommendation to Congress for designation as wilderness. At least one area is anticipated for recommendation. Saint Mary's Wilderness West Addition was acquired

by the Forest Service for the express purpose of expanding Saint Mary's Wilderness The Plan will also identify management desires for the rest of the areas.

Issue Special Management Areas

A. Wilderness

1. What was the Plan Striving For?

The GW Plan provided direction for the four designated wildernesses: Ramseys Draft, Rich Hole, Rough Mountain, and St. Mary's, totaling about 32,000 acres or roughly 3% of the forest's area. Three areas, totaling about 12,000 acres were recommended for Wilderness Study (MA 8): The St. Mary's Addition, Three Ridges, and the Priest. The Desired Condition is to protect and perpetuate the wilderness character and values of these areas as directed in the Wilderness Act and subsequent Wilderness designating legislation including providing opportunities for solitude, education, physical and mental challenge, inspiration, scientific study and primitive recreation. Wilderness ecosystems are the result of natural succession and natural processes with as little human intervention as possible while retaining wilderness character. There is little evidence of visitor use and low interaction among users. The few trails and associated facilities present are retained primarily to protect the wilderness resources. No motorized use is permitted. The plan provides specific standards for management of the various resources and activities that are or could potentially occur in the wildernesses including, recreation, fire, lands, minerals, fish and wildlife, insects and disease, research, search and rescue, special uses, and hydrology.

2. Where is the Plan Now?

In 2000, the Priest and Three Ridges areas were designated as Wilderness by Congress, adding an additional 10,571 acres. The St. Mary's addition, totaling about 1500 acres has not been designated but continues to be managed to retain its wilderness attributes pending Congressional action on whether to designate or have the agency study it further.

In 1998 and 2005 the St. Mary's River and several of its tributaries were treated with helicopter applied limestone sand to counteract the effects of human caused acidification on the aquatic ecosystem. This watershed may need additional treatments in the future to maintain the pH of the streams at a level to support the aquatic biota. For this action, a site specific forest plan amendment allowed for the temporary reduction in the VQO below preservation.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Generally yes, except for fire management. There is no provision in the Forest Plan for managing unplanned ignitions for resource benefits in wilderness. Therefore, naturally caused (lightning) fires continue to be suppressed.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? There is need for naturally caused fires to be allowed to serve their role in the shaping of the wilderness ecosystems. This could happen to a much greater extent if direction to allow managing unplanned ignitions for resource benefits in wilderness were to be included in the Forest Plan.

The more current language from the Jefferson Plan direction regarding DFC and standards for wilderness and recommended wilderness should be used in developing the GW Plan wilderness direction.

c. Tentative Options or Proposed Actions for Change

C-1. Include managing unplanned ignitions for resource benefits as a suitable use within wilderness and adopt Jefferson standard #FW-140 that says: "FW-140: Lightning-caused fires may play their natural ecological role as long as they occur within prescribed weather and fuel conditions that do not pose unmitigated threats to life and/or private property, particularly to property within the wildland/urban interface zone."

C-2. Do nothing. Continue to disallow management of unplanned ignitions for resource benefits within Wilderness

5. What are the Consequences of Not Changing?

Fire is one of the most important and influential natural agent of change in a wilderness. Continuing to disallow lightning fire to play its natural role in the ecosystem is a significant trammeling (human control) of the wilderness. Over time, the continued aggressive suppression of fire will result in unnatural fuel buildup and increases in insects and diseases within the wilderness systems.

Proposed Action

Propose Option C1.

6. Recommendations for Plan Revision

Adopt desired conditions and standards and guidelines in the revised Plan that allow wildland fire to play its natural ecological role within wilderness.

B. Wild and Scenic Rivers

1. What was the Plan Striving For?

The GW Plan EIS identified and evaluated 14 streams located in or close to the forest. These evaluations determined which have outstandingly remarkable qualities that make them eligible for inclusion in the National Wild and Scenic River System. The evaluations also determined whether the eligible stream should receive wild, scenic or recreational classification. The streams where broken down into segments based on ownership or distinct geographical breaks. The evaluations were in accord with the 1968 National Wild and Scenic Rivers Act and were in response to and informed by the National Rivers Inventory and concerns of the American Rivers Conservation Council.

Eligibility is the initial step in the designation process. Streams or stream segments identified as eligible for designation are to be managed to preserve free-flowing conditions and to protect the outstandingly remarkable values of their segments

including the scenic, recreation, geologic, fish and wildlife, historic, and cultural values that made them eligible. Until designation decisions are made or other river studies are conducted, National Forest System lands associated with each eligible river corridor are managed to perpetuate or enhance the current conditions. Characteristics of the streams and their corridors are not to be reduced below the standards of their preliminary classification.

2. Where is the Plan Now?

The evaluation documented in Appendix D identified a total of 16 stream segments as eligible for designation based upon having at least one outstandingly remarkable value. The summary of these segments appears on page D-34 of the EIS Appendix. Most of these streams were allocated to Management Area 10, Scenic Rivers and Recreational Rivers with 55 miles of streams in the scenic river classification and 200 miles in the recreational river classification. Both classifications have corridor widths of ¼ mile on each side of the stream. There are approximately 4,000 acres in the scenic river corridor and 4,000 acres in the recreational river corridor. Portions of six streams segments are within other management areas but management practices permissible in these allocations will not preclude future inclusion of these river segments into the National Wild and Scenic River System under their identified classifications. Segment A of the St. Mary's River is the only stream identified as eligible under the wild classification. It is embedded in Management Area 8, Wilderness, which provides protection for the ½ mile river corridor.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? No

b. Why? The 1993 Wild and Scenic River Eligibility Study was comprehensive. Since that time and to date, there are no known additional streams on the forest needing evaluation and there does not appear to be a need for a reevaluation of identified streams. Streams will remain in the eligible status until suitability studies and the associated site-specific analyses are conducted. Meanwhile, eligible stream corridors would be protected and their respective classifications retained as under the current plan.

5. Recommendations for Plan Revision

Identify the currently eligible stream segments with desired conditions and standards and guidelines that recognize the need to maintain these areas in conditions that do not affect their eligibility for further consideration as Wild, Scenic or Recreation Rivers.

C. Important Scenic and Recreational Areas

1. What was the Plan Striving For?

Mount Pleasant National Scenic Area

Though there is direction for aesthetic and recreation management in each Management Area of the 1993 Revised Forest Plan, several have scenery and/or recreation resources as primary resources. These include: MA 5, Massanutten Mountain; MA 6, the Appalachian National Scenic Trail; MA 7, Scenic Corridors and the Highlands Scenic Tour; MA 10, Scenic and Recreational Rivers; MA 12, Developed Recreation; and MA 13, Dispersed Recreation (42,000 acres in numerous areas with heavy dispersed recreation use).

Additionally, MA 21, Special Management Areas is made up of 59,000 acres in four areas, Big Schloss, Laurel Fork, Little River, and Mount Pleasant. From the 1993 plan, *"These areas contain a variety of unique natural resources where a mixture of compatible management emphases is deemed the wisest management."* Scenic and recreational resources are among the mixture.

2. Where is the Plan Now?

The scenic and recreation resources of these areas remain intact. The scenic and recreation resources of the forest remain to be protected, enhanced, and preserved. The Mount Pleasant National Scenic Area has received congressional designation since the plan was written.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? No

b. Why? The goal of protecting scenic or recreation purposes remains the same. Though individual areas may have changed status, (e.g., Mt. Pleasant) the management for scenery and/or recreation has not changed forestwide. There are no additional travelways to add to the list of scenic corridors.

5. What are the Consequences of Not Changing?

The scenic and recreation resources are protected without change.

6. Recommendations for Plan Revision

Include desired conditions and standards and guidelines for the scenic corridors identified in the current plan. Also retain identification of desired conditions and standards and guidelines for the heavily used dispersed recreation areas.

Issue Aesthetics

Lake Moomaw, James River Ranger District

1. What was the Plan Striving For?

The 1993 Revised Forest Plan used adopted Visual Quality Objectives (VQO) to preserve and enhance the scenic resources of the forest. The inventory VQOs were derived using the National Forest Landscape Management Visual Resource Management System (VMS). Using the inventory as a basis, every acre of the forest was assigned an adopted VQO by management area. Adopted VQOs in the 1993 plan are more restrictive than the inventory VQOs. See the acreage table below.

For the 1993 plan, forest landscape architects updated and verified components of the VMS. All roads (Interstate, federal, state, and forest), major vistas, developed recreation sites, hiking trails, and viewing points were examined during leaf off to inventory seen areas on the forest. The public was invited to review the inventory and their input was used to refine the concern levels used in developing the final inventory VQOs. This inventory was then used in developing the adopted VQOs.

Table 3-14 (pages 3-119 through 3-121) of the 1993 plan presents contrast reducing standards used in vegetation management on the forest. Standards are given for different vegetation management activities based on the adopted VQO.

The 1993 plan went beyond the VMS direction and placed a great importance on constituent analysis.

2. Where is the Plan Now?

In 1995, after the 1993 Revised Plan was put in place, the Forest Service revised the VMS and renamed it Scenery Management System (SMS) A direct excerpt from the SMS handbook (USDA Handbook 701) explains,

> *The Scenery Management System evolved from and replaces the Visual Management System (VMS) as defined in Agricultural Handbook #462, while the essence of the system remains essentially intact, still supported by current research findings. Conceptually, the SMS differs from the VMS in that: it borrows from and is integrated with the basic concepts and terminology of Ecosystem Management. The SMS provides for improved*

integration of aesthetics with other biological, physical, and social/cultural resources in the planning process

While the VMS has adopted visual quality objectives, the SMS has adopted scenic integrity objectives (SIO) for each management area to describe the desired future condition for managing the scenic resources of the forest. The table below shows 1993 plan inventoried and adopted VQOs by acreage. The equivalent Scenic Integrity Objectives (SIO) under the SMS is also given.

Adopted Visual Quality Objectives	1993 Inventoried (Thousand Acres)	1993 Adopted (Thousand Acres)	Scenic Integrity Objectives
Preservation	34	46	Very High
Retention	94	379	High
Partial Retention	279	548	Moderate
Modification	641	88	Low
Maximum Modification	12	0	Very Low

In addition to the five long-term VQOs on the left, the 1993 plan adopted two short-term VQOs, rehabilitation and enhancement, to be used as needed, though they are not assigned to any particular management areas. The SMS establishes scenic classes, a step that was not included in the VMS, although the components used to derive scenic classes were included in the VMS inventory process. The two components of scenic classes are landscape visibility and scenic attractiveness. Landscape visibility relates to concern levels and distance zones, and scenic attractiveness equates to variety class. The inventoried combination of viewing distance, concern level, and scenic attractiveness will produce seven scenic classes with classes 1 and 2 having high public value and classes 6 and 7 having low value. There is no need for a wholesale reinventory of the scenic resources of the GW, but public input may result in site specific review and/or change.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? The Scenery Management System is now used by the Forest Service in scenic resource management.

c. Tentative Options or Proposed Actions for ChangeC-1. The SMS is evolutionary rather than revolutionary from the VMS. Therefore, the inventoried distance zones, variety classes, and sensitivity levels are used in SMS. Convert the adopted visual quality objectives of the 1993 plan to scenic integrity objectives for the revised plan by using the inventory components, determine the scenic classes and then assign SIOs in the standards and guidelines that are both appropriate to the management emphasis of the prescription area and adequately protect the scenic resource .

C-2. Do nothing.

5. What are the Consequences of Not Changing?

The Scenery Management System is the national direction for managing scenic resources on national forests and is being adopted by most forests in the plan revision process. While not adopting the SMS will have no effect on the quality of the scenic resources of the GW National Forest, the forest will be behind in terminology and tools. Practically, the scenic resource will remain protected regardless of which system is used.

Proposed Action

Propose Option C1.

6. Recommendations for Plan Revision

Adopt the Scenery Management System to maintain the high level of emphasis on scenic quality across the Forest and remain current with direction provided in the Agriculture Handbook for Scenery Management.

Issue Vegetation Manipulation

1. What was the Plan Striving For?

The Revised Plan allowed for a combination of even-aged and uneven-aged regeneration harvest methods. It also provided management for wildlife species, but not as featured species. Instead, the Revised Plan emphasized habitat for the traditional 'featured species' in Management Areas 14, 15, 16 and 22 while monitoring and evaluating the effects of management practices through management indicator species. The Revised Plan provided for a forest environment with a wide variety of habitats to meet the needs of wildlife species inhabiting the Forest.

2. Where is the Plan Now?

See the discussion of timber harvest by harvest method under Issue 2. C. Allowable Sale Quantity. Also see the discussion of habitat management for wildlife under Issue Wildlife and the discussion of successional habitat in Issue Biodiversity.

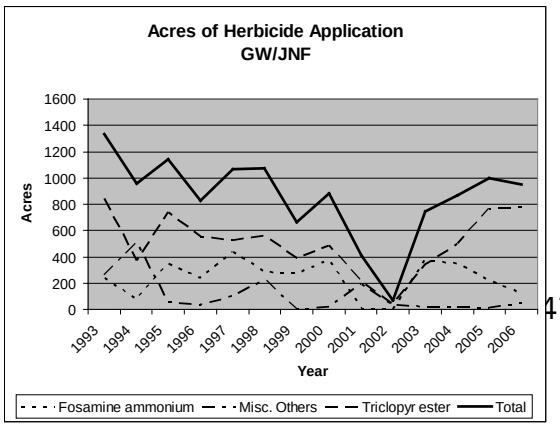
A. Herbicides

1. What was the Plan Striving For?

The Plan strove to safely utilize appropriate herbicides while avoiding significant adverse impacts to the human environment based on site-specific analysis (Plan, page 2-32).

2. Where is the Plan Now?

The graph shows the amount of land treated by herbicides over the combined George Washington and Jefferson National Forest. Figures for the GW alone are not available.



3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes, all herbicides applied were Class A herbicides as approved by the Environmental Protection Agency and the Regional Forester.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? No

b. Why? Herbicides are being used safely and conforming to appropriate State and Federal laws and policy.

5. Recommendations for Plan Revision

Utilize similar standards and guidelines as in the current plan to assure safe use of herbicides in management of vegetation.

Issue Minerals and Energy

A. Federal Minerals

1. What was the Plan Striving For?

The Revised Plan strived to continue to offer opportunities to explore and develop federal leasable minerals (energy minerals, such as natural gas, and non-energy minerals) and federal mineral materials on the Forest as one of the products important to the public (Plan page 2-33). In areas of high mineral resource potential, minerals were to be recognized as an important multiple use that may be developed in coordination with other resource values. Areas needing special protection (i.e. wilderness, recreation areas, etc.) either were to have minerals activities prohibited by law or restricted by timing, controlled surface use, or no surface occupancy stipulations according to the appropriate management area direction (Plan page 2-33). Furthermore, as existing oil and gas leases expire; new leases were to be issued under the standards of the appropriate management area (Plan page 2-33).

Federal oil and gas leasing was an issue in the development of the 1993 Revised Plan. Public involvement and environmental analysis (EIS) were considered in making the decision on what areas of the Forest would be available for federal oil and gas leasing, and under what condition or stipulation. In the EIS, the Forest examined withholding consent across the entire Forest (entire Forest unavailable for leasing). The Forest also examined withholding consent on various areas but found that Stipulations on leases could achieve similar protection of surface resources. Special Areas made available to lease under Controlled Surface Use Stipulation or No Surface Occupancy Stipulation have severe restrictions or prohibitions on ground disturbing activities. For example, the No Surface Occupancy Stipulation prohibits roads, well pads, and other ground disturbance on a lease, providing the same protection of surface resources as if consent to lease was withheld. It was also recognized that no ground disturbing activity could occur on any lease until a second environment analysis with public involvement was conducted for any site-specific proposal.

Although a large number of acres are 'available' for mineral activities, mineral deposits suitable for mining are scarce. Areas needed for mineral extraction are relatively small and isolated features on the vast acreage of the Forest. At most, only a very small percentage (less than 1%) of the Forest is expected to contain mineral activities.

2. Where is the Plan Now?

Federal leasable minerals

The Forest manages federal leasable minerals (energy minerals, such as natural gas, and non-energy minerals) in cooperation with the Bureau of Land Management (BLM), Department of Interior, which is the federal agency that issues federal energy and non-energy leases (36 CFR 288 B and E). Since 1993 the Forest has not received from BLM any requests for federal leases of non-energy minerals. From 1993 to 2006 no BLM-issued federal leases of non-energy minerals have been in effect on the Forest. Since 1993 natural gas has been the only leasable mineral on the Forest where there has been federal lease activity.

Federal oil and gas leasing on the Forest involves two levels of environmental analysis with public involvement and opportunities for public request for administrative reviews. The first environmental analysis with public involvement was the 1993 Forest Plan Revision EIS leading to the 1993 Forest Plan decision on the lands administratively available for leasing. The first administrative review was a Forest Service administrative review as a result of the 1993 Forest Service decision on lands administratively available for leasing. The second opportunity for administrative review is a BLM administrative review and occurs if and when BLM places any of these administratively available lands on a BLM public notice of competitive oil and gas lease. BLM places such lands on competitive lease sale in response to public nominations or expression of interest in leasing particular lands. This occurred in November 2007 when BLM placed on a competitive sale notice 4,802 acres on the Warm Springs Ranger District and 5,441 acres on the North River Ranger District. The public had the opportunity to request BLM administrative review of BLM's decision to offer these lands in the November 2, 2007 BLM public notice for lease.

No ground disturbance can occur on these existing leases or any future lease until the lessee submits an Application for Permit to Drill (APD) to the BLM, and a second environmental analysis with public involvement is conducted by the Forest Service and BLM. This second environmental analysis is site specific, focus on a specific proposal in a specific area of a specific lease. The Forest Service would review and approve the Surface Use Plan of Operations (SUPO). When the Forest Service makes its decision on the SUPO, and when BLM makes its decision on the APD, the public also has opportunity to request administrative reviews.

The fact that federal leases are issued does not automatically mean that any wells or road construction will be conducted on a lease. For example, during the oil and gas boom of the late 1970s and 1980s federal oil and gas leases were issued on hundreds of thousands of acres of George Washington National Forest. The result was a few

unsuccessful exploration wells were drilled that disturbed a few acres and were reclaimed. 99% of the leases expired with no ground disturbance.

Another reason for no ground disturbing activity on some federal leases can be because the drilling occurs on private land adjacent to federal land. Knowing how long it can take the federal government to process an APD and the wide range of environmental protections and restrictions on federal leases and APDs, some oil and gas operators may choose to drill on private land adjacent to federal leases.

The Laurel Fork Special Management Area became unavailable for future oil and gas leasing in a January 31, 1997 site-specific decision. Connected with this decision, the agency also withdrew consent to the Eastern States Office of the BLM to offer leases for oil and gas in the area. The Revised Plan was amended (Amendment #4) to be consistent with this decision. Federal gas wells in West Virginia are producing gas from a federal lease issued in 1952 in the Laurel Fork area. Wells drilled on a federal lease in West Virginia several decades ago showed this lease as well as the lease in Laurel Fork area was capable of gas production; but the leases did not produce because no pipeline was present. A gas pipeline was constructed in West Virginia in the 1990s. The gas pipeline allowed production from several federal gas wells in West Virginia near the Virginia state line as well as the lease in Laurel Fork area. No roads or wells are associated with the lease in Laurel Fork; it is drained by federal wells in West Virginia.

Since 1993 some seismic exploration was conducted and one natural gas exploratory well was drilled on a federal oil and gas lease in Highland County on the Warm Springs Ranger District. The exploration well drilled in 1997 did not discover commercial quantities of gas, and the well site was abandoned and reclaimed.

Oil and gas prices which were rising in recent years spiked upward in mid-2008 in the U.S. and around the world. In addition, there has been expression of interest in leasing in Hardy County and interest in the Marcellus shale (Devonian shale) as a potential source of natural gas in Virginia and West Virginia. Oil and gas prices dropped dramatically from mid-2008 to first quarter of 2009. Since 2008 the U.S. economy has slowed, and this has reduced demand for oil and gas. Interest in exploration and development for domestic energy sources, particularly oil and gas, can be expected to continue and may result in more oil and gas leasing on George Washington National Forest. However, the severe economic situation in the U.S. suggests reduced expectations or low level of potential oil and gas activity or any other mineral activity on federal mineral rights on the Forest. The Revised Forest Plan provides the direction for responding to requests to lease federal oil and gas by showing, by management area, which condition or stipulation would be applied.

Executive Order 13212 (Actions to Expedite Energy-Related Projects) of May 18, 2001 states “executive departments and agencies (agencies) shall take appropriate actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy.” Executive Order 13212 requires that: “For energy-related projects, agencies shall expedite their review of permits or take other actions as necessary to accelerate the completion of such projects, while

maintaining safety, public health, and environmental protections." Laws and environmental protections are still complied with, it is just that agencies are required to process energy projects diligently and not put energy projects off to the side and ignore these projects for months or years.

Federal mineral materials

Mineral materials include aggregate, landscaping rock, rip-rap, flagstone, and other rock or earth construction materials. Mineral materials are basic raw materials needed to construct and maintain Forest infrastructure. Every year the Forest uses mineral materials: to build and maintain trails, roads, campgrounds; to control erosion and sedimentation; to restore riparian and aquatic habitat; to reduce effects of acidic rain; to prevent or repair flood damage; etc. Most of the mineral materials used by the Forest are extracted from mines off the Forest, but some mineral materials are from small borrow pits on the Forest.

The Forest issues mineral material authorizations to the public and to state and county road departments. Congress gave the Forest Service authority to sell mineral materials to the public. Since 1993 the Forest each year has issued permits to the public for mineral materials, such as flagstone. Federal mineral materials are managed by the USDA Forest Service (36 CFR 228C), and are not the BLM-issued federal leasable minerals, such as oil and gas. The Forest can make mineral materials available as free use to governmental agencies.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? As changes are made in revising the plan we will likely need to update the oil and gas leasing availability. The Revised Plan continues to offer opportunities to explore and develop federal leasable minerals (energy minerals, such as natural gas, and non-energy minerals) and federal mineral materials while providing integration with and protection of surface resources. Furthermore, site-specific analysis on any ground-disturbing mineral activity must still occur.

B. Private Mineral Rights on Federal Lands

1. What was the Plan Striving For?

The Forest Plan provided brief mention of outstanding and reserved mineral rights. The Forest Plan recognized the existence of outstanding and reserved mineral rights with three Forest-wide Standards 151, 152, and 153 (Forest Plan page 3-140). These standards strived for basic administration of mining operations (including oil and gas drilling) in areas of outstanding and reserved mineral rights on the Forest.

The owners of the private mineral estates underlying the Forest possessed those rights before the Forest Service acquired the surface estate. The Forest Service acquisition of

the surface estate was subject to these valid existing mineral rights. These private mineral rights include the right of access and use of the surface to explore and develop the mineral estate. This section on private mineral rights does not deal with federal mineral rights or the private companies that lease federal oil and gas or other minerals; refer to section on federal minerals for discussion on federal leases.

2. Where is the Plan Now?

Mineral rights are privately-owned on 16 percent (approximately 167,000 acres) of the Forest. Of the privately-owned mineral rights, 76 percent are mineral rights outstanding to third parties, and 24 percent are mineral rights reserved by the grantor at the time of acquisition by the federal government.

Since 1993, an offer to sell private mineral rights under part of the National Forest is occasionally presented to the Forest Service. Because of other land acquisition priorities, the Forest Service generally has not pursued such offers. Thus, mineral rights remain privately-owned on 16 percent (approximately 167,000 acres) of the Forest.

Mining of shale on the Pedlar Ranger District in the 1980s was an operation under private mineral rights on National Forest System land. Reclamation of the shale mine on the Pedlar Ranger District is an operation under private mineral rights conducted under Plan implementation.

In 2005 the James River Ranger District received a proposal to exercise private mineral rights by mining. Forest Service requested additional information about the proposal, but has not received the information. To date, the proponent has not pursued the proposal with the Forest Service.

It is important to recognize that just because mineral rights are privately owned does not automatically mean that the mineral rights will be exercised to explore and develop minerals. In fact, the exercise of private mineral rights on the George Washington National Forest going back for decades is rare. As with federally-owned mineral estates, mineral deposits suitable for mining are scare on privately-owned mineral estates on the George Washington National Forest. For example, there has never been a private mineral rights oil and gas well developed on the George Washington National Forest. Areas needed for mineral extraction are relatively small and isolated features on the vast acreage of the Forest. At most, only a very small percentage (less than 1%) of the Forest is expected to contain mineral activities. Since 1993 there has not been any ground disturbing operations to explore and develop any of the 167,000 acres of private mineral rights on the George Washington National Forest

3. Did Management Activities Move the Forest towards the Desired Future condition?

The Forest Plan has served adequately. Since 1993 there has not been any ground disturbing operations to explore and develop any of the 167,000 acres of private mineral rights on the George Washington National Forest

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? Over the past 20 years the Jefferson National Forest has experienced substantially more outstanding and reserved mineral rights operations, especially oil and gas operations, than the George Washington National Forest. Integration of private mineral rights with management area direction was an issue in the 2004 Revised Jefferson Forest Plan. The analysis showed that failure to consider private mineral rights under federal surface when allocating management areas could produce incompatible and conflicting land uses. The potential for conflict with the exercise of private mineral rights is particularly high where management activities are restrictive, such as in recommended wilderness study areas or inventoried roadless areas.

The George Washington Forest Plan could be improved by providing more consideration and integration of private mineral rights in the Plan and the Revision process. The 1993 Revised GWNF planning effort did not analyze the potential conflicts between management areas on federal surface and exercise of private mineral rights on federal surface to the degree analyzed in the Revised Jefferson Forest Plan completed in 2004. This reflects the fact that the Jefferson National Forest has more private mineral rights activity than the George Washington National Forest. However, as part of this Plan Revision it is prudent to apply some lessons learned from the Jefferson Plan Revision process regarding potential effects or conflicts relating to private mineral rights. Even though the exercise of private mineral rights on the George Washington National Forest has been rare, the potential to exercise private rights cannot be ignored, as even one operation can have substantial effects. Moreover, these private mineral rights have legal status as valid existing rights on the National Forest and need to be recognized and respected in the Forest Plan. There are two potential effects or conflicts relating to outstanding and reserved mineral rights:

a) The potential effects of outstanding and reserved mineral operations on federal surface management (for example, potential for access roads and oil/gas wells pads in recommended wilderness study areas or inventoried roadless areas), and
b) Potential effects of highly restrictive surface management direction on the exercise of outstanding and reserved mineral rights on the National Forest (for example, the potential for "taking" of private mineral rights due to federal action or inaction that prevents or unreasonably delays private mineral operations in recommended wilderness study areas or inventoried roadless areas).

The exercise of private mineral rights (reserved and outstanding) to explore and develop privately-owned minerals on NFS lands is a private decision, not a federal decision. Tens of thousands of acres of the George Washington National Forest System lands were acquired subject to these private mineral rights. Forest Plan direction needs to recognize and respect these existing private rights (outstanding and reserved mineral rights). It creates a challenging situation to manage public resources, but unless and until the government acquires these private rights, Forest management is subject to these valid existing rights.

Oil and gas prices which were rising in recent years spiked upward in mid-2008 in the U.S. and around the world. Then, oil and gas prices dropped dramatically from mid-2008 to first quarter of 2009. Since 2008 the U.S. economy has slowed, and this has reduced demand for oil and gas. Interest in exploration and development for domestic energy sources, particularly oil and gas, can be expected to continue and may bring requests to

exercise private mineral rights on the George Washington National Forest. However, the severe economic situation in the U.S. suggests reduced expectations or low level of potential oil and gas activity or any other mineral activity on private mineral rights on the Forest.

Additional rationale for the need for change for the GWNF Revised Forest Plan is contained in the following extended excerpt from the Jefferson NF Revised Forest Plan FEIS. The same rationale applies to the GWNF Revised Forest Plan.
The Jefferson NF Revised Forest Plan FEIS (p. 3-358, 3-359) noted:

> A Comptroller General Report to Congress (GAO/RCED-84-101; July 26, 1984) found that the Forest Service in the eastern U.S. failed to provide Congress with information about private mineral rights and their potential effect on wilderness management. After designating many Wilderness areas in the eastern U.S., Congress was concerned about tens of millions of dollars that the Forest Service then said could be needed to acquire private mineral rights in several Wildernesses. The Forest Service was faced with management problems, litigation, and administrative costs, and was looking to Congress to purchase the private mineral rights. As the GAO noted: "Recent attempts by the federal government to acquire private mineral rights and prevent development in eastern wilderness areas have caused considerable controversy and congressional debate primarily because of the high costs associated with these purchases."

The GAO recommendation to the Secretary of Agriculture was: "Because the Forest Service did not analyze the potential problems or costs associated with private mineral rights when it developed its 1979 wilderness recommendations, GAO recommends that the Secretary direct the Forest Service's southern and eastern regional offices to do this type of analysis when reevaluating its wilderness recommendations. This analysis should include for each area consideration of private mineral development potential, the government's ability to control mineral development if it occurs, the need to acquire private mineral rights, and a range of acquisition costs."

These problems (management conflicts, litigation, and high costs) apply not only to Wilderness, but to 1) any highly restrictive surface use designation that conflicts with exercise of private mineral rights on National Forest System lands, and 2) management area direction that impose severe restrictions on use of the surface or prohibit certain activities such as road construction or mining. Examples include Special Biological Areas, Appalachian Trail Locations/Relocations, Wild & Scenic River designations, Wilderness Study Areas, or backcountry recreation areas. In 1997, the Jefferson National Forest spent more than $300,000 to acquire private minerals interests and lands to shut down private sand mine deemed inappropriate near the Appalachian Trail in Smyth County. Currently the Jefferson National Forest is evaluating purchase of another private mineral interest in NFS land near the Appalachian Trail in Smyth County.

The 5th Amendment to the U.S. Constitution provides that private property shall not be taken for public use without just compensation. In addition to designation or direction that prohibit mining or are de facto prohibitions on mining, a "taking" can have other forms. For example, the time required to process private mineral activities under the Forest Plan's framework might result in unreasonable delays that amount to a "taking" of the mineral rights. Partial takings are also possible. Executive Order 12630

“Governmental Actions and Interference with Constitutionally Protected Property Rights" was signed in 1988. E.O. 12630 requires federal decision-makers to 1) evaluate carefully the effect of their administrative actions on private property rights, and 2) to show due regard to these 5th amendment rights and to reduce the risk of undue or inadvertent burdens on the federal treasury. Concern about government "takings" of private property rights is a national issue. In 1995, Congress held hearings on this issue.

c. Tentative Options or Proposed Actions for Change

C-1. Recognize, consider and integrate outstanding and reserved mineral rights during the Forest Plan Revision process, such as in assessing suitability for Wilderness designation.

C-2. Adopt a guideline such as: "Scoping for projects, including special designations, should determine whether reserved or outstanding mineral rights may affect or be affected by the proposed action."

C-3. Adopt a guideline reflecting that review of proposed operations involves more than just riparian areas.

C-4. Do nothing.

5. What are the Consequences of Not Changing?

The consequences of not changing is that the Revised Plan may create 1) unnecessary resource conflicts, 2) inability to achieve desired future conditions in some areas, 2) public controversies that could have been avoided, 3) situations ripe for “takings” of private mineral rights, 4) multi-million costs to federal government to avoid potential “takings”, 5) another Congressional investigation and GAO report for not implementing the 1984 GAO recommendations regarding analysis of private mineral rights and the potential effect on National Forest management.

Proposed Action

Propose Option C1, C2, and C3.

6. Recommendations for Plan Revision

Consider outstanding and reserved mineral rights throughout the planning process. Adopt standards and guidelines to assure proper review of mineral rights during project implementation.

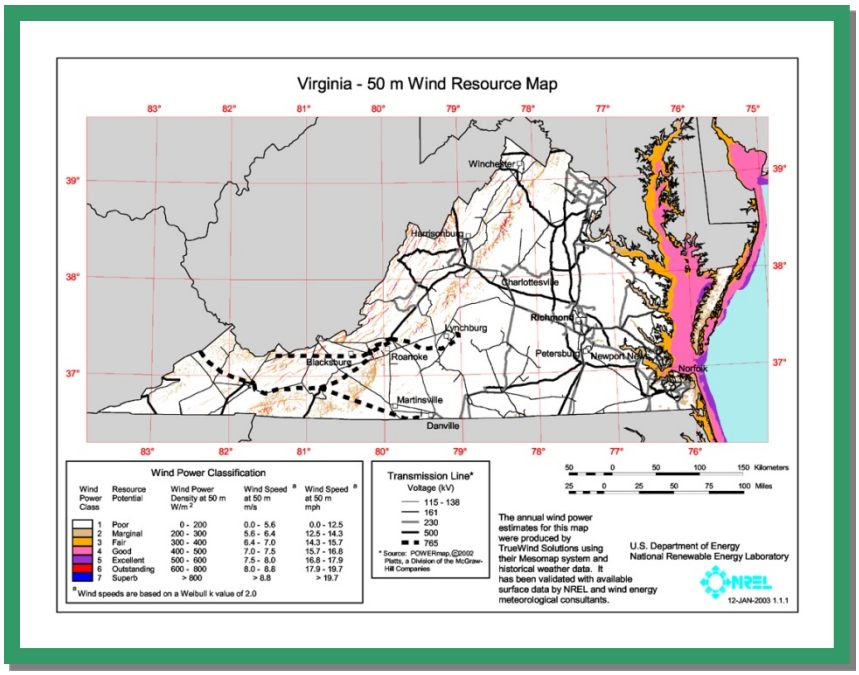
C. Wind Energy Development

Highland County, Virginia approved a wind energy development on private land ridgeline in its county. Wind energy projects are being discussed in neighboring West Virginia Counties. The Virginia Counties of Rockbridge, Warren, and Nelson counties have discussions in their comprehensive plans on the protection of mountain ridgelines. Nelson County’s policy is to “discourage ridgeline development”. Warren County’s objective is to develop standards for ridgeline development. Rockbridge County’s strategy is to explore the potential for establishing a mountaintop development

ordinance, which would be designed to protect valuable ridgelines from future development using a threshold elevation.

Ridgeline development associated with wind energy development is not discussed in the George Washington 1993 Forest Plan.

This is an emerging public issue. Representatives of Virginia's environment groups first met with representatives of Virginia's Wind Energy Collaborative at James Madison University on May 9, 2003. The Virginia Wind Energy Collaborative (VWEC) published a Model Small Wind Zoning Ordinance. The Model Ordinance is based on the ordinance adopted in October 2004 by Virginia's Rockingham County. VWEC and an Environmental Working Group had an Environmental GIS Wind Siting Tool Workshop on April 21, 2005. The overriding issue regarding this topic is the potential for requests related to the development of commercial wind facilities on public lands. Current Forest Service Policy follows that developed by the Bureau of Land Management for consideration of such a request. The Forest Service designated a National Team to investigate this topic and develop guidance and requirements regarding commercial wind development on Forest Service Lands. Progress of this Team will be tracked and available information included in the Plan as it becomes available. In the mean time, BLM processes and procedures will be followed.



Map courtesy of U.S. Dept. of Energy

The Forest Plan's existing rural development desired condition (Plan, page 2-13) is still valid. The desired future condition involves continuing Forest contributions to the economic and social vitality of the Forest's neighbors. The Forest works with neighboring people and communities in developing natural-resource-based opportunities and enterprises within the capabilities of the resources.

Commercial wind farms fall into the category of a special use of the National Forest. Forest Plan special use standard 236 states "Each new request is evaluated on a case-by-case basis for consistency with management area objectives and public need."

Guidelines for development of wind energy on land suitable could be developed based upon the best information and science available on the effects of wind farms on key environmental resources such as avian threatened, endangered, and sensitive species,

views from certain roads and trails, and other environmental considerations such as noise. Guidelines may need to focus on scale of development.

c. Tentative Options or Proposed Actions for Change

C-1. Identify the Forest as suitable for locating wind energy development (commercial wind farms) outside of the following special areas: Wilderness or wilderness study areas; special botanical, zoological, geological, or research natural areas; Shenandoah Mountain Crest (Cow Knob Salamander Habitat); both Indiana Bat protection areas; Appalachian Trail corridor; remote backcountry areas; Mt. Pleasant National Recreation Area; and Big Schloss, Laurel Fork, and Little River Special Areas. The Forest is assuming that only Department of Energy wind power classes 3 or greater would be generally commercially feasible in these areas. In addition,

1. If and when an application is received and, during site-specific analysis, consider designating as a special area the wind energy site.
2. For commercial scale requests, adopt as guidelines those guidelines developed by BLM, followed by any nationally Forest Service-developed guidelines. These will be incorporated into the planning process as they become available. Guidelines for development of wind energy on land suitable could be developed based upon the best information and science available on the effects of wind farms on key environmental resources such as avian threatened, endangered, and sensitive species, views from certain roads and trails, and other environmental considerations such as noise.

C-2. Identify as suitable for locating wind energy development (commercial wind farms) the entire National Forest outside of Congressionally-designated areas. The Forest also recognizes that only Department of Energy wind power classes 3 or greater would be generally commercially feasible in these areas. In addition, the sub-options 1 and 2 would still pertain.

C-3. Do not address in the Revision effort, acknowledging that agency does not know enough about this subject as it pertains to eastern United States. Agency would address through site-specific analysis as proposals are received.

C-4. Identify that nowhere on the National Forest is suitable for wind energy development because of known effects on bats, particularly the Indiana bat (whose summer habitat is the entire Forest), until such time as wind energy technology exists that significantly lessens the known effects of the turbines on bats.

Proposed Action

Propose Option C1.

Recommendations for Plan Revision

Identify the following special areas as unsuitable for locating wind energy development (commercial wind farms): Wilderness or wilderness study areas; special botanical, zoological, geological, or research natural areas; Shenandoah Mountain Crest (Cow Knob Salamander Habitat); both Indiana Bat protection areas; Appalachian Trail corridor;

remote backcountry areas; Mt. Pleasant National Recreation Area; and Big Schloss, Laurel Fork, and Little River Special Areas. Proposals for wind energy development in other areas would be addressed following Agency policies for special use permits and any Agency policy specifically for wind energy development.

Issue Mix of Goods and Services

Developed Recreation in West Virginia

A. Developed Recreation

1. What was the Plan Striving For?

The 1993 Revised Forest Plan describes a developed recreation program (MA12) with facilities provided to: 1) protect the natural resources of the developed recreation sites, 2) provide for the safety of visitors, and 3) enhance the visitors' recreation experiences. Facilities range from minimally developed sites with emphasis on resource protection to highly developed recreation areas that provide facilities for visitor comfort and convenience. Several facility expansion and enhancement projects are called for, all to meet then current and projected demands. Another statement says that most developed recreation facilities are made accessible as funding allows. The 1993 vision of a balanced developed recreation program remains valid.

The Forest plan (pages 2-38 and 2-39; 3-61, 3-62, and 3-63) scheduled construction of 15 new developed recreation facilities and rehabilitation and expansion of 11 other facilities.

2. Where is the Plan Now?

Demand for developed recreation opportunities on the GWNF continues to grow as was projected in the 1993 plan, particularly at highly developed recreation sites such as Bolar Mountain and Sherando Lake. There has been good progress made in upgrading, replacing, and rehabilitating many recreation areas, yet few new or expansion facilities have been built. For instance, in recent years many replacement vault toilets have been installed, several highly developed toilet/shower buildings have been constructed, campsites have been reconstructed at campgrounds, and swim sites have been enhanced, all as called for in the 1993 Plan. All of the construction and rehabilitation was completed with accessibility for persons with disabilities included as a matter of course. But, there is a whole lot of work called for in the Plan that has not happened primarily due to funding shortfalls.

Under the plan, fifteen new developed recreation areas are called for as funding permits. The table below shows the status of construction of new facilities. Though intended as developed sites with toilets, water, and camping facilities, so-called dispersed camps are meant to accommodate horse users as well as hunters and other types of dispersed recreation users. Some such as Shaw's Fork and Oliver Mountain are site specific, and

others are for yet to be determined sites. Lacking funding and staffing, most were not accomplished. It is not that they are not good ideas; it is that money was better spent elsewhere.

Status of Construction of New Developed Recreation Areas

Ranger District	Area Name	Status
North River	Shaws Fork Dispersed Camp	Completed
	Dry River Dispersed Camp	No
	Dry River Rifle Range (VA)	No
James River	Oliver Mtn Dispersed Camp	No
	Highlands Scenic Tour	Completed
Lee	Bear Wallow Dev Campground	No
	Bucktail Dispersed Camp	No
	Edinburg Gap Dispersed Camp	Partially Complete
	Lee Rifle Range	No
Pedlar	Crabtree Meadows	New toilets only
	Pedlar Dispersed Camp	No
	Pedlar Rifle/Archery Ranges	No
	Environmental Education Center	Road Only
Warm Springs	Greavers Ridge Dispersed Camp	No
	Warm Springs Dispersed Camp	No

Under the plan several existing recreation areas are scheduled for expansion and/or rehabilitation as funding permits. This is meant to be more than just toilet replacement. It is intended to add capacity as well as upgraded facilities.

Status of Construction/Expansion at Existing Developed Recreation Areas

Ranger District	Area Name	Status
North River	Hone Quarry expansion/upgrade	New toilets only
	Braley Pond expansion	No
James River	Longdale expansion	No
	Morris Hill expansion	Incomplete
Lee	Elizabeth Furnace expansion	New campsites, vault toilets only
	Camp Roosevelt expansion	No
	Trout Pond expansion	No
Pedlar	Crabtree Falls Trail and Obs Point	Completed
	Sherando Lake expansion	No
Warm Springs	Bolar Mountain CG Conversion	Completed
	Hidden Valley expansion/upgrade	New vault toilets only
	Greenwood Point expansion	No
	Blowing Springs expansion/upgrade	New vault toilets only
	McClintic Point Camp	New vault toilet only

Since 1993, six minimally developed recreation areas have been closed and have been either abandoned or moth-balled, likely to never reopen. The ability of recreation managers to provide adequate maintenance and capacity has been reduced by funding and staffing cuts. Demand for these areas has not been great enough to warrant funding and personnel time for operations and maintenance. These areas include Reddish Knob

Hang Gliding, Shenandoah Mountain Picnic, Hazard Mill Family Camp, Hazard Mill and High Cliff Canoe Camps, and New Market Gap Picnic.

All new and altered facilities will be accessible to persons with disabilities to the extent called for in the Forest Service Outdoor Recreation Accessibility Guidelines (FSORAG) regardless of plan options selected for implementation

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes, but at a slower pace than anticipated.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? The developed recreation program called for in the 1993 Forest Plan was good, but did not consider a realistic expectation of funding. There was a sharp decline in recreation funding in the early years of the new millennium. From 2002-2003, the George Washington National Forest conducted a Recreation Realignment, in accordance with direction from the Regional Office, to analyze use-specific and site-specific costs and benefits in order to make fiscally responsible decisions about recreation areas management. As a result, many actions were implemented from simply modifying opening and closing dates to actually closing visitor centers and stand-alone picnic areas and low use sites. In 2006, more than 100 part-time workers involved with the Senior Community Service Employment Program, who worked primarily in developed recreation, were transitioned to non-Forest Service assignments under new grantees, which resulted in reduced services at many recreation sites. To add insult to injury, fixed costs have risen substantially for supplies, trash collection, pumping vault toilets, utilities, mowing contracts, personnel and vehicles to transport personnel to recreation areas. Recreation fees were increased at six campgrounds on the George Washington National Forest in 2008, however the increased revenues did not keep pace with increased costs of operations and maintenance.

The next step for the Forest is to develop a portfolio of sustainable recreation facilities. It is believed that additional measures will be taken to reduce the development scale and/or reduce visitor services at moderate to low level developed recreation sites and limit the highly developed recreation areas to those that currently exist.

c. Tentative Options or Proposed Actions for Change

C-1. Do nothing but administrative corrections by revising the proposed facilities construction lists to reflect accomplishments and removing from the list areas that have been closed. Maintain the existing developed recreation program in the 1993 plan, with updates to reflect accomplishments and closings and with realization and acceptance that funding will be limited. The distinction of minimally developed and highly developed sites would remain.

C-2. Make an administrative change by removing the listings of individual developed recreation facilities. The developed recreation program for expansion and/or new construction will be dealt with by site specific analysis and completed only to the extent that funding and staffing levels allow. The Plan would continue to provide for a variety of development scales, from minimally to highly developed recreation sites.

5. What are the Consequences of Not Changing?

By not changing the plan, there will be no acknowledgement that funding levels are limiting and Forest Service personnel and recreation program resources are subject to unexpected and sometimes radical changes.

No hard consequences will result if changes are not made. Developed recreation facilities will be managed as funding allows. A quality program responsive to visitor needs is desired and intended either way.

The advantage of change in the plan is that the forest will maintain the issue of providing a quality developed recreation program to the extent practical. Managers acknowledge the visitor desires for developed recreation opportunities with site specific analysis. Knowledgeable management is more likely to be funded to provide a better developed recreation program.

Proposed Action

Propose Option C2.

6. Recommendations for Plan Revision

Remove the list of potential projects from the Plan desired condition. Acknowledge the desire to maintain and improve the existing developed recreation facilities. If new opportunities become available, address them through a site specific analysis.

B. Dispersed Recreation

1. What was the Plan Striving For?

The current GW plan recognized the importance of providing a variety of present and future dispersed recreation opportunities for the approximate 60 million residents within a day's drive of the forest. These opportunities include but are not limited to hunting, fishing, wildlife viewing, hiking, backpacking, camping, horseback riding, mountain biking, OHV use, driving for pleasure, and visiting historical sites. The Plan strove to meet demand for each of various Recreation Opportunity Spectrum (ROS) class settings as well as both motorized and non-motorized types of recreation. According to the EIS (page 3-34), as of 1993 the forest had ample land capacity to meet current and future demand for all the various ROS classes.

The GW Plan adopted six ROS classes to reflect the types of recreation opportunities and settings available on the forest. These six were: Rural, Roaded Modified, Roaded Natural, Semi-primitive Motorized – Subclass 1 (SPM1), Semi-primitive Motorized – Subclass 2 (SPM2) and Semi-primitive Nonmotorized (Plan Table 2-11, page 2-40).

Roaded Modified areas were differentiated from Roaded Natural areas solely on the basis of visual quality objectives (VQO). Roaded modified areas were to be managed to meet a modification VQO, while Roaded Natural areas were managed to meet the full range of VQOs except modification (FEIS, Appendix G, and page G-6.)

SPM1 and SPM2 areas were differentiated from each other based on whether roads built into an area were available for public motorized use. SPM1 areas were to be managed so that roads built could be open year-round, open seasonally, or closed year-

round depending on site-specific considerations. Conversely SPM2 areas were to be managed so that roads built into this area were not available for public motorized use (FEIS, Appendix G, page G-4 and G-5.)

A more thorough discussion of these six classes was discussed in Appendix G of the EIS.

2. Where is the Plan Now?

All management areas allowed for some form of dispersed recreation and the desired future condition for each included a discussion of the settings and types of opportunities that are consistent with the management area direction. Dispersed recreation was emphasized in MA5, Massanutten Mountain Sensitive Viewshed; MA6, Appalachian Trail; MA7, Scenic Corridors and the Highlands Scenic Tour; MA8, Wilderness/Wilderness Study; MA10, Scenic Rivers and Recreation Rivers; MA11 All-Terrain/Off Highway Vehicle Routes; MA13, Dispersed Recreation; MA 14 Remote Habitat for Wildlife, MA 15 Mosaic of Wildlife Habitat, MA16 Early Successional Habitat for Wildlife, MA21 Special Management Areas; and MA22 Habitat-Small Game/Watchable Wildlife. Forestwide and management area standards were designed to protect the environment from human caused impacts while providing recreation opportunities.

As of 1993 the Roaded Natural (RN) class comprised by far the largest percentage of the forest at 58%. This class provides the widest range of settings and opportunities since it tends to be amenable to both motorized and non-motorized forms of recreation. The Semi-Primitive Non-Motorized (SPNM) class, which restricts motorized recreation, comprised about 14% of the forest. Roaded Modified (RM)) which least restricts motorized recreation comprised approximately 8% of the forest.

While the Plan had six classes, the normal ROS inventory would have only four germane to the GW. The roaded modified is a subset of the Roaded Natural Class. Likewise the Semi-primitive Motorized, SPM1 and SPM2 are subsets of Semi-primitive Motorized class.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes, there did not seem to be any problems in managing the Forest under the adopted ROS concept. However, there is direction in the FEIS Appendix G that is not in the Plan regarding how roads built into SPM 1 and SPM2 areas are to be managed.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? The GW Plan is technically silent on the type of road (temporary, permanent, or both) that can be constructed and how it should be managed within adopted ROS class areas. The direction about road construction and management of SPM1 and SPM2 areas is in the FEIS and should be in the Plan. Furthermore, it may not be appropriate to have a differentiation from the SPM inventory to deal with how one aspect – roads – are managed.

The Plan's Roaded Modified distinction is not warranted. This is not a class that is provided in the Recreation Opportunity Spectrum. The protection of scenic quality is provided by assigned Scenic Integrity Objectives for every acre of Forest Service land that can be viewed from roads, trails, overlooks, and other viewing vantage points on, or

outside of, the national forest. The Scenery Management System contains direction on compatibility with ROS. Roaded Modified therefore serves no useful purpose and is redundant.

According to The Public Survey report, Southern Appalachian National Forests, 2002 (Cordell) 52% of respondents viewed wildlife/scenery, 52% drove for pleasure, 41% visited a wilderness and almost 34% hiked on the GW at least once that year. The other dispersed uses such as OHV use, fishing, biking, backpacking, and hunting are substantially lower but there is no statistical evidence or surveys indicated that demand for dispersed recreation in general is declining. Based on qualitative evidence from public contacts and volunteerism, equestrian and mountain bike use and interest is continuing to increase. Hiking and backpacking use fluctuates considerably based on seasonal weather conditions but appears to be remaining steady to increasing slightly. Hunting, by contrast, is evidently declining based on the drop in numbers of state hunting licenses issued over the past several years. This survey data confirms the need for providing a good mix of ROS classes while avoiding loss of opportunities for the activities tied to the more primitive/remote settings found primarily on the national forest.

For context, the most primitive class in the ROS system is Primitive (P). This class is characterized as being essentially unmodified; at least 5,000 acres in size and at least 3 mile from all roads, railroads or utility corridors. There are no Primitive (P) ROS class areas inventoried on the forest and there is little or none of it known to exist anywhere in the East. Thus the Semi-Primitive ROS classes (SPNM and SPM) are the most primitive to be found on the GW. These approximately 2,500 acre areas comprise roughly a third of the GWNF land area. While this is significant percentage of the forest, on a landscape scale these areas are scarce and comprise a very small percentage of the total land base (less than 2% of Virginia). The national forest is the primary provider of these types of settings and opportunities which are dependent upon land that is at least ½ mile from a better than primitive road to provide remoteness. Over time, the Semi-primitive classes will inevitably continue to shrink due to development on adjacent private lands. In addition, on the GW currently there is little protection in place against the increase in adjacent road construction which in turn would cause shrinkage of the semi-primitive ROS classes and their associated settings and opportunities.

While the GW Plan used six ROS classes for management of the recreation experience, the Jefferson Plan utilized four ROS classes: Roaded Natural, Semi-primitive Nonmotorized, Semi-primitive motorized (SPM) and a subset of SPM called Semi-primitive motorized 2 (SP2). The SP2 area was differentiated from SPM areas to provide a buffer to protect SPNM and SPM areas by allowing only temporary roads to be built within a ½ mile of an inventoried SPNM or SPM area. (Plan, page 2-42, standards FW-163 to FW-168) Thus both forests handled road construction and management differently and for different purposes.

c. Tentative Options or Proposed Actions for Change

C-1. No change. Continue to use the existing GW Plan adopted ROS classes by applying them to identified areas of the Forest.

C-2. Remove the SPM 1, SPM2, and Roaded Modified designations from the GW Plan, thereby collapse the GW ROS classes into the basic inventory classes; and provide suitable uses and associated guidelines on road construction and management by SPM and SPNM classes in the Plan.

C-3. Complete a new inventory of ROS on the GW and adopt the inventory in place of the 1993 adopted ROS classes. Incorporate into plan direction a desire that the acres of SPNM and SPM will be maintained (where it is within our management control). This could be done with a guideline on road construction or using the SP2 Class concept from the Jefferson Plan. The SP2 Class concept creates a buffer area around SPNM and SPM areas were permanent road construction is limited to protect against loss of SPNM and SPM areas.

5. What are the Consequences of Not Changing?

Areas with SPNM and SPM opportunities have a potential for shrinking due to adjacent road construction and use on the Forest.

Proposed Action

There is no proposed action on this issue at this time.

Additional Information

The ROS classes were re-inventoried in 2009.

The following table displays the inventory from 1993, the acres adopted by class in the 1993 Forest Plan and the current inventory. Acres of RM were combined with RN for the Forest Plan adopted acres.

Acres of ROS Class			
ROS Class	1993 Inventory (Acres)	1993 Adopted (Acres)	2009 Inventory (Acres)
SPNM	167,000	150,000	198,266
SPM	203,000	208,000	211,000
RN	691,000	703,000	655,200

The ROS inventory shows that the semi-primitive class areas on the GW increased from 35 percent to 38 percent of the Forest from 1993 to 2009. The semi-primitive component of the GW is also substantially greater than that on the Jefferson NF (22 percent). So while the effects of development on adjacent lands have diminished some areas of semi-primitive opportunities, management activities on the National Forest have had minimal effects on semi-primitive opportunities.

c. Tentative Options or Proposed Actions for Change

C-1. No change. Continue to use the existing GW Plan adopted ROS classes by applying them to identified areas of the Forest.

C-2. Remove the SPM 1, SPM2, and Roaded Modified designations from the GW Plan, thereby collapsing the GW ROS classes into the basic inventory classes; and provide suitable uses and associated guidelines on road construction and management by ROS classes in the Plan.

C-3. Remove the SPM 1, SPM2, and Roaded Modified designations from the GW Plan, thereby collapse the GW ROS classes into the basic inventory classes. In addition, use the new ROS inventory to help identify remote backcountry areas and evaluate potential wilderness areas. Additional standards or suitable use restrictions will not be identified. Any potential projects in the future that could affect the current ROS setting will be addressed through site specific project analysis.

6. Recommendations for Plan Revision Propose Option C-3.

C. Land Ownership

1. What was the Plan Striving For?

The Plan was striving for the consolidation of national forest ownership by exchange or acquisition with particular emphasis on acquiring desirable interior tracts, high value recreation lands, or threatened, endangered, and sensitive species' habitat.

The objectives are to have an exchange program of 100 acres per year and an acquisition program of 200 acres per year. The existing lands objectives do not reflect the reality of what can be accomplished under current National and Regional criteria and funding. (Plan Page 2-41, 2-42)

2. Where is the Plan Now?

The Plan goal has not changed. It is still striving for the consolidation of national forest ownership.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? A change is warranted because it is no longer feasible to accomplish the goals with the funding program, Land and Water Conservation Fund (LWCF) identified or in the time/acreage frames set in the Plan.

The land exchange program history shows that since 1993 in only two out of thirteen years was the 100 acre objective achieved or exceeded. The average for the exchange program was 34 ½ acres. The land acquisition program history shows that in only two of the years during the same period was the 200 acre goal achieved or exceeded. The average was 146 acres.

Trend in Land Acquisitions and Conveyances across the Combined Forests

Year	Land Acquired Thru Exchange, Purchase or Donation (Acres)	Federal Land Conveyed Thru Selling or Exchanges (Acres)	Land Acquired Thru Exchange, Purchase or Donation (Acres)	Federal Land Conveyed Thru Selling or Exchanges (Acres)	Land Acquired Thru Exchange, Purchase or Donation (Total Acres)	Federal Land Conveyed Thru Selling or Exchanges (Acres)	Net Increase in National Forest System Land (Acres)
Forest	**GW**	**GW**	**Jefferson**	**Jefferson**	**GWJEFF**	**GWJEFF**	
1987	296	-175	869	-132	1,165	-307	858
1988	4368	-130	885	-504	5,253	-634	4,619
1989	71	-212	524	-240	595	-452	143
1990	137	-376	0	0	137	-376	(239)
1991	83	-43	2058	-240	2,141	-283	1,858
1992	29	-23	1175	-293	1,204	-316	888
1993	167	-10	2011	-82	2,178	-92	2,086
1994	29	0	943	-370	972	-370	602
1995	192	0	3771	-46	3,963	-46	3,917
1996	76	0	1521	0	1,597	0	1,597
1997	35	-54	256	-444	291	-498	(207)
1998	95	0	1715	-34	1,810	-34	1,776
1999	772	-194	1039	-5	1,811	-199	1,612
2000	181	0	994	-99	1,175	-99	1,076
2001	210	-20	47	0	257	-20	237
2002	0	-170	381	-62	381	-232	149
2003	22	0	234	0	256	0	256
2004	0	0	1806	-54	1,806	-54	1,752
2005	120	-1	80	0	200	-1	199
2006	0	0	13	0	13	0	13
2007	14	25	0	5	14	30	44
						Grand Total	23,236

c. Tentative Options or Proposed Actions for Change

C-1. Modify the Forest Plan by:

a) Making administrative correction by removing all reference to Land and Water Conservation Fund (LWCF) as the funding source for land acquisition since no funding is available for land acquisition.

b) Deleting land program objectives for an exchange and acquisition program and replacing with language that states exchanges and acquisitions of land will be accomplished as funding is available

C-2. Do nothing.

5. What are the Consequences of Not Changing?

The changes will reflect that land managers are keeping abreast of changes in the program and are working toward realistic goals.

Proposed Action

Propose Option C1.

6. Recommendations for Plan Revision

Make the proposed changes.

D. Special Uses

1. What was the Plan Striving For?

The Plan was striving to minimize and or discourage the dedication of public land to a single private use. However, the plan did allow for special uses provided the uses were consistent with the objectives of the management area where the use was to be applied. Every use request was to be assessed to determine compatibility and compliance. (Plan Page 2-42)

2. Where is the Plan Now?

The Plan objective has not changed. It is still striving for minimizing the dedication of public land to a single private use.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Yes

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? No

b. Why? The objectives as stated in 1993 are still valid for the next planning period.

E. Grazing

1. What was the Plan Striving For?

The 1993 Revised Plan continues the current program of grazing on five allotments on 250 acres (Plan, page 2-42). Four allotments are located along the South Fork of the Shenandoah River (Moody, Whitting, Cullers, and Curl) and one is along Cedar Creek (Zepp Tannery) on the Lee Ranger District. Grazing is to be used to maintain a pastoral setting on lands historically grazed or

cultivated. (GW Plan Pg 3-130).

2. Where is the Plan Now?

Grazing continues on three of the five allotments; the Curl and Cullers allotments are no longer grazed. Lee District likes to have the presence of the permittee on these isolated tracts to discourage illegal use and traffic on these lands.

Even though the allotments are grazed to maintain the pastoral setting of these lands, impacts on soils and water are occurring. The Moody, Whitting, and Zepp Tannery allotments are currently being grazed with varying degrees of riparian protection or animal access to stream channels. The allotment on Cedar Creek has no controls to keep cattle from the creek. Otherwise, the other allotments have reasonable controls in place to limit cattle access to the South Fork of the Shenandoah.

3. Did Management Activities Move the Forest towards the Desired Future condition?

Pastoral settings are being maintained through grazing on three of the five allotments. While other the allotments (Curl and Cullers) are not being grazed, their pastoral setting is now being maintained by mowing or haying the fields.

4. Is There a Need for Change?

a. Is a Change in the Plan warranted? Yes

b. Why? Maintaining pastoral settings through grazing may not be appropriate on each of the five allotments. On the South Fork of the Shenandoah River, pastoral settings are common. However, Eastern Riverfront Hardwood communities (Bottomland Hardwoods) are not common. The JNF Plan (pages 3-170 and 3-178) recognizes the importance of this ecosystem, while the George Washington currently does not.

As a corollary, if pastoral settings is appropriate, and since cattle still have access to the streams for water, there is a need to strengthen the desired conditions and standards and guidelines under which grazing can occur. Utilizing just cattle to maintain a pastoral setting may not be appropriate. Currently the Curl tract's setting is maintained by mowing or haying. Utilizing cattle may conflict with trying to have intact riparian corridors and high water quality given that cattle have access to the stream/river water for drinking. Management of the allotments could become a model for other privately-managed farms in the valley.

Likewise, the NRCS is the leader in agricultural conservation in the United States and its standard practices on reducing effects from cattle grazing should be adopted by the Forest Service. NRCS can recommend appropriate practices for these allotments.

c. Tentative Options or Proposed Actions for Change

C-1. Remove pastoral settings and cattle grazing as a desired condition and replace the desired condition to be one of a bottomland hardwood forest along the South Fork of the Shenandoah River.

C-2. Change the desired condition to include having bottomland hardwood forest as well as pastoral setting (managed through grazing, burning, mowing, or hay fields), and bring any grazing program in line with the Jefferson Plan and Natural Resource Conservation Service (NRCS) practices by:

a) Adopting as desired conditions and objectives Jefferson Plan Goal 28 and Objectives 28.01.

b) Adopting Jefferson Plan Forestwide range standard FW-212.

c) Adopting Jefferson Plan Management Prescription 7G (Pastoral Landscapes) desired condition statements as they pertain to pastoral settings and grazing.

d) Adopting Jefferson riparian standards 11-38 through 11-40.

e) Creating an objective that the existing four grazing allotment plans be revised over the next 10 years.

C-3. Do nothing. Leave pastoral settings and grazing as is in the Plan.

5. What are the Consequences of Not Changing?

Cattle will still graze and will still have access to the rivers and streams. The Forest would continue to attempt to remove cattle access to rivers and streams on a site-specific basis as funding permits.

Proposed Action

Propose Option C2.

6. Recommendations for Plan Revision

Include a desired condition for bottomland hardwood forest as well as pastoral setting (managed through grazing, burning, mowing, or hay fields) and bring any grazing program in line with the Jefferson Plan and Natural Resource Conservation Service (NRCS) practices by:

a) Adopting as desired conditions and objectives Jefferson Plan Goal 28 and Objectives 28.01.

b) Adopting Jefferson Plan Forestwide range standard FW-212.

c) Adopting Jefferson Plan Management Prescription 7G (Pastoral Landscapes) desired condition statements as they pertain to pastoral settings and grazing.

d) Adopting Jefferson riparian standards 11-38 through 11-40.

e) Creating an objective that the existing four grazing allotment plans be revised over the next 10 years.

CHAPTER 5. ADDITIONAL ISSUES

A. Drinking Water

Many comments were received regarding the need to emphasize protection of water quality in watersheds that provide drinking water to downstream users. Resolutions

requesting that the Forest identify drinking water watersheds and develop direction to protect water quality in those watersheds were received from: Clarke County, Town of Timberville, Dayton Town Council, Warren County, Page County, Shenandoah Riverkeeper, Friends of the North Fork of the Shenandoah, Shenandoah Forum, Shenandoah Valley Network, Community Alliance for Preservation, Scenic 340 Project, Town of Amherst, Central Shenandoah Planning District Commission, Robert E. Lee Soil & Water Conservation District, Amherst County, Staunton City, Central Virginia Land Conservancy, Campbell County, and Bedford County. Wild Virginia prepared a document, *The State of Our Water: Managing and Protecting the Drinking Water Resources of the George Washington National Forest* that identified many drinking water watersheds and some recommendations for management.

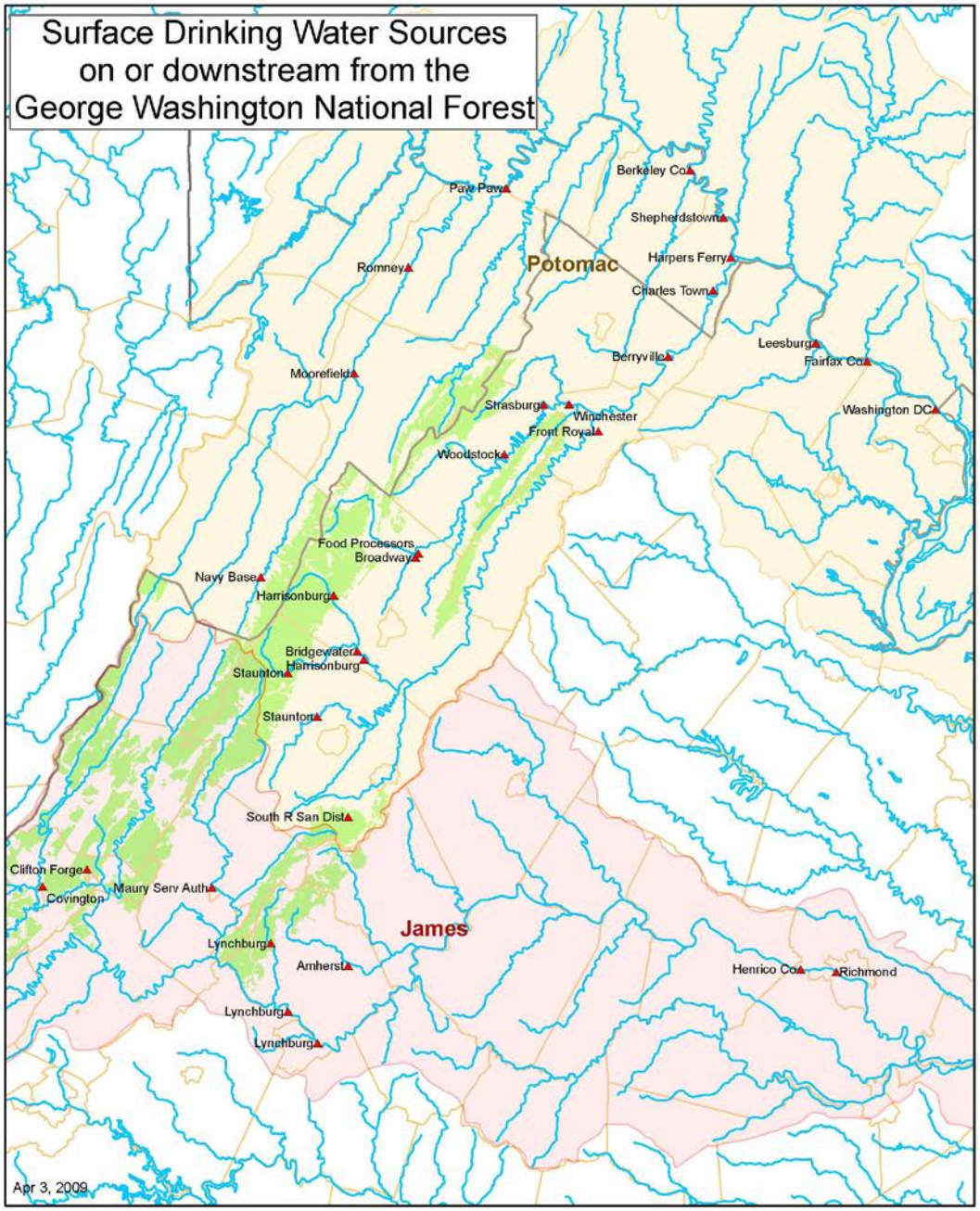
Water has been a key factor in National Forest Management since the creation of the National Forests and has been a key component of forest planning efforts on the GWNF (Cite 1960 plan) for over forty years. Proper management of water requires managing healthy forests throughout the watershed and taking appropriate management precautions in all activities. However, one of the main aspects of protecting water quality is managing the streams and the lands immediately adjacent to the streams – the riparian areas. (See the Riparian section of this document.) On the Forest we must provide water quality that is sufficient to support all of the aquatic life in our streams. Many of these plants and animals are very sensitive to water quality and we have a number of endangered and threatened aquatic species. Therefore, we have established guidelines that protect water quality for these species. By protecting them, we provide water quality of very high quality for drinking water sources.

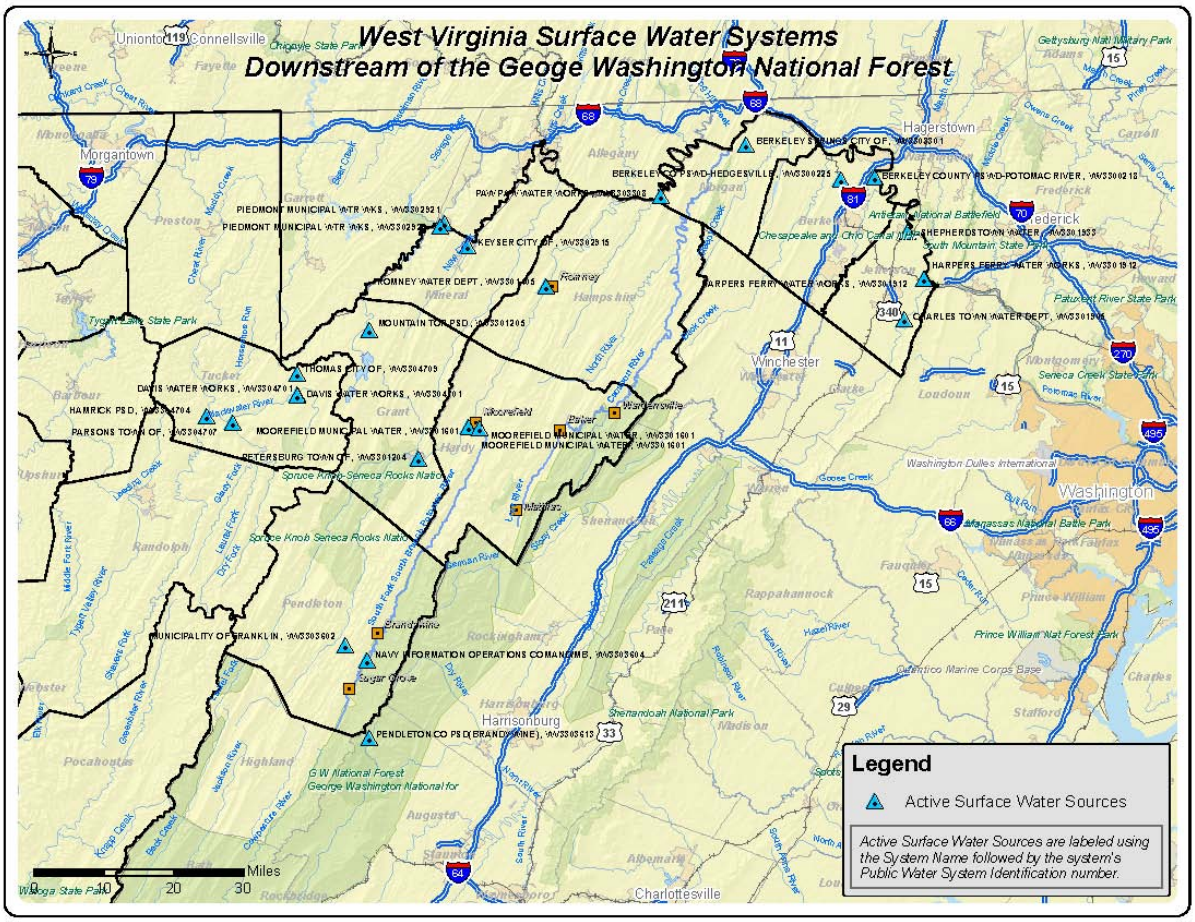
In the revised Plan we need to identify the drinking water supplies that depend on the National Forest. See Map and list of water supplies. In the strategy section of the revised Plan we can identify the importance of considering downstream uses in determining priorities for watershed improvement activities.

DRINKING WATER SUPPLIES WITHIN OR DOWNSTREAM OF GEORGE WASHINGTON NATIONAL FOREST

SYSTEM NAME	RIVER SYSTEM
LYNCHBURG, CITY OF	JAMES RIVER – COLLEGE HILL
LYNCHBURG, CITY OF	JAMES RIVER – ABERT
RICHMOND, CITY OF	JAMES RIVER
HENRICO COUNTY WATER SYSTEM	JAMES RIVER
AMHERST, TOWN OF	BUFFALO RIVER
JAMES RIVER CORRECTIONAL CTR	JAMES RIVER
LYNCHBURG, CITY OF	PEDLAR RESERVOIR
MAURY SERVICE AUTHORITY	MAURY RIVER
COVINGTON, CITY OF	JACKSON RIVER
CLIFTON FORGE, TOWN OF	SMITH CREEK
SOUTH RIVER SANITARY DISTRICT - ACSA	COLES RUN RESERVOIR
STAUNTON, CITY OF	NORTH RIVER DAM
HARRISONBURG, CITY OF	DRY RIVER – RIVEN ROCK
HARRISONBURG, CITY OF	NORTH RIVER
BRIDGEWATER, TOWN OF	NORTH RIVER

SYSTEM NAME	RIVER SYSTEM
BROADWAY, TOWN OF	NORTH FORK SHENANDOAH RIVER
FOOD PROCESSORS WATER COOPERATIVE, INC	NORTH FORK SHENANDOAH RIVER
WOODSTOCK, TOWN OF	NORTH FORK SHENANDOAH RIVER
FRONT ROYAL, TOWN OF	SOUTH FORK SHENANDOAH RIVER
WINCHESTER, CITY OF	NORTH FORK SHENANDOAH RIVER
STRASBURG, TOWN OF	NORTH FORK SHENANDOAH RIVER
FAIRFAX COUNTY WATER AUTHORITY	POTOMAC RIVER
BERRYVILLE, TOWN OF	SHENANDOAH RIVER
LEESBURG, TOWN OF	POTOMAC RIVER
BERKELEY COUNTY PSWD-POTOMAC RIVER	MAIN STEM POTOMAC RIVER
ROMNEY WATER DEPT	SOUTH BRANCH POTOMAC RIVER
MOOREFIELD MUNICIPAL WATER	SOUTH BRANCH POTOMAC RIVER AND SOUTH FORK OF THE SOUTH BRANCH POTOMAC RIVER
CHARLES TOWN WATER DEPT	SHENANDOAH RIVER
HARPERS FERRY WATER WORKS	MAIN STEM POTOMAC RIVER
SHEPHERDSTOWN WATER	MAIN STEM POTOMAC RIVER
PAW PAW WATER WORKS	MAIN STEM POTOMAC RIVER
NAVY INFORMATION OPERATIONS COMAND/MB	SOUTH FORK OF THE SOUTH BRANCH POTOMAC RIVER


Surface Drinking Water Sources
on or downstream from the
George Washington National Forest
Berkeley Co
Paw Paw
Shepherdstown
Harpers Ferry
Potomac
Romney
Charles Town
Leesburg
Berryville
Fairfax Co
Moorefield
Strasburg
Winchester
Washington DC
Front Royal
Woodstock
Food Processors
Broadway
Navy Base
Harrisonburg
Bridgewater
Harrisonburg
Staunton
Staunton
South R San Dist
Clifton Forge
Covington
Maury Serv Auth
James
Lynchburg
Amherst
Henrico Co
Richmond
Lynchburg
Lynchburg
Apr 3, 2009



B. Environmental Education

Many comments were received regarding the importance of providing environmental education opportunities on the Forest. While environmental education is not a plan component, it is important to highlight the need for more emphasis on environmental education and to acknowledge the tremendous opportunities that the Forest provides to meet the need to educate youth about the Forest's resources.

C. Climate Change

Please see the separate report addressing climate change, *Climate Change Trends and Strategies for the George Washington National Forest*.

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APPENDIX A – SUPPLY AND DEMAND

Introduction

According to 36 CFR 219.12(e), the forest plan shall contain the following:
"(3) Projections of demand using best available techniques, with both price and nonprice information. "

Range Supply and Demand

The range program on the George Washington NF is so small in scope that supply and demand conditions were not considered necessary.

Timber Supply and Demand

The timber supply and demand analysis should answer the following questions about the timber resource on the George Washington National Forest (GWNF):

- How much timber, by product groups, does industry need and how much would local industry desire from the GWNF?
- How much timber, by product groups, is available from all ownerships and how much timber could the GWNF produce under various policy, legal and social limitations?
- What niche in the timber economy could the GWNF fill?

Answers to these questions will provide guidance in identifying alternatives, desired conditions, and objectives during the plan revision.

Definitions

Definition and context for supply: Timber supply is estimated as the current standing volume of timber plus annual net growth within the given analysis area(s). While a baseline estimate considers only standing volume, ultimately factors such as harvesting economics, resource quality, and landowner attitudes should be considered. Timber supply in the South is strong and appears to have expanded throughout the 1990's in spite of competing land use pressures (Wear et al., 2007). In the Commonwealth of Virginia, for every unit of hardwood removed, 1.3 units have grown to replace it (Department of Forestry, 2008). Given the reduction of timber removals on the George Washington National Forest (GWNF), coupled with continued growth, baseline timber supply has increased greatly in the past decade.

Definition and context for demand: Timber demand is estimated as the current consumption by primary processing mills within the given analysis area. Concentration yards are not included as primary producers since most of the concentration yards serve primary producers in the various market areas.
Timber production in the Southeastern United States has grown both in absolute terms and relative to that in other regions of the country since the 1970's. However, recent changes in domestic consumption patterns, coupled with shifts in international trade, has shifted timber demands. Depreciation and closure of older mills, especially in the paper industry has accentuated these factors and changed the spatial distribution of timber markets. This leads many in the forestry community to conclude that timber markets in the South are expected to decline (Wear et al., 2007)

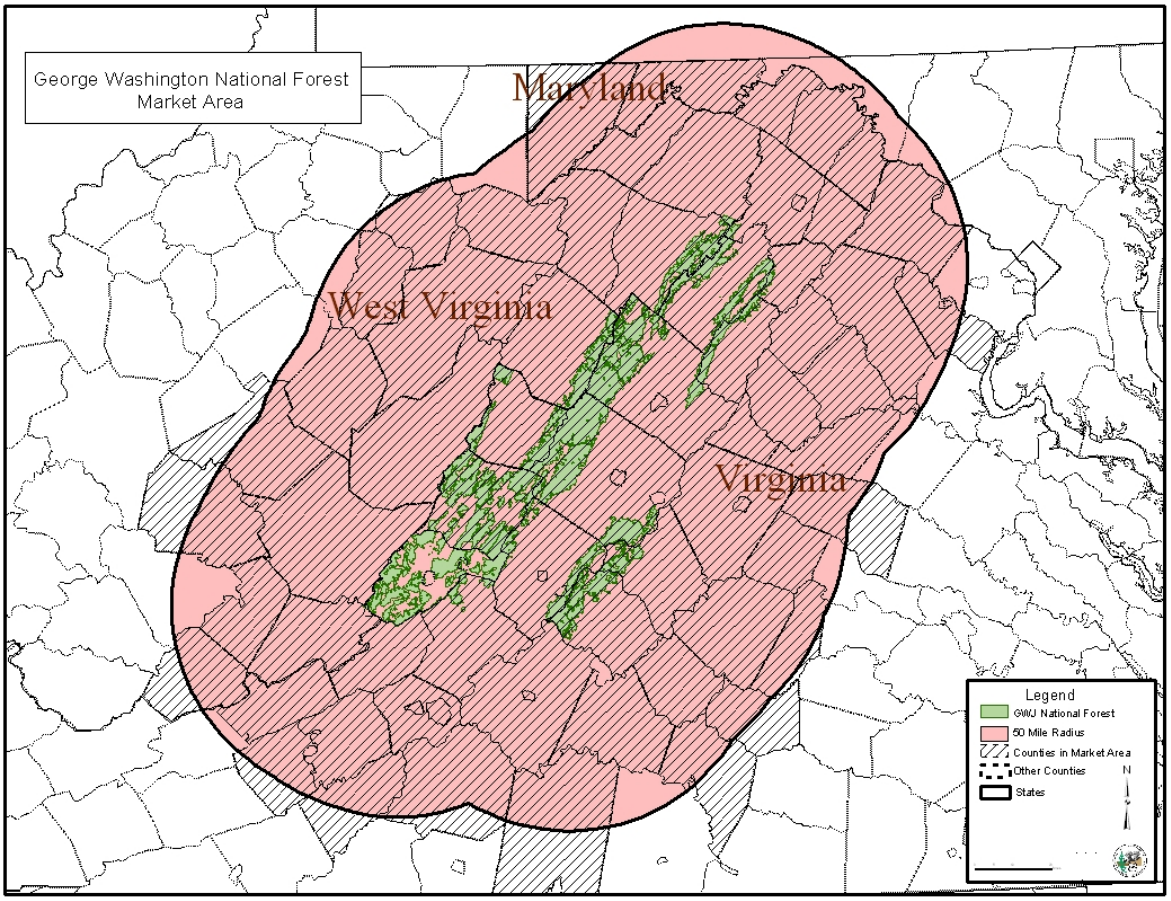
On the other hand, production of newer engineered wood products continues to grow. The potential use of wood products as biomass energy may develop in the near future. Indeed, long run forecasts of timber market activity predict an expanding domestic demand over the coming decades and this increasing production is expected to be concentrated in the South (Wear et al., 2007).

Market Area

Two factors were considered in determining the market area for the GWNF. First, through personal communication with local paper mills we understand that a 60 mile haul for pulpwood is considered standard. Long haul adjustments for haul distances in excess of 60 miles are often offered by the mills. These long haul adjustments are designed to compensate for the extra transportation cost involved and make wood beyond 60 miles competitive with wood less than 60 miles from the mill. We also examined historical timber sale appraisal information. The average appraised haul distance for hardwood pulp was 41 miles. Sawtimber haul distances were somewhat less. However, since pulpwood is a product on nearly every timber sale, it seems reasonable to consider the longer distance of the two products.

Considering these two factors, we believe that a 50 mile radius around the GWNF is a very reasonable market area. To simplify the analysis of FIA data used, only whole counties whose midpoint fell approximately within the 50 mile radius were included.

Figure 1. Market area for George Washington National Forest timber.

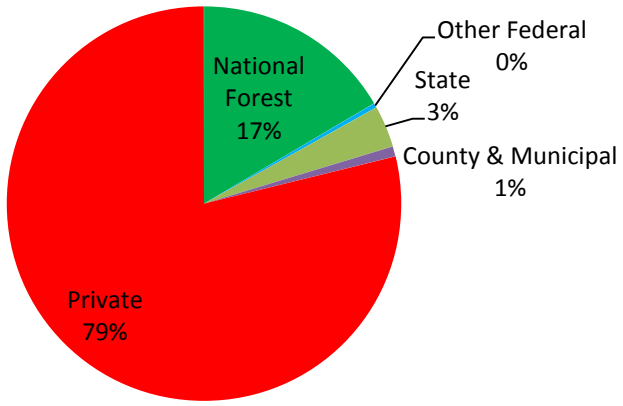


This market area includes a total of 64 counties in 3 States (2 counties in Maryland, 41 counties in Virginia, and 21 counties in West Virginia). A total of 19.2 million acres are contained within this market area (.7 million acres in Maryland, 11.5 million acres in Virginia, and 7 million acres in West Virginia).

Timber Resources (Supply)

Information regarding the supply of timber was compiled using the most recent available Forest Inventory and Analysis (FIA) data. The FIA Database Version 4 was used to query and compile this information. Of the 19.2 million acres in the market area, 12.5 million acres are inventoried as timberland. Timberland is defined as forested land capable of growing at least 20 cubic feet of industrial wood per acre per year. Figure 2 provides the percentage of area of timberland within broad ownership classes. The two largest categories include privately held and National Forest Service (NFS) lands accounting for 96% of the timberland in this market area. The GWNF comprises approximately 5.5% of the land within the market area.

Figure 2: Percent Ownership of Timberland in the George Washington N.F. Market Area



We know that non-industrial private forest (NIPF) lands are an important component of ownership in this market area. Unfortunately, the FIA data used for this analysis did not differentiate between industrial and NIPF lands. However, Worthington et al. found that 80% of the timberland in this same general area was NIPF land. This figure is also consistent with the Virginia Department of Forestry findings (2008 State of the Forest). The Southern Appalachian Assessment report identifies anywhere between 69% and 73% of the area in the Northern Ridge and Valley and Blue Ridge sub-regions as NIPF lands. For the purposes of this analysis, we will consider all of those lands identified as private to mean NIPF lands.

There are approximately 26.7 Billion Cubic Feet (bcf) of live volume on these timberlands. Some 13 bcf, or about half of the total live volume, is found in fully stocked or overstocked stands while only 3 bcf (11%) occurs within poorly stocked or non-stocked stands. Approximately 82% of this volume is found in large diameter stands (>19”), indicating that a vast majority of the live volume in the market area is mature. Sawtimber volume accounts for about 9.1 bcf or about 35% of the total live volume. The distribution of live volume across various ownerships is very similar to that discussed for area of timberland above (e.g. 19% on NFS lands and 77% on privately held lands). Net growth, that is growth minus mortality and/or removals, in the market area of live trees on timberland equates to 1.9 bcf per year.

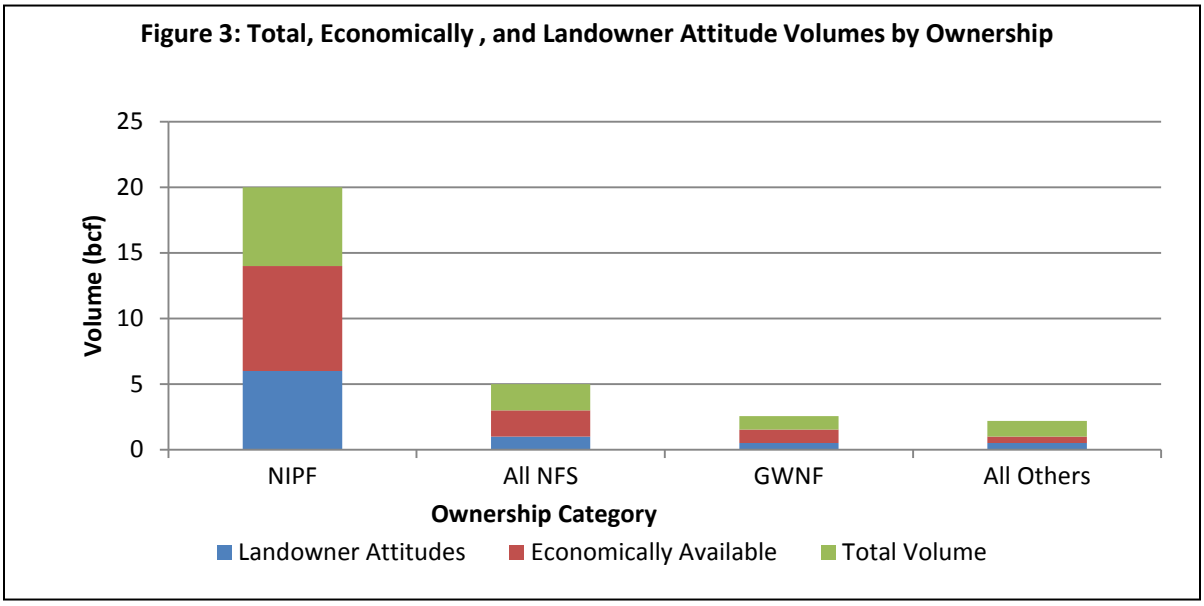
In summary, there is a baseline supply of approximately 27 bcf, with about 9 bcf occurring as sawtimber in the market area. Roughly three-quarters of that volume occurs on private lands while another 20% occurs on National Forest Lands. Assuming current growth, mortality, and removals rates do not change dramatically over the next decade or so, we can expect to gain another 1.9 bcf in live volume per year.

However, not all of this 27 bcf is available as a supply of wood products. Worthington et al. examined several factors which result in changes to availability of this standing volume; primarily economic consideration and landowner attitudes.

Worthington et al. concluded that approximately 67% of the standing volume was economically available based on exhaustive modeling and analysis given market conditions in 1996. Of course markets have changed since that time, so an adjustment to this figure should be attempted. Data published by the Appalachian Hardwood Center, an affiliate of West Virginia University, indicates that Red Oak stumpage prices have fallen by 165% since 1996 (red oak is a major component of the hardwood products in this market area and is used as a proxy for all sawtimber for this purpose). Hardwood pulp stumpage increased by 250%, since 1996. When we consider that 35% of the standing volume in the market area is sawtimber and 65% is pulp (a vast majority of which is hardwood pulp), these decreases and increases over time balance each other. We find that overall stumpage prices in this market area are about 104% of the 1996 stumpage prices. Thus, the findings in Worthington et al. can still be used to approximate current market conditions for this broad scale analysis. Therefore we estimate that a total of approximately 18 bcf is economically available in the market area; 14 bcf on privately held lands, 3 bcf on NFS lands, 1.5 bcf of that on the GWNF, and 1 bcf on other public lands.

Landowner attitudes are a large influence in wood product availability, especially on the NIPF lands that compose a vast majority of this market area. For the purposes of this discussion, we will term this consideration of landowner attitudes “social availability” for harvest. Worthington et al. estimated that about 14% of NIPF landowners reflect a “never harvest” segment of the market. Within the remaining segment, dollar returned was considered the primary factor in wood availability. They further estimated that an additional 41% of the standing volume would not be available because the value returned would not be high enough for the NIPF owner to sell. Thus, a combined reduction of 55% of the volume could be considered unavailable on privately held lands. This means that in general 45% of the economically available volume on NIPF lands would actually be available considering landowner attitudes, equating to approximately 6.3 bcf of total standing volume.

This concept of landowner attitudes can also be extended to public lands. Much of the Other Federal lands identified by FIA data include reserved lands administered by the National Park Service and Fish and Wildlife Service, meaning this volume would also fall into the “never harvest” segment of the market. Similarly, about 32% of the current GWNF is considered suitable for timber production. The availability of volume on State and Municipal lands varies widely, but this area is such a very small component of the market area (about 4%), that those lands do not figure heavily in wood product availability in the market area as a whole. For the purposes of this analysis we will estimate that 1 bcf would be available on NFS lands and .51 bcf of that on the GWNF after considering lands unsuitable for timber production. From 0 to 1 bcf is available on all other lands. Figure 3 summarizes the volumes available by ownership category and availability.



Thus, it is estimated that a total standing volume of approximately 7 to 8 bcf would be available as a timber supply on all lands in the market area, equating to a 70% reduction of the total standing live volume in the market area. Applying this same percentage to growth, we estimate, we expect to gain a net increase of 0.57 bcf each year on economically and "socially" available lands due to growth minus removals and mortality.

Biomass fuels for the generation of energy is gaining interest and support in many parts of the south. Biomass fuels are viewed by many to be one way to decrease dependence on fossil fuels. Biomass is also considered by some to be carbon neutral, meaning that over its life cycle, a product or process that does not add more carbon dioxide to the atmosphere. For instance, a tree consumes carbon dioxide while it grows, then when transformed into and used as fuel it releases an equivalent amount of carbon dioxide back into the atmosphere.

The potential to supply biomass fuels from the GWNF is included in the afore-mentioned estimates. Of the .51 bcf available as supply, anywhere from 0 to .25 bcf could potentially be utilized as biomass fuel, or a maximum of 8.75 million tons forestwide. The upper bound of this estimate is the small roundwood component plus the traditionally non-merchantable material in branches and tops; we presume that no sawtimber would be utilized as biomass fuels. However, it is important to note that under current management the entire Forest only produces about 70,000 tons of wood, including sawtimber. This puts the almost 9 million ton figure identified as a maximum into perspective; it is probably not realistic.

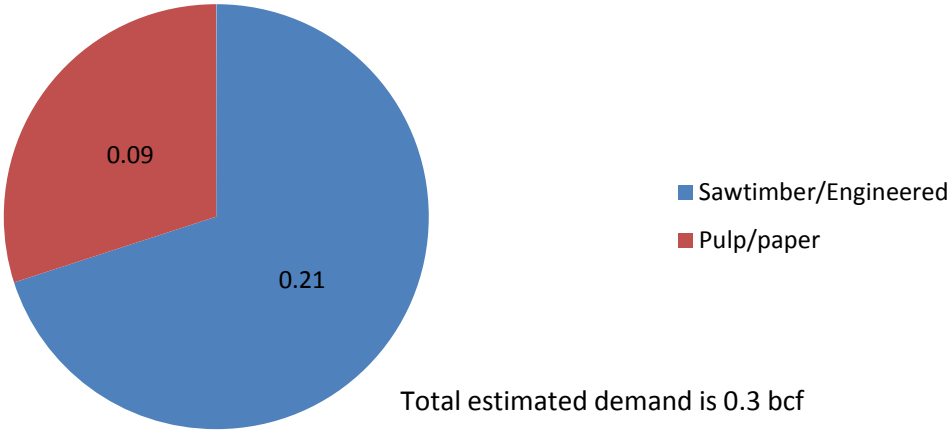
It is also important to note that the use of the raw wood product is beyond the control of the Forest Service and is ultimately dictated by local market factors. Depending upon the amount of competition and demand for wood chips, the amount of product that may be utilized as biomass fuels could be none, just the tops and branches, or anything up to sawtimber size. We do not envision supplying biomass fuel specifically (other than personal use firewood, which is a form of biomass fuel). We do envision supplying wood products in the course of achieving Forest goals and objectives and the use of that raw product will be at the purchaser's discretion.

Primary Processor Capabilities (Demand)

Information on demand was compiled from Forest Product Directories for the counties included in the market area and the George Washington and Jefferson National Forests Appraisal Schedule. This

information identified 217 sawmills, 3 paper/pulp mills, and 3 engineered wood product manufacturers in the area. We used mill capacity as an indicator of demand. Unfortunately, mill capacity information in these directories was only available for West Virginia, which occupies 33% of the total number of sawmills or engineered wood product mills (and 0 paper/pulp mills). We assumed that mill capacities in West Virginia are indicative of the market area as a whole and extrapolated the West Virginia information to estimate mill capacity, a proxy for demand for wood products, for the entire market area. Mill capacity in the West Virginia portion of the market area total approximately .07 bcf. This results in an estimate of demand at 0.21 bcf per year for sawtimber and engineered wood product primary producers in the entire market area. The capacity of the 3 pulp/paper mills within this market area is estimated at .09 bcf per year. Thus, the total demand for wood products by primary producers within this market area is estimated at 0.3 bcf per year. Figure 4 summarizes the total demand for wood products per year in the market area.

Figure 4: Estimated Annual Demand of Wood Products by Product based on Mill Capacities (bcf)



Total estimated demand is 0.3 bcf

As Worthington et al. points out, timber supply and demand in the Appalachian hardwood region is not homogenous. There is a wide variation in species, size, and quality that equates to similar variation in value. Likewise, primary producers range in their need or desire for various qualities of wood materials; a segment of sawmills demand high quality raw material, while other sawmills specialize in extracting products from various lower quality material (e.g. ties and posts), while fibermills and paper mills can utilize low quality products so long as they are sound and the chips are mixed in proper proportions to achieve a quality final product.

Although Worthington et al.'s in-depth analysis targeted the Jefferson National Forest, their market area included about half of the market area defined for the GWNF analysis. Indeed the resource itself, ownership patterns, and mix of primary producers are quite similar throughout the Appalachian Mountains, Blue Ridge and Plateau of Virginia and West Virginia, which form the heart of both market areas. Thus Worthington et al.'s conclusions regarding segmented demand are also quite applicable to the GWNF.

Worthington et al.'s segmented market analysis found that when we look at the proportion of high, medium, and low quality standing timber we find that NFS lands contain a slightly higher percentage of high quality timber than the average for all ownerships (23% on NFS lands vs. 21% on all lands). Certainly there is more high quality timber on NIPF lands (78%), but this is simply a function of the distribution of ownership overall. NIPF lands comprise some 75%-80% of the market area, so it is not surprising that they contain the most high quality timber over the entire market area. We believe what is more important is that NFS lands have slightly more high quality timber in terms of the percentage found within a given ownership than the average of all ownerships. Worthington also found that the demand for high quality timber constituted 51% of the overall demand for sawtimber in the market area, which equates to .15 bcf per year in this market area.

Worthington performs an in-depth analysis of the effects of a "restricted supply" scenario on segmented supply and demand. They required that like quality timber would only be transported to the nearest like quality mill and examined the economic availability of each segment of supply. The ultimate conclusion of this analysis was that while there is an excess of medium and low quality supply of timber to meet that medium and low quality demand, there is increasing economic pressure on high quality raw material. When we consider the restricted timber availability on NIPF lands discussed previously as landowner attitudes, we can expect even more pressure on high quality timberland equating to increased demand.

Currently, the demand for biomass fuels on the GWNF, other than traditional firewood, is negligible. There are 2 electrical cogeneration plants of any size within the market area; one located in Pittsylvania County and the other in Campbell County. Combined, these plants have the capacity to utilize approximately 1.25 million tons per year. There is an indication that one of these plants will soon be taken off-line, reducing the potential capacity to about 1 million tons per year. There no plants that produce fuel pellets from raw wood products. We do not have the technology at this time to economically produce bio-fuels (e.g. ethanol) from wood, although those processes are being researched and perfected. While we foresee an increase in demand for biomass fuels over the life of this analysis, it appears that there may actually be a decrease in such demand in the near future. We cannot reliably predict or quantify that demand at this time.

Supply and Demand – GWNF Niche

In summary, we estimate 8 bcf of timber supply on economically available timberland and considering landowner attitudes. More importantly, we can expect this to grow by about 0.57 bcf per year. Thus, .57 bcf per year represents the maximum sustainable supply of wood products given the previous assumptions regarding economic and social availability in the market area.

We estimate total demand for timber to be 0.3 bcf per year, or approximately 4% of the estimated total supply of standing volume. This estimated annual demand is less than annual net growth, indicating a sustainable resource. Bear in mind that these numbers consider economic availability and landowner attitudes, which are subject to change as markets and landowners change. Figure 5 displays a comparison of the estimated demand within the market area to the total available volume and annual growth.

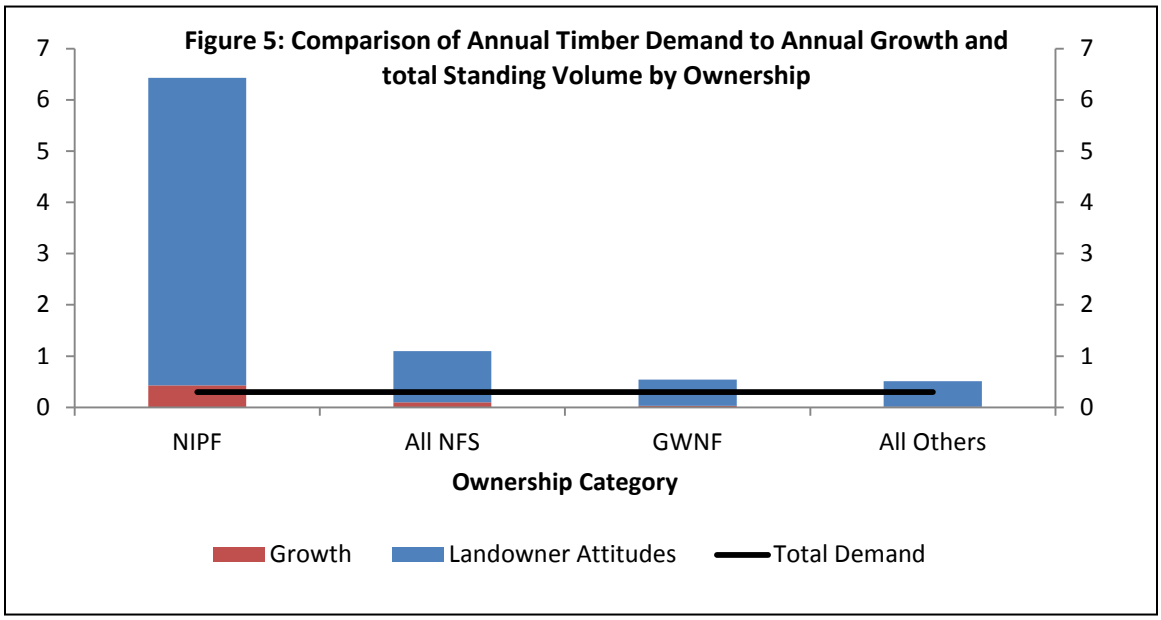


Table A-1 provides a similar comparison in table form.

Table A-1: Comparison of bcf volumes of annual demand for timber (bcf), annual growth, total standing available by land ownership class.

	NIPF	All NFS	GWNF	All Others
Total Demand	0.3	0.3	0.3	0.3
Annual Growth (i.e. Maximum Sustainable Production)	0.43	0.1	0.03	0.01
% of Demand	143%	33%	10%	3%
Available Standing Volume	6	1	0.5	0.5

The GWNF comprises a very small market share within this market area. Total standing volume is estimated at about .5 bcf and growth is estimated at .03 bcf per year. We estimate that we could only sustainably provide about .03 bcf per year, or approximately 10% of the annual demand. For comparison, NIPF lands could supply about 140% percent of the estimated demand. However, when we consider the variation in quality of supply and the demand for quality timber, the GWNF may have a slightly more significant role to play. Demand for high quality products is greater, we expect increased pressure on high quality timber, and the GWNF has a proportionally higher percentage of high quality timber on NFS lands as compared to all lands (albeit only slightly higher). So, while the primary producers of the timber industry within this market area do not depend on the timber from the GWNF to any large extent, the GWJ can play a more significant role in the supply of high quality sawtimber to the sawtimber segment that demands high quality timber.

In terms of biomass fuels, the GWNF would likely comprise an even smaller share of the market, if such a market were to develop. Typically, energy production mills that utilize wood in part or in whole require a million or more of tons of fiber annually. Realistic estimates, under current management, indicate that the GWNF could produce perhaps 30,000 tons annually within any given 50 mile radius around a mill location. Although the scope of this analysis is very broad, encompassing some 64 counties in 3 States, we believe it is also important to consider the role of NFS lands on a more local level. NFS lands occupy more than 50% of 5 of these counties and many more counties contain 30-40% NFS lands. Certainly the role that the timber supply from NFS lands play in these local economies is quite important and should not be lost or discounted when taking a larger view.

Finally, we should also consider that the production of wood and fiber for society is not the only, or even the most important, purpose of commercial harvesting on all NFS lands. Managing habitat for various wildlife species and/or ecosystem restoration can be of equal or more value in driving the commercial timber sale program on the GWNF. From that viewpoint, it is perhaps less important to focus on the role of the GWNF in the overall market area and more important to focus on the role of the timber market in facilitating our use of a commercial timber sale program to achieve other ecosystem and ecological service objectives. Or, put more bluntly, can we sell the relatively small amount of timber we need to harvest to achieve the overall objectives of the GWNF? Historically, the answer has been yes. In the last decade the George Washington and Jefferson National Forests combined only experienced 4 years with no-bid sales averaging just over one no-bid sale per year for the decade. These incidents appear to be episodic in nature and relate to downturns in the hardwood market resulting in purchaser uncertainty. During the most recent downturn in prices, once the initial drop had occurred and the market prices steadied at a lower rate, we experience more interest in NFS commercial harvests. We conjecture that lower market prices resulted in very little availability on NIPF lands and increased the pressure on public lands to

provide timber. Despite episodic market changes, we believe we will be able to market a large majority of our timber products through commercial timber harvests and facilitate implementing our other ecological objectives.

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Developed and Dispersed Recreation Supply and Demand

Affected Environment

National Forests provide over 191 million acres of public land within the United States. National Forests in the Southern Appalachian region contribute approximately 4 million acres to the national total and provide unique settings for a variety of outdoor recreation activities such as primitive and developed camping, hunting, fishing, hiking, backpacking, horseback riding and OHV driving, canoeing/kayaking and whitewater rafting as well as picnicking, sightseeing, nature watching, walking for pleasure and driving for pleasure.

Market Area

Market areas have been established for different national forests to better evaluate public demand for recreation opportunities. Past research has demonstrated that most national forest visits originate from within a 75-mile (1 ½ hour driving time) radius. Variation in preferences varies surprisingly little for broad population groups (i.e., age strata) across geographic areas. Therefore, the use of market area provides a reasonable basis for assessment of recreation demand. (*George Washington National Forest Recreation Realignment Report* Overdest and Cordell, 2001). For this analysis, the market area has been defined as all counties that fall within a 75-mile straight-line radius from the national forest border. For the George Washington National Forest, the market area entails portions of Virginia, West Virginia, Pennsylvania, Maryland and North Carolina. The population living within the market area is about 9,200,204 (Source: U. S. Census Bureau. July 1, 2004 estimate). Table A-2 provides a summary of the cities, counties and population within the market area for the George Washington and Jefferson National Forests.

Table A-2 Summary of States, Counties, Cities and Population Within the Market Area

DC and States	Number of Counties & Cities	Sum of Population
DC	1	553,523
MD	9	2,794,633
PA	6	523,223
VA	83	4,351,587
WV	32	977,238
TOTAL	131	9,200,204

Source: National Survey on Recreation and the Environment, Southern Research Station, Last Updated August 2010

The most populated counties in the market area are Fairfax, Virginia, and Montgomery and Prince George's Counties, Maryland, followed by Washington, DC. Other large municipalities within the market area include Alexandria, Arlington, Blacksburg, Charlottesville, Fredericksburg, Harrisonburg, Lynchburg, Manassas, Staunton, Vienna, and Winchester, Virginia; Beckley, Bluefield, Elkins, Martinsburg and Princeton, West Virginia; and Frederick and Silver Spring, Maryland.

Opportunities for outdoor recreation within the market area are not limited to the George Washington National Forest. Within the market area, the U.S. Forest Service offers additional opportunities on the Jefferson and Monongahela National Forests. The National Park Service offers opportunities in Shenandoah National Park, Blue Ridge Parkway, Harpers Ferry National Historic Park, C&O Canal National Historic Park, multiple historic sites, and the National Capital Region (mall, memorials and historic sites in

Washington, DC). All of these areas connect and expand opportunities for recreation on federally managed public lands. The Appalachian National Scenic Trail also provides a unique long distance hiking opportunity north to south across the entire length of the market area. It connects multiple National Forests and Parks as well as State Forests and Parks from northwest Georgia to northwest Maine, with approximately one-fourth of its length being in Virginia.

A key finding of the Southern Forest Resource Assessment is that "of public ownerships, Federal tracts typically are large and mostly undeveloped. They fill a niche of providing back-country recreation. State parks and forests are usually smaller and more developed." (Southern Forest Resource Assessment, Chapter 11: Forest-Based Outdoor Recreation, H. Ken Cordell and Michael A. Tarrant, 2002.) Within the Commonwealth of Virginia, many state parks are located within a 75-mile radius of the George Washington National Forest border. These state parks such as Claytor Lake, Douthat, Fairystone, James River, Lake Ana, Shenandoah, Sky Meadows and Smith Mountain Lake provide higher levels of development including overnight lodging. Smith Mountain Lake and Claytor Lake provide water-based recreation opportunities within the Market Area. West Virginia State Parks and Forests within the GWNF market area include Cacapon Resort, Lost River, Cass Scenic Railroad, Seneca, Watoga, Beartown, Greenbrier, Moncove Lake, Babcock, Bluestone and Pipestem. Likewise, a majority of these West Virginia State Parks and Forests offer highly developed recreation facilities.

The George Washington National Forest provides approximately 1,065,918 acres of public land in the Valley and Ridge and Blue Ridge physiographic regions of western Virginia and eastern West Virginia. The Shenandoah Valley divides the George Washington National Forest into two separate sections. Each section provides a variety of unique recreation opportunities.

Recreation Demand & Trends

Recreation demand is a complex mix of people's desires and preferences, availability of time, range of price, and offering of facilities. The evaluation of current and future demand for recreation on the George Washington National Forest is based on recent surveys that identify and quantify:

- Estimated number of current recreation visits to the George Washington National Forest;
- Participation rates for recreation activities within the forest market area;
- Future activity demand based on projected population growth; and
- Activity demand by demographic strata.

The National Visitor Use Monitoring (NVUM) effort by the Forest Service has provided baselines for estimating current use of recreation sites. The 2001 and 2006 NVUM surveys data is not specific to each national forest, but rather the survey findings combined recreation use and activities for both the George Washington and Jefferson National Forests. These numbers only account for people engaging in recreation activities; they do not include the millions of people that drive through the national forest without stopping to recreate, unless they did so for the purpose of viewing scenery. Table A-3 provides a summary of estimated national forest visits by site type for 2006.

Table A-3 Fiscal Year 2006 Estimated Recreation Use on the George Washington and Jefferson National Forests

Type of Recreation Sites	2006 Total Annual Estimated National Forests Site Visits*	2006 Percentage of Total Estimated National Forests Site Visits*
Day-Use Developed Sites	399,800	24%
Overnight-Use Developed Sites	212,800	13%
Wilderness	47,100	3%

Type of Recreation Sites	2006 Total Annual Estimated National Forests Site Visits*	2006 Percentage of Total Estimated National Forests Site Visits*
General Forest Areas	1,010,300	60%
Special Events and Organizational Camp Use	4,200	>1%
Total Estimated Site Visits	1,674,200	100.0%
Source: National Visitor Use Monitoring Results, Data Collected Fiscal Year 2006, Report Last Updated March 2009.		
*Site Visit is defined as the entry of one person onto a National Forest site or area to participate in recreation activities for an unspecified period of time.		

Based on this NVUM data, the "developed recreation" day and overnight use areas combined makes up just over one-third of the estimated recreation site visits. Almost two-thirds of recreation site visits can be defined as "dispersed recreation" that occurs away from developed sites in general forest areas and designated Wilderness. About one-third of 1% of recreation site visits are attributed to organized special use events and camps that occur in both developed and dispersed recreation settings.

People within the defined market area for the George Washington National Forest engage in a variety of recreation activities. Table A-4 lists the types of activities ranked in order from highest to lowest participation rates based on the 2000-2004 National Survey on Recreation and the Environment (NRSE), an on-going national telephone survey sponsored by the U.S. Forest Service. The data here is specific to participation in activities in which the market area population engaged, although the activities may or may not have occurred on the George Washington National Forest.

Table A-4 Types of Activities In Which The Market Area Population Engages (On and Off National Forest System Lands)

RECREATIONAL	Market Area Survey	
ACTIVITY	Percent	# of People*
Walk for pleasure	87.7%	6,303,054
Family gathering	75.2%	5,405,870
Visit historic sites	64.0%	4,602,377
Visit nature centers, etc.	63.7%	4,581,037
Picnicking	63.3%	4,551,409
View/photograph natural scenery	63.2%	4,545,428
Driving for pleasure	61.3%	4,406,426
Sightseeing	60.3%	4,332,833
View/photograph other wildlife	48.8%	3,510,264
Swimming in an outdoor pool	48.6%	3,489,977
View/photograph wildflowers, trees, etc.	48.3%	3,471,564
Visit a beach	47.5%	3,416,639
Swimming in lakes, streams, etc.	45.4%	3,260,576
Bicycling (any type)	42.9%	3,083,258
Boating (any type)	38.8%	2,789,632
Day hiking	38.3%	2,751,542
Visit a wilderness or primitive area	35.2%	2,532,350
View/photograph birds	33.3%	2,392,019

RECREATIONAL ACTIVITY	Market Area Survey Percent	# of People*
Snow/ice activities (any type)	32.1%	2,307,625
Visit a farm or agricultural setting	30.5%	2,194,107
Gather mushrooms, berries, etc.	29.9%	2,150,416
Visit other waterside (besides beach)	29.1%	2,092,235
Freshwater fishing	25.2%	1,809,067
Visit prehistoric/archeological sites	25.2%	1,810,139
Mountain biking	25.1%	1,800,834
Motorboating	22.2%	1,592,503
View/photograph fish	22.1%	1,591,664
Developed camping	21.9%	1,571,514
Warmwater fishing	19.5%	1,399,697
Drive off-road	19.2%	1,379,365
Coldwater fishing	14.1%	1,009,775
Primitive camping	13.3%	959,277
Saltwater fishing	11.6%	831,240
Hunting (any type)	11.5%	827,106
Canoeing	11.3%	809,605
Backpacking	10.9%	781,897
Downhill skiing	10.5%	754,489
Rafting	10.3%	743,500
Big game hunting	10.1%	728,982
Horseback riding (any type)	9.5%	682,560
Sailing	8.5%	609,380
Use personal watercraft	8.1%	584,063
Horseback riding on trails	7.9%	569,578
Small game hunting	7.8%	561,735
Waterskiing	6.7%	481,981
Snorkeling	5.7%	412,772
Kayaking	5.2%	371,519
Snowboarding	4.8%	346,660
Rowing	4.7%	336,069
Cross country skiing	4.1%	293,023
Snowmobiling	3.7%	268,327
Anadromous fishing	3.4%	241,287
Surfing	1.8%	129,616
Scuba diving	1.7%	119,137
Migratory bird hunting	1.4%	102,656
Windsurfing	0.9%	63,568

Source: 2000-2004 National Survey on Recreation and the Environment. USDA Forest Service. Southern Research Station. Athens, Georgia.

**George Washington NF local area: 131 counties, 16 and older population (2004 Census estimate). Percentages were rounded after the number of participants was derived.*

The Virginia Department of Conservation and Recreation has been sampling participation rates in outdoor recreation since 1965. According to the *2007 Virginia Outdoors Plan*, the two highest needs for outdoor recreation in the next five years are access to recreational waters of the state and trails close to home. Table A-5 shows the results of the *2006 Virginia Outdoors Survey* (Virginia Outdoors Plan, 2007) with the most popular outdoor recreation activities in Virginia.

Table A-5. Ranking of Outdoor Recreation Activities Based on Percent of Households Participating (Source: 2007 Virginia Outdoors Plan)

Activity	Percent of Population, 2006	Percent of Population, 2002	Percent of Population, 1996
Walking for pleasure	72	67	65
Visiting historic sites	56	40	35
Driving for pleasure	55	62	60
Swimming	44	52	53
Visiting nat. areas, parks	44	27	24
Sunbathing on beach	36	39	42
Fishing	26	42	29
Picnicking	26	29	31
Using a playground	25	24	24
Boating	24	34	31
Jogging	24	22	20
Visiting gardens, arboretums	21	22	20
Bicycling	21	40	31
Camping	18	28	26
Hiking, backpacking	16	18	15
Golf	14	25	20
Basketball	12	15	12
Fitness trail	10	7	6
Soccer	9	9	6
Snow skiing, boarding	9	12	13
Tennis	8	16	20
Hunting	7	14	17

The West Virginia Development Office produced a 2009 Statewide Comprehensive Outdoor Recreation Plan (SCORP) that included a 2008 recreation survey of state residents. Walking, birdwatching, fishing, and hunting activities all ranked above 35%, followed by camping and canoeing at 7%. The SCORP reports that hunting levels and economic returns have remained high compared to other states and national trends.

However, in Virginia, a significant trend in outdoor recreation activities indicated in the *2006 Virginia Outdoor Survey* is the decline in the numbers of hunters in Virginia. In the past 10 years, hunting has decreased from an activity engaged in by 17 percent of households in 1994 to 7 percent of households in 2006. According to the 2007 Virginia Outdoors Plan "the continued change in land use patterns from rural to urban and suburban may have driven this change. Sixty-five percent of hunters in Virginia hunt on

private lands. The lack of access to previously hunted private lands due to landowner changes has also driven a change in supply of lands for hunting. In fact, where lands remain rural, hunting participation rates are much higher than in the urban crescent (Northern Virginia). Participation in the mountain region was 21.4 percent, Piedmont region was 16.4 percent and Chesapeake region was 16.5 percent, as contrasted with the participation rates of 6.1 percent in the urban crescent."

The Resources Planning Act (RPA) Assessment reports on the status and trends of the Nation's renewable resources on all forest and rangelands, as required by the Forest and Rangeland Renewable Resources Planning Act of 1974. The RPA mandates periodic assessments of the condition and trends of the Nation's renewable resources including recreation, fish, wildlife, biodiversity, forest and range resources as well as land use change, climate change and urban forestry. Consistent with this Act, the U.S. Forest Service Southern Research Station and the University of Georgia, Athens, develop and present outdoor recreation participation projections for specific recreation activities or recreation composites for regions of the United States. Future renewable resource conditions are influenced by changes in population, economic growth, and land uses. Using these major drivers, three equally likely scenarios were used by the 4th Assessment by the Intergovernmental Panel on Climate Change (IPCC 2007) and are adopted by the U.S. Forest Service and University of Georgia in developing projections for participation in outdoor recreation. They are labeled scenarios A1B, A2 and B2. Table A-6 provides general descriptions of these three scenarios regarding projections in population, personal income and household income.

Table A-6 General Descriptions for Projections Scenarios

Factor	Scenario A1B	Scenario A2	Scenario B2
U.S. Population Projection	447 million people 370 million adults	505 million people 418 million adults	397 million people 329 million adults
Avg. Personal Income by 2060	$73,000	$50,000	54,000
Avg. Household Income by 2060	$137,000	$97,000	$108,000
Source: Bowker, J. M., and Askew, Ashley (forthcoming). Outdoor Recreation Participation Projections 2010 to 2060. In: Outdoor Recreation Trends and Futures: Technical Document Supporting the Forest Service 2010 RPA Assessment. GTR-SRS-XXX. Asheville, North Carolina: U.S. Department of Agriculture, Southern Research Station.			

Table A-7 provides Forest Service projections in public participation in outdoor recreation activities on the George Washington NF. This list of individual activities or activity composites was derived from the National Survey on Recreation and the Environment and was adjusted for the GWNF.

Table A-7. Fifty Year Projected Activities in Outdoor Recreation on GWNF (number of people, in thousands)

Recreation Activity	2010	2020	2030	2040	2050	2060
Camping						
Developed Camping	105.16	117.44	130.13	140.87	151.81	163.68
Driving						
Driving For Pleasure	47.77	53.38	59.19	64.06	68.98	74.36
Other Motorized Travel	0.83	0.93	1.03	1.12	1.20	1.30
Motorized Water Travel	24.42	27.23	29.74	32.29	35.36	38.78
TOTAL FOR GROUP	73.02	81.55	89.96	97.47	105.54	114.45

Recreation Activity	2010	2020	2030	2040	2050	2060
Fishing						
Fishing	189.82	208.12	224.94	238.62	253.22	268.93
General						
General Relaxing	74.05	82.75	91.75	99.30	106.93	115.28
Swimming	57.19	64.51	71.78	78.49	85.70	93.63
TOTAL FOR GROUP	131.24	147.27	163.53	177.79	192.63	208.91
Hiking						
Hiking/Walking	210.56	237.34	265.76	291.31	318.09	347.74
Hunting						
Hunting	99.49	104.57	108.09	110.14	112.29	114.34
Nature						
Visiting Nature Centers, VIS	1.23	1.38	1.54	1.69	1.83	1.99
Gathering Berries, Natural Products	10.92	12.31	13.74	15.00	16.31	17.75
TOTAL FOR GROUP	12.15	13.69	15.28	16.68	18.14	19.74
Off-Highway Vehicles						
Off-Highway Vehicles	8.34	9.03	9.56	10.15	10.88	11.65
Primitive Camping						
Primitive Camping	5.01	5.52	6.00	6.44	6.91	7.42
Backpacking, Camp in Unroaded Areas	3.34	3.68	4.00	4.29	4.61	4.95
TOTAL FOR GROUP	8.35	9.20	10.01	10.73	11.52	12.36
Picnicking						
Picnicking	7.36	8.22	9.11	9.86	10.63	11.46
Trails						
Bicycling	15.13	17.05	18.88	20.79	22.99	25.46
Horseback Riding	2.52	2.82	3.08	3.37	3.73	4.13
Non-Motorized Water Travel	1.67	1.82	1.93	2.07	2.24	2.42
TOTAL FOR GROUP	19.32	21.69	23.90	26.23	28.96	32.02
Viewing						
Viewing Scenery	117.33	131.12	145.38	157.35	169.43	182.66
Viewing Wildlife, Birds, Fish	72.95	82.47	92.70	100.67	108.36	116.76
TOTAL FOR GROUP	190.28	213.60	238.08	258.02	277.80	299.42
Wilderness						
Wilderness	11.48	12.64	13.75	14.75	15.83	16.99
TOTAL FOR ALL GROUPS	1,066.56	1,184.35	1,302.08	1,402.63	1,507.33	1,621.68

Data Source: Bowker, J. M., and Askew, Ashley (forthcoming). Outdoor Recreation Participation Projections 2010 to 2060. In: Outdoor Recreation Trends and Futures: Technical Document Supporting the Forest Service 2010 RPA

Assessment. GTR-SRS-XXX. Asheville, North Carolina: U.S. Department of Agriculture, Southern Research Station. The data for three projections scenarios were averaged by Paul Arndt, Regional Planner, U.S. Forest Service Southern Region. Omitted from the list are various winter sports, which are not relevant to projections for the Southern Region.

National recreation projections emphasize growth in some activities that require specialized skills and/or specialized equipment, such as snow skiing. Bringing the focus closer to home, Dr. H. Ken Cordell of the USDA Forest Service's Southern Research Station, offered the following information about how recreation in the Southern Region differs, in some regards, from the national picture. " ...recent overall trends for the most popular activities in the South (having over 30 million participants) show that walking for pleasure, family gatherings outdoors, gardening or landscaping, viewing/photographing natural scenery, sightseeing, and visiting outdoor nature centers occupy the top six slots. Other popular growth activities include driving for pleasure, viewing/photographing flowers and trees, viewing/photographing wildlife (besides birds and fish), swimming in an outdoor pool, and picnicking. Activities oriented toward viewing and photographing nature (scenery, flowers/trees, and wildlife) have been among the fastest growing in popularity."

"For moderately popular activities, having between 10 and 30 million participants, the NSRE analysis indicated that the activities of viewing or photographing birds, bicycling, gathering mushroom/berries, warm water fishing, visiting a wilderness, visiting a farm or agricultural setting, viewing and photographing fish, and day hiking are most popular. Growth has been especially strong for off-highway vehicle driving, gathering mushrooms and berries, and visiting farms or agricultural settings."

"Among activities having under 10 million participants, camping at primitive sites, big game hunting, waterskiing, using personal watercraft, and equestrian activities were at the top and showed some growth. Kayaking was the fastest growing of these activities by a wide margin, followed by other water-based activities such as waterskiing and canoeing. Some activities posted declines during this decade."

"According to the U.S. Fish and Wildlife Service, the overall number of hunters and anglers in the U.S. declined about 7 percent from 1996 to 2006. On the other hand, wildlife watching participation increased about 13 percent during this period." [1]

Closer to home yet, demographic information collected for the 2001 Recreation Realignment report within the market area revealed trends that were popular across a variety of demographic groups (age, gender, number of people per household, race and ethnic strata). At the time of the Recreation Realignment effort, these were primarily those that do not require specialized skills or equipment and that can engage multi-generations together. The ten most popular activities on the GWNF, according to the Recreation Realignment Report, were viewing/photographing wildlife and birds, viewing/photographing features and scenery, swimming, hiking or walking for pleasure, visiting a Wilderness, gathering forest products, fishing, camping in a developed site, and ATV/OHV use.

Recreation Opportunity Spectrum (ROS)

For planning purposes, recreation supply is defined as the opportunity to participate in a desired recreation activity in a preferred setting to realize desired and expected experiences. Recreationists choose a setting and activity to create a desired experience. Three components of supply are settings, activities and facilities. (SAA, p.140) The US Forest Service manages a supply of settings and facilities.

The Recreation Opportunity Spectrum (ROS) is a planning tool used to identify and evaluate the supply of recreation settings on national forests. Five ROS classes have been inventoried on the George Washington National Forest. These settings include Primitive (P), Semi-Primitive Non-Motorized (SPNM), Semi-Primitive Motorized (SPM), Roaded Natural (RN), and Rural (R).

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[1] Cordell, H. Ken. forthcoming. Outdoor recreation trends and futures. A technical document supporting the Forest Service 2010 RPA Assessment. GTR-SRS-XXX. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station.

Primitive (P) is the most remote, undeveloped recreation setting on the forest. These settings are generally unmodified, natural environments located at least three miles from any open road and are 5,000 acres in size or larger. Interaction between users is very low and motorized use within this area is not permitted. The area is managed so that it is essentially free of evidence of on-site controls and restrictions.

There are no land areas on the George Washington National Forest that are more than three miles from any open road, however there are areas that are managed to meet the other Primitive setting descriptions. Specifically, the Primitive ROS class is assigned to all designated Wildernesses on this national forest, even though they may not meet the size or distance from road(s) requirement. Designated wilderness areas currently range in size from 4,608 to 9,835 acres and do not contain any open roads. With few exceptions, the Wilderness Act restricts the use of mechanized equipment and motorized transport for recreational use, search and rescue, resource protection, trail construction, and maintenance. A Forest Supervisor's Order restricts group size in Wilderness to ten or less to retain a sense of solitude.

Semi-Primitive Non-Motorized (SPNM) areas are predominated by a natural or natural appearing environment. Interaction between visitors is low, but there may be evidence of other users. They are managed to achieve a sense of remoteness, although SPNM areas can be as small as 2,500 acres in size and only a half-mile or greater from any open road. These areas are managed to minimize the presence of on-site controls and restrictions. These settings accommodate dispersed, non-motorized recreation.

Semi-Primitive Motorized (SPM) areas are natural or natural appearing. Interaction between visitors is low, but there often is evidence of other users. Motorized use is permitted. SPM accounts for areas on the National Forest that either buffer SPNM areas or stand alone as tracts of land 1,500 acres or larger with a low road density of 1.5 miles of road/1,000 acres.

Roaded Natural (RN) settings are natural appearing with moderate evidence of sights and sounds of humans. Interaction between visitors may be low to moderate, but evidence of other users is prevalent. Conventional motorized access is accommodated. RN areas are located within a half mile of a road and usually provide higher levels of development such as campgrounds, picnic areas and river access points.

Rural settings are substantially modified natural environments. Sights and sounds of other humans are readily evident and interaction between users may be moderate to high. Facilities for concentrated motorized use and parking are provided. Rural settings represent the most highly modified natural settings on the forest and include only highly developed recreation sites. Acreage in the Rural ROS class is negligible.

Table A-8 Current Distributions of ROS Classes as Inventoried on the George Washington National Forest

Recreation Opportunity Spectrum (ROS) Class	Current ROS Inventory Acres on the GWNF (approximate acres)	Current Percentage of each ROS Class on the GWNF
Primitive (P)	0*	0%
Semi-Primitive Non-Motorized - SPNM	198,000	18.6%
Semi-Primitive Motorized - SPM	211,000	19.8%
Roaded Natural - RN	656,000	61.6%
Rural	<2,000	<1%
Urban	0	0%

Source: GWNF Geographic Information System (GIS inventory data)

*There are no lands on the GWNF that meet the inventory requirements for Primitive ROS setting (due to proximity to roads). However, the GWNF manages all designated Wilderness (42,674 acres) as Primitive ROS setting.

The Southern Appalachian Assessment: Social, Cultural, Economic Technical Report (SAA) provides data about landscape settings in 10 ecological sections of the Southern Appalachians. The report includes settings on both public and private lands. It states that about 5% of the region is developed into urban settings and 12% is developed into suburban or transitional settings. Approximately 45% of the landscape is in rural settings, 2% are covered in large rivers and lakes and 3% could not be determined using satellite imagery. About 8% of the area in the study provides Primitive or Semi-Primitive settings, with 100% of the Primitive settings being provided on public lands. [2]

Developed Recreation Supply

A developed site is characterized by a built environment containing a concentration of facilities and services used to provide recreation opportunities to the public. They typically represent a significant investment in facilities and management under the direction of an administration unit in the National Forest System. Recreation sites are developed within different outdoor settings to facilitate desired recreational use. Developed recreation sites include such facilities as campgrounds, picnic areas, shooting ranges, swimming beaches, interpretive sites, visitor centers and historic sites. Developed recreation sites provide different levels of user comfort and convenience based on the assigned Recreation Opportunity Spectrum (ROS) setting. Development levels range from 1 to 5, with the lower end of the spectrum representing the most primitive, natural settings. Site amenities are provided only if needed for the protection of resources. The upper end of the spectrum represents the highest level of development and facilities for the comfort and enjoyment of the visitor.

The George Washington National Forest has three Development Level 5 recreation areas: Bolar Mountain, Sherando Lake and Trout Pond. Each is a recreation complex offering amenities and services for the comfort of users. They offer multiple types of camping facilities (family and group) and campsites with utility hookups. The campground roads are paved, bathhouses have flush toilets and warm water showers, and each offers a highly developed day use area. There is an entrance station and on-site staff and volunteers.

Brandywine Lake, Cave Mountain Lake and Morris Hill are three examples of Development Level 4 campgrounds. They also offer many facilities for the comfort of users including bathhouses with flush toilets and showers and have day use areas. However they are smaller in scale than the Level 5 sites and they do not offer utility hookups. Volunteer campground hosts are on-site during the peak use season.

Hidden Valley, and North Creek are examples of Level 3 Campgrounds. They have gravel roads, restroom facilities that may have vaults rather than flush toilets and no showers. There is typically, but not always, an on-site volunteer campground host during peak season weekends.

Level 2 sites include campgrounds like Hawk and McClintic Point. These provide facilities for the protection of resources rather than for visitor comfort. These are smaller areas offering vault toilet buildings, gravel roads and rarely, if ever, an on-site volunteer host. Some do not offer drinking water or trash collection – users pack in drinking water and pack out trash. Mowing is done infrequently.

The Forest Service defines the capacity of developed recreation sites in terms of "people at one time" that a site can support, called PAOTs (pronounced "pay-yots"). Currently, there are 59 developed sites managed by the George Washington National Forest to accommodate different recreation activities. Tables A-9 and A-10 illustrate the different types of facilities provided across the forest and their current capacity in PAOTs.

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[2] Southern Appalachian Man and the Biosphere (SAMAB). 1996. The Southern Appalachian Assessment Social/Cultural/Economic Technical Report. Report 4 of 5. Atlanta: U.S. Department of Agriculture, Forest Service, Southern Region.

Table A-9 Current Supply of Day-Use Developed Areas on George Washington NF

Site Type	Number of Sites	Total Capacity (PAOTs)
Motorized Boating Sites*	2	350
Campgrounds & Complexes**	21	6,740
Horse Campgrounds	1	25
Interpretive Sites	10	815
Observation Sites	4	485
Picnic Sites	10	730
Swimming Sites*	7	945
Target Ranges	4	120
Grand Total	59	10,210

Source: INFRA-Recreation Sites Report. INFRA is a Forest Service database that contains all developed recreation sites inventory data.

*Coles Point offers both a swimming area and a boat ramp. The entire capacity of Coles Point is listed with the swimming site.

** All of the level 5 campgrounds and three of the level 4 campgrounds have day lakes with sand swimming beaches. The capacity of these day use areas is included with the Campgrounds & Complexes.

Several Level 2 campgrounds on the George Washington National Forest have developed over time in response to riparian resource degradation and sanitation concerns in concentrated use areas along popular river and stream corridors. Facilities installed to protect resources have included vault toilets, designated parking areas and hardened impact areas for camping. A couple of examples where facilities are provided to protect resources from the impacts of recreational uses are Oronoco and North River campgrounds.

The public demand for campsites with utility hookups currently exceeds supply on the George Washington National Forest. The Forest has not installed additional utility hookups in recent years due to the cost of installation and ongoing maintenance, desires to reduce our carbon footprint, and in keeping with our Forest's recreation niche which is primarily trails and dispersed recreation. State parks and privately owned campgrounds meet some of the public demand for sites with utility hookups and other amenities for visitor comfort. State parks and private sector campgrounds are, typically, more highly developed than Forest Service campgrounds.

Shooting ranges have historically been challenging to keep maintained to Forest Service standards due to ongoing vandalism. Any attempt to close a shooting range as a result of ongoing vandalism is met, appropriately, with objections from responsible users who enjoy these facilities. The US Forest Service is partnering with Tread Lightly! in their campaign "Respected Access is Open Access" in hopes to curb the vandalism to shooting ranges as well as other remote recreation facilities.

Dispersed Recreation Supply

Dispersed recreation is defined as those activities that occur outside of developed recreation sites such as boating, hunting, fishing, hiking and biking. Parking is also provided at two hang gliding sites, although they have seen little use and little maintenance in recent years. There are 56 developed recreation sites that facilitate dispersed use of the forest such as trailheads, trail shelters and boat ramps. Table A-10 provides a summary of the developed areas used to access dispersed recreation opportunities on the national forest.

Table A-10 Developed Access Points for Dispersed Recreation on the George Washington NF

Site Type	Number of Sites	Total Capacity (PAOTs)
River and Lake Boating Access	9	325
Fishing Sites	7	701
Observation Sites	3	96
Hang Gliding Sites	4	70
Trail Shelters	13	109
Trailheads	20	1,307
Grand Total	56	2,608

Source: INFRA-Recreation Sites Report, 08/20/2010. INFRA is a Forest Service database that contains all developed recreation sites inventory data.

The George Washington National Forest offers approximately 1,078 miles of trails. The majority are for non-motorized, multiple uses and are shared by hikers, equestrians and bicyclists. Notable exceptions are the Appalachian National Scenic Trail and several short interpretive trails that are open to hikers only and trails in designated Wilderness where bicycles are prohibited. Also excluded from multiple uses are some trails within developed recreation areas. Approximately 65 miles on three trail systems provide motorized use opportunities. All three trails are open to all-terrain vehicles and motorbikes, and one of the three trails has portions open to off-road or four-wheel drive trucks.

Table A-11 gives a breakdown of the miles of trail that are managed for various types of uses. The total trail miles do not add up to the total National Forest System Trail miles because of the overlap in uses allowed.

Table A-11 Approximate Miles of Trail Offered on the George Washington NF

Wilderness	68	Total of approximately 1,078 miles.
Non-Wilderness	1,010	
Trail miles that allow hikers	1,008	Should be all trails = 1,078; error in Infra.
Trail miles that allow equestrians	811	All except Appalachian Trail, interpretive trails, and trails within developed recreation areas including angler trails
Trail miles that allow bicyclists	794	All except Appalachian Trail, trails in designated Wilderness, interpretive trails and certain trails within developed recreation areas including angler trails
Trail miles that allow ATVs and OHVs	65	Allowed on designated motorized trails only
Source: INFRA-Trails Report, 08/30/2010, edited to manually separate Pedlar Ranger District Trails from combined Glenwood-Pedlar Ranger District trails.		

Demand for long-distance trails for special recreation events, such as long-distance mountain bicycling, equestrian endurance rides and runner marathons, has increased in recent years. The demand is greatest among the equestrian and mountain biking communities. Events are not permitted in designated Wilderness and neither of these user groups is permitted on the Appalachian National Scenic Trail. Concern has been expressed among these user groups that any additional Wilderness designations exclude, to the extent possible, trails that currently are used, or that by their connectivity to other trails could be used, for long-distance trail riding opportunities and special recreation events.

There is more demand for than supply of motorized trail opportunities. There is a goal in the current George Washington National Forest Land and Resources Management Plan to add a new motorized trail in the area of Archer Run, however the Archer Run area does not meet the criteria for establishing a new ATV trail. Furthermore, due to concerns with resource damage on and off trail, the Patterson Mountain all-terrain vehicle trail on the north end of the Jefferson National Forest is temporarily closed and potentially could be closed permanently, putting more stress on the motorized trails of the George Washington National Forest. At several public meetings related to this Forest Plan Revision, local communities expressed concern over losing economic benefits of motorized trail users due to our current limited supply of motorized trails.

The ability of the national forest to provide such a significant trails program is largely dependent on the volunteer workforce that helps with maintenance of trails. In fiscal year 2010, volunteers contributed 50,928 hours to the dispersed recreation program, equivalent to 28 full time employees. The motorized trail program relies heavily on grants from the Virginia and West Virginia Recreational Trails Fund program. While support from volunteers and the grant programs have been consistent, a decline in either of these programs will have negative implications for the sustainability of the dispersed recreation program.

Hunting and fishing are traditional and popular recreational uses of the George Washington National Forest. The Forest Service manages the habitats that sustain populations of small and big game species as well as cold and warm water fisheries. The Virginia Department of Game and Inland Fisheries stock certain streams, and the national forest stocks some small lakes for organized kids' fishing days. Table A-12 provides acres currently managed for fish and wildlife habitat emphasis.

Table A-12 Acres of Current Fish and Wildlife Habitat Emphasis Areas

Type of Fish & Wildlife Habitat Emphasis	Unit of Measure
General Big & Small Game Habitat	463,394 Acres
Early Successional Habitats	39,651 Acres
Stocked (Put & Take) Streams	67 Miles of Streams

Type of Fish & Wildlife Habitat Emphasis	Unit of Measure
Stocked (Put & Take) Reservoirs	2,830 Acres*

*This includes 2,530 acres at Lake Moomaw.

Minerals – Supply and Demand

Federal Leasable Oil and Gas

The federal government owns 100% mineral rights on about 84% of the Forest. Private parties own mineral rights on the remaining 16% of the Forest. As of September 2010, federal oil and gas leases were in effect on about 1% of the Forest (12,412 acres) but there are no active oil and gas wells. Exploration on GWNF lands has been sparse and activity on surrounding lands has been minimal. Thus far, only five wells have been drilled on Forest lands. All were designed to test a specific horizon and all were dry holes. Two small natural gas fields have been developed adjacent to GWNF lands, but, with the exception of one well, there has been no drilling activity since the 1990's.

Several oil and gas plays exist in the area. The most significant of these plays is related to the Marcellus Shale which is present on the surface and in the subsurface under more than half of the GWNF lands. Current industry focus directed toward the exploration for and exploitation of organic shales, and in particular the Marcellus, is high at this time. Development of the Marcellus shale is generally done with horizontal drilling and use of hydrofracking at numerous locations throughout the horizontal bore holes. Marcellus shale-type development through horizontal drilling has not yet occurred on the Forest. Patchen and Avary (2008) state, "The Middle Devonian Marcellus Shale is the oldest, thickest and most widespread of four formations in the Hamilton Group of central and eastern New York. This black shale unit extends from New York southward to Virginia and West Virginia, and westward into eastern Ohio where it pinches out beneath the Middle Devonian unconformity. In Ohio, the Marcellus Shale generally is not separated from younger rocks in the lower Olentangy Formation; in Virginia, the Marcellus usually is included in the basal portion of the thick Millboro Shale." Enomoto (2009) states, "In the Virginia portion of the Appalachian Basin, the Devonian Mahantango Formation and the Marcellus Shale are mapped collectively as one unit that is named the Millboro Shale. This unit in Virginia consists of black, fissile shale units, with interbeds of dark gray argillaceous limestone or calcareous shale. Thin, dark gray, aphanitic limestone beds occur near the base. Geophysical logs from wells drilled in Highland and Rockingham counties, Virginia, indicate that the thickness of the Millboro Shale ranges from 368 to 570 feet thick in this region." The following table shows the estimated extent of the Marcellus shale formation on the Forest, as it relates to oil and gas leasing considerations.

Table A-13. GWNF Mineral Status and Marcellus Shale

MINERAL STATUS	ACRES	Percent of GWNF (%)	Marcellus Shale Acres	Percent of Land Status in Marcellus Shale (%)
TOTAL GWNF ACRES	1,065,499	100.0%	592,300	55.6%
Withdrawn from mineral leasing by law	50,727	4.8%	22,537	44.4%
Not withdrawn from mineral leasing by law	1,014,772	95.2%	569,763	56.1%

Outstanding or reserved mineral rights -Partial or complete private mineral interest (subtotal of "not withdrawn" acres)	167,206	15.7%	97,615	58.4%
100% federal mineral ownership (subtotal of "not withdrawn" acres)	847,566	79.5%	472,148	55.7%
Existing federal oil & gas leases	12,412	1.2%	12,412	100.0%

Future projections of the kind and amount of oil and gas activity that could be reasonably anticipated began with a Reasonable Foreseeable Development Scenario (RFD) prepared by the Bureau of Land Management (BLM). The RFD is based on the assumption that all lands on the Forest would be available for oil and gas leasing under standard lease terms and conditions, except for those areas withdrawn from leasing by law (Wilderness and National Scenic Area). It covers a time period of 15 years and includes all lands within the boundaries of the George Washington National Forest (GWNF) regardless of mineral estate ownership. Privately owned mineral rights are constitutionally protected property rights and can be exercised at any time. The Forest Plan can identify lands with federal mineral rights as administratively unavailable for federal leasing in addition to those withdrawn by law. Therefore, the RFD can be viewed as the 'maximum' amount of federal oil and gas leasing activity projected.

The RFD estimated that a maximum of 20 vertical exploration/evaluation wells could be drilled over the next 15 years which will prove the presence of productive Marcellus Shale in the area of the GWNF. Additionally, 50 vertical and 249 horizontal development wells could be drilled.

Minerals – Federal Leasable (other than oil and gas)

Historically, iron mining and some coal mining occurred on the Forest. But there is no recent interest in these or other hardrock leasable minerals. Some geothermal leasing occurred on the Forest in the 1980s, but there has been no recent interest in geothermal leasing.

Private Mineral Rights (Reserved and Outstanding Mineral Rights)

Private mineral rights (reserved and outstanding mineral rights) underlie about 16 percent of the Forest. These outstanding or reserved mineral rights (non-federal mineral rights) are partial or complete mineral interests. Reserved rights are those retained in part or in whole by the seller when the federal government acquired the tracts comprising the National Forest. Outstanding rights are mineral rights owned and retained by a third party when federal government acquired the tracts comprising the National Forest. Of the privately-owned mineral rights, about 76 percent are mineral rights outstanding to third parties, and 24 percent are mineral rights reserved by the grantor at the time of acquisition by the federal government.

The only active operation under private mineral rights is a shale mine in operation since the 1980s on the Pedlar Ranger District. Since 1993 reclamation of the previous shale mine has occurred, while additional mining has occurred in recent years. In 2005 the James River Ranger District received a proposal to exercise private mineral rights by mining. Forest Service requested additional information about the proposal, but has not received the information. To date, the proponent has not pursued the proposal with the Forest Service.

APPENDIX B - BENCHMARK ANALYSIS

Benchmark analysis is specified in the NFMA regulations in 36 CFR 219.12(e) as part of the Analysis of the Management Situation. Benchmarks approximate maximum economic and biological resource production opportunities and are useful in evaluating the compatibilities and conflicts between individual resource objectives and in defining the range within which integrated alternatives can be developed. The following benchmark analyses are consistent with the minimum applicable management requirements of 36 CFR 219.27.

Minimum Level of Management Benchmark - 36 CFR 219.12(e)(1)(i). This benchmark represents the minimum level of management needed to maintain and protect the GWNF as part of the National Forest System. This level of management does involve some activities and costs in order to meet the following minimum management requirements:

- Protect the life, health, and safety of incidental users;
- Prevent environmental damage to the land or resources of adjoining lands of other ownerships or downstream users;
- Conserve soil and water resources;
- Prevent significant or permanent impairment of the productivity of the land; and
- Administer unavoidable non-Forest Service special uses and mineral leases, licenses, permits, contracts, and operating plans.

Alternative C in the DEIS embodies most of the elements of a minimum level of management; however some activities are allowed in this alternative to make it a more realistic and viable option. The activities in Alternative C that involve more than a minimum level of management include: the continued operation of three ATV use areas; more of an emphasis on non-motorized recreation that would include an increase in trail miles; and continued operation of some developed recreation sites.

Maximum Physical and Biological Production Potential Benchmarks - 36 CFR 219.12(e)(1)(ii) These benchmarks identify the maximum physical and biological production potentials of significant individual goods and services together with associated costs and benefits. For ecological systems, the maximum biological production is represented by the desired conditions for the cove, spruce, northern hardwood, oak and pine systems in Chapter 2 of the Plan.

Maximum Timber Benchmark. This benchmark is used to identify the maximum timber production potential of the Forest, subject to these specifications:

- The objective function maximizes timber volume in the first five decades, with a rollover to maximize present net value for 15 decades.
- All tentatively suitable acres are included, without any management prescription allocations, so every tentatively suitable acre is eligible for harvest.
- No successional habitat constraints are applied.

Several key results of the maximum timber benchmark are:

- 910,000 tentatively suitable acres are allocated to timber production
- Annual harvest is 19.68 MMCF (98.4 MMBF)
- Annual harvest is 10,331 acres
- Cumulative Present Net Value over five decades is $117,447,000
- Long-term sustained yield is 23.66 MMCF

Maximum Wilderness Benchmark. This benchmark is used to identify the maximum potential of the Forest to provide areas that meet the definition of wilderness according to the 1964 Wilderness Act. In

Chapter 2 of the DEIS, Alternative C represents this benchmark, with the recommendation for wilderness study all of the 37 areas in the Potential Wilderness Area inventory as well as Southern Massanutten Mountain and the Friars Inventoried Roadless Areas. This benchmark represents 386,800 acres recommended for wilderness study and 20,000 existing Wilderness acres.

Maximum Natural Gas Production Benchmark. This benchmark is used to identify the maximum potential for the Forest for natural gas production. This benchmark is represented by the Reasonably Foreseeable Development (RFD) prepared by the Bureau of Land Management that is based on the assumption that all lands on the Forest would be available for oil and gas leasing under standard lease terms and conditions, except for those areas withdrawn from leasing by law. The RFD is described in more detail in Chapter 3 of the DEIS. This benchmark represents the construction of 20 vertical exploration/evaluation wells and 50 vertical and 249 horizontal development wells.

Present Net Value Benchmarks – The following benchmarks are described in the 36 CFR 219 regulations.

- 36 CFR 219.12(e)(1)(iii) Monetary benchmarks which estimate the maximum present net value of those resources having an established market value or an assigned value;
- 36 CFR 219.12(e)(1)(iii)(A) For forest planning areas with major resource outputs that have an established market price, monetary benchmarks shall include an estimate of the mix of resource uses, combined with a schedule of outputs and costs, which will maximize the present net value of those major outputs that have an established market price;
- 36 CFR 219.12(e)(1)(iii)(B) For all forest planning areas, monetary benchmarks shall include an estimate of the mix of resource uses, combined with a schedule of outputs and costs, which will maximize the present net value of those major outputs that have an established market price or are assigned a monetary value;
- 36 CFR 219.12(e)(1)(iii)(C) For forest planning areas with a significant timber resource, estimates for paragraphs (e)(1)(iii)(A) and (B) of this section shall be developed both with and without meeting the requirements for compliance with a base sale schedule of timber harvest, as described in s 219.16(a)(1), and with and without scheduling the harvest of even-aged stands generally at or beyond culmination of mean annual increment of growth, as described in s 219.16(a)(2)(iii). The George Washington NF does not have a significant timber resource.

Timber Maximum PNV Benchmark. This benchmark was established to estimate the schedule of outputs and costs that would maximize the present net value of timber production without any constraints, subject to these specifications:

- The objective function maximizes net present value over the entire planning horizon.
- All tentatively suitable acres are included, without any management prescription allocations.
- No successional habitat constraints are applied.

Several key results of the maximum timber benchmark are:

- 910,000 tentatively suitable acres are allocated to timber production
- Annual harvest is 17.66 MMCF (88.3 MMBF)
- Cumulative Present Net Value over five decades is $112,392,000
- Long-term sustained yield is 19.53 MMCF

Maximum Present Net Value Benchmarks were not modeled for resources other than timber since use of the Spectrum Model (linear programming model that determines the best mix of outputs and activities to maximize an objective function, such as present net value) was confined to timber harvest outputs and activities. There is no method to maximize the present net value of other resources but the present net values of several resource programs under each alternative that was evaluated in the DEIS is presented in the following table.

Table E-7. Cumulative Decadal Present Net Values of Benefits and Costs (millions of dollars, 4% discount rate cumulative to midpoint of 5th decade)

Present Value Benefits by Program:	**Alt A**	**Alt B**	**Alt C**	**Alt D**	**Alt E**	**Alt F**	**Alt G**
Range	<$1	<$1	<$1	<$1	<$1	<$1	<$1
Timber	$36	$68	$0	$123	$38	$22	$68
Minerals	$24	$19	$4	$20	$6	$16	$6
Recreation	$1,163	$1,181	$1,007	$1,242	$1,111	$1,244	$1,205
Wildlife	$661	$669	$562	$713	$640	$698	$684
Total Present Value Benefits	**$1,884**	**$1,937**	**$1,573**	**$2,098**	**$1,795**	**$1,980**	**$1,963**
Present Value Costs by Program:	**Alt A**	**Alt B**	**Alt C**	**Alt D**	**Alt E**	**Alt F**	**Alt G**
Range	<$1	<$1	<$1	<$1	<$1	<$1	<$1
Timber	$41	$47	$0	$80	$27	$17	$47
Roads/Engineering	$29	$30	$25	$32	$29	$28	$30
Minerals	$4	$4	$4	$5	$4	$4	$4
Recreation	$84	$84	$78	$90	$78	$90	$84
Wildlife	$12	$14	$8	$15	$14	$14	$14
Soil, Water and Air	$30	$29	$15	$29	$29	$29	$29
Protection/Forest Health	$26	$42	$26	$33	$48	$42	$42
Lands	$9	$9	$9	$9	$9	$9	$9
Planning/Inventory/Monitoring	$9	$9	$9	$9	$11	$9	$9
Total Present Value Costs	**$244**	**$268**	**$174**	**$302**	**$249**	**$242**	**$268**
Cumulative Total Present Net Value	**$1,640**	**$1,669**	**$1,399**	**$1,796**	**$1,546**	**$1,738**	**$1,695**

Appendix C: Social and Economic Conditions and Trends

Introduction

The George Washington National Forest is comprised of almost 1.1 million acres of public lands located in 17 counties in western Virginia and eastern West Virginia. The Forest Supervisor's Office is headquartered in Roanoke, Virginia after the George Washington National Forest and the Jefferson National Forest were administratively combined in 1995. For over 50 years the George Washington National Forest has remained dedicated to managing resources, protecting the quality of the environment, and ensuring the productivity of the land.

History

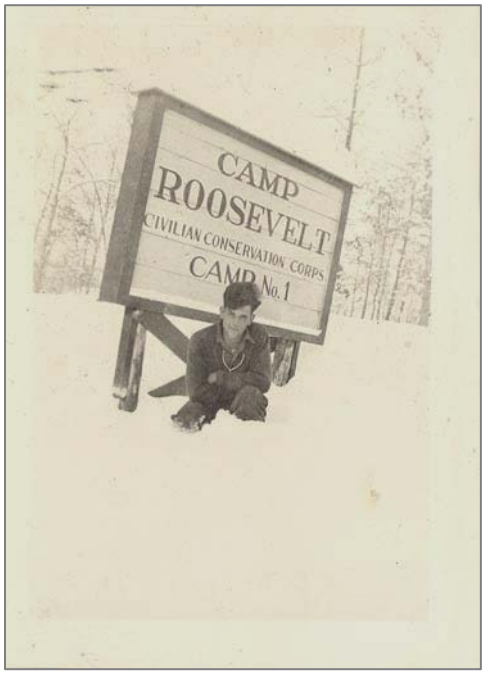
As our young nation began its westward expansion, settlement began in the valley of western Virginia. Shenandoah--daughter of the stars--was a name given to the river and the valley by Native Americans who passed back and forth through the bottom lands. The Sioux, Shawnee, Delaware, Catawba and Tuscarora Indian tribes all had their time here, hunting and harvesting the land.

Later settlers of Scotch-Irish and German heritage began to make their homes in the valley now surrounded by the George Washington National Forest. Settlers often viewed the forests as land that had to be cleared for more fields. The mountain lands, though eroded and over cultivated, were still desired by outside mining and timber interests. In the 1820's the combination of iron and trees to feed the iron furnaces made mining a profitable venture in many areas near the Shenandoah Valley. These companies brought devastation to the land. Repeated cuttings cleared the mountains, erosion caused streams to become clogged with silt and floods came more frequently and with greater damage. Perhaps the most insidious effect of industry was wildfire, which burned repeatedly over the mountains. Miners, timber operators and hunters pushed animal species like elk, white tailed deer and wild turkey to the brink of extinction.

A small group of forest reformers recognized that our natural resources were being exploited and endangered, and introduced bill in Congress that would protect the nation's forest. In 1891 the Forest Reserve Act was passed. It authorized the creation of Forest Reserves, the forerunner of what was to become the National Forest System.

Damage to the mountains also extended to the waterways. In 1911 the Weeks Act was passed, which made it possible for the Federal Government to buy deforested mountain land and protect it for watershed purposes. Land in what was to become the George Washington National Forest was among the first considered for acquisition.
In 1917 three northern Virginia purchase units were combined to become the Shenandoah National Forest. It was later renamed the George Washington National Forest to avoid confusion with the National Park bearing the same name.

The Civilian Conservation Corps (CCC) played an important role in the early days of the Forest Service. The first CCC camp in the nation, Camp Roosevelt, was located in the George Washington National Forest. A total of 14 camps were eventually opened on the Forest. The CCC employed 9,200 men in Virginia during the nine years of the program's existence. Their work is still evident today in the roads, campgrounds, picnic shelters, fire towers, and other projects scattered throughout the Forest.



One of the more remarkable changes to occur just after World War II was the development of a more mobile and recreation-seeking society. Between 1945 and 1956, the number of visitors to some areas increased as much as four times. With close proximity to Washington D.C. and Richmond, it is not surprising that the George Washington National Forest has always been a popular destination for those who enjoy outdoor recreation.

In 1960 the Multiple-use Sustained-Yield Act was passed by Congress. It stated that national forests are established and shall be administered for outdoor recreation, watershed, range, timber and wildlife purposes. A wildlife management agreement with the Virginia Department of Game and Inland Fisheries has helped to reestablish turkey, bear, deer and many other species that were nearly driven to extinction due to unregulated hunting and poor land management practices during the late 1800's. The Threatened and Endangered Species Act of 1973 has also served to protect wildlife and their habitat.

Protection, growth and management have produced many fruitful achievements on the George Washington. Good stewardship has been, and remains, the goal of those entrusted with "caring for the land and serving the people."

Use of County Comprehensive Plans and Other Documents

NOTE: THIS SECTION WAS ORIGINALLY PREPARED IN FEBRUARY OF 2007 AND UPDATED IN 2011.

County comprehensive plans have already considered changing conditions and trends that affect relevant economic and social indicators such as employment, income, capital, housing, fiscal health, individual's health, safety, and quality of lifestyle. In fact, it was the evaluation of a County's relevant social and economic conditions and trends that lead the County to adopt its comprehensive plan.

Thus, the County Comprehensive Plans and Economic Development documents serve as a functional equivalent "comprehensive evaluation reports" since they deal with social and economic conditions and trends. By reviewing a County's plan, the USDA Forest Service can determine what opportunities it has to contribute to a county's goals.

Deciding whether the current GW Plan guidance needs to change required an evaluation of each county's comprehensive plan.

County plans reflect the social, economic, and ecological values of the citizens in those counties. Citizens participated in developing or revising these county plans, which for the most part, were "issue-driven". Thus, social and economic sustainability for the purposes of this revision effort is being defined by the County Plans, which reflect the values of its citizens. The Forest then evaluates its contribution as a partner to achieving County Visions and goals as best it can.

In evaluating the County Plans, the Forest was looking not only for obvious links to National Forest System management, but was also looking for new issues (making the hidden obvious) that we weren't aware of that were important enough for County citizens that they were addressed in County Plans. Through this County Plan evaluation, the Forest was confirming data or values we already knew, and illuminating areas that we didn't know about but should know about.

In the end, the George Washington's revised plan should contain plan components providing strategic guidance that clearly contributes to maintenance or achievement of County goals.

This review only dealt with the land use ties at the strategic level to National Forest System management. In essence, the evaluation leads to identification of those county goals, objectives and strategies with land use ties to the National Forest. Two trigger questions were used in the following evaluation

> Question: What are the long-term interests of the citizens of the counties and how do they compare with the mission of the George Washington National Forest?
> Other question: What are the important roles and contributions the Forest Service can play, to achieve or maintain the goals, objectives and strategies of the counties that contain National Forest System land?

ALLEGHANY COUNTY

The following summarizes the goals, strategies and objectives of the 2007 Alleghany County Comprehensive Plan that are related to NFS land management.

Economic Development

Goal: To enhance the economic base and employment opportunities in the County.
Objectives:

Develop a regional marketing strategy to pursue programs and projects that will enhance the role of Alleghany County as a tourism destination.

Investigate the acquisition and utilization of additional land conducive to economic development along the I-64 corridor including Innovation Park and the Commerce Center.

Strengthen efforts to retain existing businesses and identify resources that encourage or facilitate expansion and development in the County, especially in the Alleghany Highlands Enterprise Zone.

Improve the County's infrastructure to accommodate future businesses and residential development, such as the development of water and wastewater treatment facilities in areas of the County in need of these services.

Land Use

Goal: To encourage desirable development and growth, while preserving the rural character of the County.
Objectives:

Promote programs that enhance the value of the National Forest as recreational uses and for its natural beauty.

Continue the development of a Geographical Information System that can be accessed by County staff and the general public to assist in the future development of the County.

Continue to improve and develop County infrastructure to ensure orderly development and land use in the County.

Monitor the potential development of the wind resource facilities in the County and develop regulations as needed.

Environmental

Goal: Protect and preserve the natural resources of the County with wise environmental management.
Objectives:

Preserve areas of unique scenic beauty and environmentally sensitive areas.

Examine and judge, by a cost/benefit analysis, public and private land development decisions in terms of their environmental consequences.

Encourage measures to improve water and air quality, and soil conservation.

Continue to monitor and regulate the development and construction within areas designated as flood hazard areas, and discourage the same within areas designated as a floodway to ensure the safety and protection of land and buildings from destruction during flooding events.

Continue to enforce and encourage sound erosion and sedimentation control practices.

Work with the Virginia Department of Forestry to encourage citizens to develop "best management practices" relating to timber removal and for protection of our natural resources; and encourage reforestation, both natural and planted, of harvested areas.

AMHERST COUNTY

The following summarizes the goals, strategies, and objectives of the 2007 Amherst County Comprehensive Plan that are related to NFS land management.

Public Water and Wastewater

Goal # 1: Provide water and wastewater utilities to support the County's growth management, land use, environmental, and economic development goals and objectives.
Objective # 3: Participate with other local governments in regional water and wastewater utility planning and participate with those projects that meet future needs.
Strategies:

Develop mutually beneficial joint ventures with the Town of Amherst and the City of Lynchburg to interconnect existing and future water and wastewater utilities within the designated growth areas, in ways determined to be desirable and cost effective.

Participate with the Region 2000 Local Government Council and other jurisdictions in the development of a regional water supply plan for Central Virginia.

Parks and Recreation

Goal #2: Maximize utilization of parks and recreation services for all ages.
Objective #1: Promote the year round use of public facilities for recreation.
Strategies:

Improve access to services and improve identification of destination points throughout the County.

Create a communications plan and implementation strategy to promote tourism.

Advertise the park and recreational assets of the community, including the county's walking and biking trails, in pamphlets identified in the communications plan.

Objective # 2: Protect natural resources while promoting public access.
Strategies:

Work in cooperation and conjunction with environmental groups within the county to protect and enjoy the natural beauty of the County.

Promote environmental education programs.

Economic Development

Goal # 5: Promote and expand recreation and tourism opportunities in the County.
Objective #1: Make Amherst County a competitive tourist destination in the state.
Strategies:

Develop the James River front to include hiking/biking trails, river access, and connectivity to Percival Island.

Investigate ways to make utilizing county-owned resources for tourism (e.g., lakes, swimming, trails, etc.) a high priority agenda item.

Continue to produce a brochure highlighting Amherst County vineyards, orchards, lakes, and trails, in the National Forest and Appalachian area.

Cultural Resources and Community Aesthetics

Goal : To expand the cultural and recreational opportunities available in Amherst County for all age groups.
Objective # 1: Promote activities that celebrate the county's cultural diversity.
Strategies:

Promote ecotourism – hiking, biking, visiting historic places, showcasing garden week, observing wildflowers, and bird watching. Promote trail development and use, through offering incentives to land owners to make their land accessible to these types of activities.

Amherst County should encourage the developers of property within Parkway viewsheds to minimize visual impacts on the Parkway. Impacts can potentially be minimized through changes in site or building design, including grading, building locations, building height, building and roof colors, street locations, lighting, landscaping, and buffering.

Protect the "gateways" to the Parkway. Route 60 and Route 130 are the gateways to the Parkway in Amherst County. Parkway visitors develop first impressions of the County based upon the scale and character of development along these routes. The County's current zoning regulations should be evaluated to determine whether or not they are sufficient in scope to require that development along these critical gateways be compatible with the rural and scenic nature of the Parkway's environs. If not, the county should consider adopting zoning amendments to create scenic corridor overlays that would manage the scale and character of new developments along these corridors.

Monitor and participate in the development of resource management plans for the George Washington National Forest. This national forest provides a significant buffer for the Parkway and protects the Parkway from the visual Impacts of rural and suburban development; however, recent federal proposals to return some of the forest in Virginia to private ownership demonstrates that communities along the Parkway must be vigilant if they wish to be proactive in ensuring that the Parkway remain a major environmental and scenic asset.

Land Use

Goal #2: To promote the preservation and use of open space and encourage viable agricultural and forest land uses to protect the County's natural beauty, rural character, wildlife habitats and water resources.
Objective #1: Identify key open spaces within the County.

Strategies:

Prepare an open space master plan based on the County's GIS conservation mapping system.

Determine criteria of attributes for desired open space such as minimum acreage, visibility, and aesthetic value.

Objective #2: Enhance public land access where funding may be available.
Strategies:

Expand James River access points.

Continue expansion of Percival Island bike trail connector and Virginia Blue Ridge Railway Trail.

Encourage volunteer effort coordination with National Forest Service for maintenance of trails and picnic areas.

Objective # 3: Provide and/or support economic incentives to encourage the preservation of open space, agricultural, and forestall lands.
Strategies:

Consider adopting an agricultural and forestall district program in Amherst County and promote its use to agricultural and forestall land owners.

Support the conservation initiatives such as the acquisition of conservation easements, of local conservation organizations.

To be cost effective, work with the Central Virginia Land Trust and the Virginia Outdoor Foundation due to their ability to leverage grant funding with modest local contributions.

Objective # 4: Increase available funding for open space and agricultural land conservation initiatives.
Strategies:

Request that the General Assembly continue the land conservation fund and increase the funding for this program.

Objective #5: Initiate/support public education programs on conservation and low-impact development techniques.
Strategies:

Work with the Robert E. Lee Soil and Water Conservation District and Central Virginia Land Conservancy to design and offer at least one conservation seminar per year on topics such as best management practices, conservation easements, and low impact site design.

Objective# 7: Promote retention of agricultural and forest land use in the County.
Strategies:

Maintain support for the Extension Service.

Encourage and promote existing rural entrepreneurial businesses.

Goal # 3: Minimize the negative environmental impacts of new and existing residential, commercial, and industrial development.
Objective # 3: Protect the County's water and air resources from degradation.
Strategies:

Consider a county riparian buffer program for waterways.

Cooperate with the Robert E. Lee Soil and Water Conservation District in a voluntary riparian buffer easement program.

Rely upon and support the Federal Environmental Protection Agency's ambient air quality standards.

Prohibit development in river and stream corridors, especially floodplains (100 year) and wetlands.

Goal # 4: To protect and enhance our air and water quality.
Objective # 1: Encourage agriculture and residential awareness of impact of lifestyle on water quality.
Strategies:

Encourage agricultural compliance with Chesapeake Bay protection guidelines by extending or expanding financial incentives.

Goal # 5: To protect our scenic view sheds.
Objective # 2: Preserve and enhance scenic corridors.
Strategies:

Identify gateways to the county and scenic corridors, and apply special zoning and littering controls including increased fines for littering.

Provide and enforce regulations limiting placement of abandoned vehicles, household items, etc. in view of public rights-of-way.

Objective #3: Encourage the protection of steep slopes and ridgelines.
Strategies:

The County may wish to research and consider establishing a mountain/ridgeline protection ordinance and enforce guidelines for building lots and access roads to new developments.

AUGUSTA COUNTY

The following summarizes the goals, policies, and objectives of the 2007 Augusta County Comprehensive Plan that are related to NFS land management.

Agriculture

Goal 1: Enhance the economic strength of the county's agriculture and forestry industry.
Objective C: Ensure that the agricultural and forestry industry in Augusta County has available to it a wide array of methods for maintaining a viable agricultural economy.

Goal 2: Protect existing agricultural and forestry operations in the Rural Conservation and Agricultural Conservation Areas from conflicts with other land uses and from being converted to other land uses.
Goal 3: Ensure that agricultural and forestry operations use environmentally sound methods.
Objective A: Support a variety of programs and strategies for farmers to ensure that their operations are both profitable and environmentally sound.

Policy 1: Best Management Practices (BMPs). Encourage BMPs through cooperation with those federal, state and county agencies, including the Headwaters Soil and Water Conservation District, the Natural Resources Conservation Service, and the Virginia Department of Forestry, that provide technical support to the farming and forestry industries.

Policy 2: Farm Conservation and Forest Management Plans. The county should encourage landowners to develop a conservation plan for their farming operation or a forest management plan for their forestry operation.

Policy 3: Nutrient Management Plans. The county should continue to require nutrient management plans for new intensive agriculture facilities.

Economy

Goal 1: Retain and expand the business and industrial operations currently located in the county. The primary focus of economic development efforts should be to retain the county's existing employers and facilitate their growth and expansion.

Goal 2: Attract industries and businesses which are compatible with and enhance the county's economic climate as well as its environmental, scenic, agricultural, and historic character.

Goal 3: Maintain the overall high quality of life in the county which serves as a major attraction for new employers and employees.

Objective A: Capitalize on the economic assets of the agricultural landscape, natural beauty, and historic resources.

Policy 2: Tourism. Promote the local tourism industry, including the conservation of the agricultural, historic, and environmental resources that fuel it.

Natural Resources

Goal 1: Protect the fundamental integrity of the county's natural environmental systems into the long-term future for the enjoyment and benefit of local citizens, businesses, tourism, recreation, and other species that co-exist within the county.
Objective A: Protect the water, air, natural systems, and water supplies of Augusta County.
Objective B: Protect the natural and scenic beauty of the county's mountains and rural landscapes.
Objective C: Protect the county's forests and special and distinctive habitats.
Objective D: Participate in state and regional programs to protect local waterways, the Shenandoah River, and the Chesapeake Bay.

Goal 4: Sustain the natural resources base that allows for productive, healthy, and environmentally-sound agricultural and forestry land uses.
Objective B: Promote agricultural and forestry operations that protect water quality and natural resources.

Policy 2: Forestry BMPs & Management Plans. Work with partner agencies, including the Virginia Department of Forestry, to promote forest management plans and forestry BMPs.

Policy 4: National Forest Management Plans. Work with the U.S. Forest Service to promote the county's interests during revision of the George Washington/Thomas Jefferson National Forest Management Plan.

Goal 5: Protect the quality and quantity of groundwater as the primary source of drinking water for county residents and as a source of water to springs and headwater streams.
Objective A: Work with the Augusta County Service Authority (ACSA) to develop wellhead protection strategies to apply to existing and needed future water supply sources that serve the Urban Service and Community Development Areas.

Policy 2: Groundwater Studies. Support Augusta County Service Authority efforts to investigate new groundwater sources and pursue geologic investigations to determine areas of influence for springs and wells.

Goal 6: Protect the citizens, property, and natural resources of the county from flood damage by integrating public safety with environmental protection.
Objective A: Ensure that the operation of flood control dams is coordinated with upstream and downstream land uses.

Policy 1: Map Inundation Zones. Support the Headwaters Soil & Water Conservation District (SWCD) and other public and private owners of flood control dams to accurately map all breach inundation zones. This should also apply to other dams that are subject to state dam safety regulations.

Policy 2: Dam Improvements. Support the Headwaters SWCD on needed dam safety improvements (necessitated by downstream development and subsequent changes to hazard classifications) in order to be in full compliance with Dam Safety standards and regulations.

Policy 3: Outreach Within Inundation Zones. Work with Headwaters SWCD and the County Fire & Rescue Department to develop outreach materials for residents within inundation zones, real estate agents, and other audiences that highlight the nature of the inundation zones and steps for emergency preparedness.

Objective B: Promote natural flood control strategies that protect public safety and help restore streams and riparian areas.

Policy 1: Establish Policy. Establish policies in the Stormwater, Zoning, and Subdivision regulations that provide incentives for naturalized and revegetated flood plains, riparian buffers, and stream restoration based on natural channel design concepts.

Policy 2: Work with Partner Agencies. Work with the Virginia Department of Forestry, Department of Conservation & Recreation, Headwaters SWCD, Natural Resources Conservation Service, the Virginia Department of Transportation, and other agencies to fund and install appropriate stream and riparian buffer restoration projects.

Parks and Recreation

Goal 1: Establish and maintain parks and recreational facilities and services that are efficient, effective, and readily available to all county residents in accord with state service standards.
Objective A: Develop new parks and recreational facilities that can efficiently and effectively provide readily available services to all county residents.

Policy 2: Location of New Facilities. The county should undertake the acquisition, planning, and development of parks and recreational facilities at various levels throughout the county to provide services in an efficient and effective manner to all residents. The following recommendations found in the Augusta County Comprehensive Parks, Recreation and Open Space Master Plan from November 2003, should provide guidance for the location of new parks and recreational facilities.

> D: Connections and Trails. The county should develop or identify "linear" facilities, which provide their own recreational opportunities and may provide connections between other recreational facilities and resources.
>
> E: Greenways. The county should prepare a Greenways Plan incorporating its existing trails and major parks and recreational areas.

Objective B: Proactively plan for the future parks and recreational needs of Augusta County. Coordinate the parks and recreation planning process with various public and private entities in the county, as well as with the Community Development Department.

Policy 1: Coordinate Planning Efforts. Planning for parks, open space conservation, scenic and historic preservation and land development should all be coordinated and integrated into a unified effort on the part of each agency and jurisdiction involved, including private sector and local community initiatives. In providing assistance to community organizations, the county should coordinate such efforts and funding so that they are consistent with a countywide approach to providing parks and recreational services so as to achieve maximum efficiency of money spent, as well as an appropriate balance in the location of facilities and services.
Objective C: Better utilize the historical and natural resources of Augusta County to provide for the recreational needs of county citizens.

Policy 1: Trail Connections to Parks. The county, with public involvement, should develop a greenways plan to explore the potential for connecting residential areas to the parks and recreational facilities located in the county.
Policy 2: Relating Park Facilities to Historic and Natural Resources. The county should explore, through the greenways plan, the potential for building new park facilities in locations that would allow them to relate to historic locations and buildings or natural resources like rivers or ridgelines.

BATH COUNTY

The following summarizes the goals and objectives of the 2007 Bath County Comprehensive Plan that are related to NFS land management.

Economy Goals

1. Strive to retain existing businesses and industry and help them to succeed.

2. Attract new businesses, while ensuring that growth and industrial development occur in suitable locations and are compatible with Bath's environmental, scenic, and rural character.
4. Strengthen the promotion of tourism in Bath County.
6. Encourage the growth of small locally-owned private businesses as opposed to a large-scale "one-size fits all" approach to new business services.

Objectives

a. Diversify the economy by working with appropriate parties that have expressed an interest in locating here, and pursue new businesses that would fit in with the existing environment.
c. Attract environmentally low-impact, high wage industries, such as those in the areas of technology, home-based or telecommuting businesses, and business incubators.
h. Support an overall campaign for the community to attract tourism dollars to the County.

Natural Environment Goals

1. Preserve and protect air quality in Bath County and the vicinity.
2. Reduce potential environmental problems associated with Karst topography.
3. Conserve the County's soil resources and protect prime soils.
4. Protect local water resources and unique aquatic habitats.
5. Minimize flood-related damage to structures, personal property, and public facilities.

Objectives

c. Consider geologic concentrations in areas before designating land uses.
d. Amend the current zoning ordinance to prevent inappropriate construction, development, or site disturbance in areas with known Karst features.
e. Work with the Department of Environmental Quality to monitor mineral resource exploration activities so as to ensure groundwater resources are not contaminated.
h. Acknowledge the County's potential for affecting soil and water quality on a regional scale by supporting the County's Erosion and Sediment Control Ordinance.
o. Adhere to the Virginia Department of Forestry's Code of Silviculture Best Management Practices.

Utilities Goals

1. Continue to evaluate future operations and maintenance needs for the County's water and sewerage system.
3. Provide public water and sewer, power, and telecommunications options for existing businesses and residential areas of highest densities and build additional capacity for future planned growth.
4. Discourage construction of industrial scale wind towers on ridgelines in Bath County, thereby preserving public viewsheds.

Transportation Goals

1. Encourage development of a safe, effective, and efficient roads, as well as bike and pedestrian trails that will shape and serve the future of Bath County.
6. New development should encourage creativity, a mix of uses, and connectivity through a variety of transportation means including roads, bicycle routes, and pedestrian trails.

Objectives

j. Consider designating Route 39 as a tourism corridor.
n. Work to ensure that Route 220 receives a "Scenic Byway" designation.

Community Facilities, Public Safety, Health & Human Services Goals

2. Strive to ensure the health, safety, and welfare of all citizens and property in the County through all fire, rescue, and law enforcement entities.
3. Promote athletic, cultural, and recreational activities to all age groups.

Objectives

f. Explore partnerships with the National Forest Service and the Department of Game and Inland Fisheries that enhance more public lands for recreational use.

q. Support the formation of Memorandums of Understanding between local, regional, and state jurisdictions, and establish a clear management structure for forming plans, policy, procedure, and protocols that strive to achieve consensus among fire, EMS, law enforcement, and other health and safety related groups, and grant the ability to cross jurisdictional boundaries.

Land Use Goals

New growth should complement the County's natural, historical, and cultural setting.

Objectives

c. Consider alternative energy sources (i.e.- wind, solar) at an appropriate scale and location, for use within the local community.
d. Preserve and protect the water quality, scenic beauty, and natural character of the Cowpasture and Jackson Rivers, as well as Back Creek, by using established Best Management Practices.
f. Avoid developing on steep slopes (greater than 25%) due to potential problems with erosion, sedimentation, and water pollution.
g. Avoid development within areas characterized by Karst topography so as to minimize structural instability and groundwater pollution.
h. Discourage or carefully regulate development of land areas within the 100-year floodplain of any river or stream.
k. Consider revising the current Zoning Ordinance to include the following:
3) Adopt a set of comprehensive telecommunications, wind, and solar facilities siting guidelines.
4) Include model ordinances that will protect water quality, ridgetops, viewsheds, dark skies, and soil quality.

BOTETOURT COUNTY

The following summarizes the goals, policies, and objectives of the 2004 Botetourt County Comprehensive Plan that are related to NFS land management.

Economic Development

Goal: To enhance the economic base and employment opportunities in Botetourt County.
Objectives:

Develop adequate public facilities and services to meet the needs of an expanding economic base.

Coordinate closely with VDOT, and other agencies that can assist with economic development opportunities associated with new or expanding businesses.

Continue to pursue and facilitate work-force training opportunities that will assist new or expanding businesses

Coordinate closely with other local, regional, and statewide economic development organizations.

Policies:

As resources become available, implement planned public water and sewer extension projects and planned road improvements to accommodate future economic growth.

Use the future land use map and the zoning map to identify and reserve land areas suitable for future economic activities.

Community Services and Facilities

Goal: To enhance the quality of life in the County by making government services more efficient and available.

Policies: Continue to promote the County's proximity to the Appalachian Trail, National Forests, the Blue Ridge Parkway and the James River as important and accessible recreational opportunities.

Land Use

Goal: To achieve a balanced land use system that provides sufficient and compatible land areas for all community land use needs, while protecting sensitive natural environments, and important local historic and cultural resources.

Objectives:

Discourage scattered development patterns which are incompatible with the County's ability to provide adequate and cost effective public services and facilities.

Enhance the rural character of the County through the preservation of agricultural and forestal lands.

Implement appropriate policies and procedures to provide reasonable protection to the Blue Ridge Parkway and Appalachian Trail.

Policies:

Large residential, commercial and industrial development proposals should only locate in areas planned for the use, where there are adequate public facilities, and where the transportation system can accommodate the demands of the new use.

Encourage the conservation and preservation of major historic and archeological sites. Continue to provide comment on potential new sites within the County.

Environmental Quality

Goal: To maintain and enhance the County's high standard of environmental quality.

Objectives:

Protect the County's natural resources including ground and surface waters, and air quality.

Maintain the rural character and scenic beauty of the County.

Policies:

Encourage the Department of Forestry to closely monitor all timbering operations to ensure they comply with all required environmental standards.

Continue to participate in the regional Early Action Compact as a strategy to avoid an EPA designation as an Ozone Non-Attainment area.

Review and comment on proposed National Forest Plans to ensure a coordinated effort in the protection and management of forest resources in the County.

Pursue programmatic and incentive based regulatory approaches to the protection of mountain ridgelines and critical mountain viewsheds.

FREDERICK COUNTY

The following summarizes the goals and strategies of the 2007 Frederick County Comprehensive Plan that are related to NFS land management.

Goal: Provide support to travel and Tourist Related Activities

Strategies

Promote activities which will encourage tourism, including the preservation of historic sites and scenic vistas.

Goal: Identify and protect important natural resources

Strategies

Identify which natural resources are important and undertake efforts to locate and protect those resources.

HIGHLAND COUNTY

The following summarizes the goals and objectives of the 2007 Highland County Comprehensive Plan that are related to NFS land management.

Economy

Goal1: Maintain a viable, diverse economy for Highland County Citizens
Objective – 11: Recognize tourism as a diverse and viable economic development opportunity with emphasis on regional heritage, eco-tourism, agri-tourism and outdoor recreation.

Land Use

Goals

LG-1 Maintain Highland's special rural character

LG-2 Recognize the special role the county's natural environment, historic landscapes, and traditional land use patterns combine to make the county a distinctly scenic place to live and visit.

LG -3 Maintain viable commercial, agricultural and forestry sectors when making land use decisions.

LG -4 Ensure that effective land use planning is kept in balance with the freedom and rights of individual landowners.

Objectives

LO -3 Protect the productivity of farm and forest land.

LO -5 Promote "Dark Skies"

LO-6 Assess the impact of wind development on the county's tourism, land values and revenues

NELSON COUNTY

The following summarizes the goals and principles of the 2002 Nelson County Comprehensive Plan that are related to NFS land management.

Economic Development

Goal – Support and encourage tourism as a viable means to diversify the local economy.
Principles

Support local tourism and link it to the region's many tourism programs.

Promote historic sites that are accessible to the public as part of the tourist economy.

Promote local greenways and other recreational opportunities to enhance tourism.

Natural, and Scenic, and Historic Resources

Goal – Recognize that the natural environment is an important facet of our quality of life and efforts should be made to support and enhance that environment.
Principles

Recognize the importance of ground water and surface water to the county by supporting guidelines for the protection of these resources and conducting additional water studies as needed.

Protect natural resources, including prime soils for agricultural use, groundwater, air, wetlands, and forest resources.

Recognize the county's major rivers and waterways as significant environmental resources and provide for their protection and appropriate use for recreation.

Goal – Protect the county's scenic resources as essential to the county's rural character, economic strength and quality of life.

Principles

Protect the county's scenic roadways by designating them as State Scenic Byways and by adopting a local scenic byways ordinance as needed. In particular, support designation of Route 29 from Woods Mill to the Albemarle County line and Route 664 as scenic byways.

Maintain areas of scenic beauty of the county's waterways and rivers as natural resources and in support of the county's tourism program.

Promote the preservation of the viewsheds of scenic vistas as an important part of the county's tourism program.

Discourage ridgeline development.

Goal – Preserve and protect the historic character and features of Nelson County.

Principles

Recognize and honor stewardship of historic properties and sites through, for example, the Historic Designation Program and through formal recognition by the Board of Supervisors.

Encourage the establishment of local historic districts in support of the county's tourism program and to protect their historical, architectural, and cultural significance. Lovingston and Schuyler, in particular, are appropriate for historic district designation.

Recreation

Goal – Promote a diversity of recreational opportunities for Nelson's citizens and for those who visit the county as tourists.

Principles

Promote recreation facilities that are county-wide resources for recreation and athletic events.

Support the development of county greenways, including the Blue Ridge Railway Trail, and new greenways, for recreation, and to preserve open space and protect river and stream corridors.

For increased recreational and tourism opportunities, provide access and connections to key destination points and attractions.

Rural Conservation

Goal – Maintain the rural character of Nelson County.

Principles

Protect sensitive rural areas such as steep slopes, river and stream corridors, prime farmland, old growth forests, and historic sites from encroaching development by discouraging rural growth in areas adjacent to these sensitive areas.

Protect rural scenic roadways through vegetative buffers between the roadways and new rural subdivision growth.

Protect scenic views and vistas by encouraging the siting of new buildings in conformance with the existing topography and into the existing landscape and vegetation.

Goal - Protect productive agricultural and forestal land.

Principles

Promote voluntary measures such as Agricultural Forestal Open Space designations and voluntary dedication of easements as undeveloped land.

PAGE COUNTY

The following summarizes the goals and policies of the 2009 Page County Comprehensive Plan that are related to NFS land management.

Goal 1: Preserve and enhance historic and cultural resources that reflect the heritage of the County.

Policy 1.1 Preserve and protect significant scenic, cultural, architectural, historical, and archaeological sites and structures for the benefit of existing and future citizens.

Policy 1.2 Encourage and assist property owners to pursue State and National Register designation, either individually or through thematic nominations.

Policy 1.3 Encourage preservation and adaptive re-use of archeological sites and historic buildings, districts and sites by the private sector through the creation of incentives programs, use of conservation easements, designation of landmark buildings and districts, design review, public improvements and other tools.

Policy 1.5 Require public and private development to preserve, to the maximum extent feasible, significant buildings and sites.

Policy 1.6 Encourage surveys and recordings of public and private cemeteries and burial grounds.

Policy 1.7 Encourage community awareness and public education about historic preservation.

Policy 1.8 Pursue private and public partnerships to finance cultural facilities, programming and events.

Policy 1.9 Protect the cultural and economic identity of the County and its unincorporated communities.

Goal 2: Preserve and protect the natural, rural, and open space character of the County, its ecology and environmental features.

Policy 2.1 Preserve a rural lifestyle in the County outside of the towns, Incorporated Areas Tier and Community Service Area Tiers.

Policy 2.2 Limit the impacts of development on the community's environmentally sensitive lands and key natural resources.

Policy 2.3 Protect environmentally sensitive areas such as perennial streams, floodplains, wetlands, steep slopes and highly erodible soil.

Policy 2.4 Preserve valuable open space and forests.

Policy 2.5 Conserve and protect fragile and critical natural resource areas, which include woodlands, unique geological formations and environmentally sensitive areas.

Policy 2.6 Encourage the protection of agricultural and environmental lands through conservation subdivision design, conservation easements, private covenants, deed restrictions or other mechanisms approved by the County.

Policy 2.7 Require that non-residential developments be designed to preserve and enhance natural features such as vegetation, wildlife, waterways, wetlands, and topography.

Policy 2.8 Encourage multiple uses of forested land that are non-intensive and compatible, such as outdoor recreation, wildlife habitats, watershed protection, and selective timber harvesting.

Policy 2.9 Ensure that development on forestland is compatible with the environmental features of that land and does not diminish natural and scenic values.

Policy 2.10 Encourage best practices for forest management, including reforestation.

Policy 2.11 Preserve and protect National Parks and Forests from inappropriate development patterns.

Policy 2.12 Protect open spaces around natural and historic areas such as land adjoining Shenandoah National Park, George Washington-Jefferson National Forest and the Shenandoah River to protect the integrity of the park and other natural scenic attractions.

Policy 2.13 Encourage the preservation and protection of views from Skyline Drive and George Washington National Forest.

Policy 2.14 Encourage lower density development in appropriate locations to preserve the rural character of the County and support environmental policies, such as water quality protection.

Policy 2.15 Encourage the development of additional and connected green and open space throughout the County and its communities.

Policy 2.16 Encourage greenways and blueways and other public access to link natural, cultural, and scenic resources such as designated scenic rivers and highways, registered historic properties, permanent open space easements, the National Park, National Forest and the Appalachian Trail Systems.

Policy 2.17 Encourage and facilitate the donation of open space and conservation easements on land that is identified as having important scenic, historic, open space, conservation, agricultural, or wildlife-habitat qualities.

Policy 2.18 Encourage preservation of important open space, conservation, agricultural, or wildlife-habitat lands during the development review process, including re-zonings or land use map amendments.

Policy 2.19 Discourage land uses that have adverse environmental impacts.

Policy 2.20 Emphasize coordination between land use policies with soil limitations, such as shallow depth to bedrock, and seasonal high water tables.

Policy 2.21 Encourage coordination between land use policies, ordinances and Watershed Management Plans, as appropriate, with the towns of Luray, Stanley and Shenandoah.

Policy 2.22 Encourage the use of Low-Impact Development (LID) and Green Infrastructure principles and techniques5

Policy 2.23 Encourage best practices for storm water management.

Policy 2.24 Protect scenic viewsheds.

Policy 2.25 Protect the night sky from light pollution particularly as it impacts Shenandoah National Park and George Washington National Forest.

Policy 2.26 Protect *Karst* terrain from inappropriate development to preserve ground and surface water resources, reduce the potential for property damage from subsidence or other earth movement and sinkhole flooding and protect the public's health and safety.

Policy 2.27 Encourage the reuse and recycling of residential, industrial, commercial and agricultural by-products.

Policy 2.28 Support the incorporation of environmental education activities into the school district curriculum in order to encourage student environmental awareness and education.

Goal 4: Protect and manage the County's surface and ground water resources

Policy 4.1 Encourage best management practices to prevent potential groundwater pollution.

Policy 4.5 Support the protection of groundwater resources.

Policy 4.6 Protect water quality by limiting areas of impervious surfaces and utilizing best management practices.

Policy 4.8 Encourage and support preservation programs such as scenic easements, land purchase, tax incentives, and federal and state grants-in-aid to achieve water quality, open space and other environmental objectives.

Policy 4.9 Protect flood prone areas from inappropriate development.

Policy 4.10 Discourage housing and commercial development in the 100-year floodplain.

Policy 4.11 Protect local and regional water resources through the application of the Chesapeake Bay Management Regulations.

Policy 4.12 Support watershed management planning and consider watershed management objectives in conjunction with land use decisions.

Policy 4.13 Encourage low or no-impact open space activities in flood plains, wetlands and other sensitive areas where possible.

Goal 6: Encourage and develop a diverse and viable local economy compatible with the County's Rural character.

Policy 6.2 Encourage economic growth that is compatible with the County's rural character while generating a positive net cash flow for the County.

Policy 6.5 Protect and enhance the environmental resources of the County, recognizing they can attract agriculture, business and industry as well as provide hunting and fishing for local residents and tourists.

Policy 6.7 Encourage the attraction of new business activities that enhance existing industrial and commercial activities in the county, particularly active farming and forestry operations.

Goal 9: Enhance the visual appeal and identity of Page County.

Policy 9.2 Encourage the use of cluster development, new urbanism or neotraditional development, and mixed-use design as alternatives to conventional suburban and rural sprawl.

Policy 9.4 Encourage and support major corridors and gateway locations to promote a positive visual appearance, including landscaping and signage.

ROCKBRIDGE COUNTY

The following summarizes the goals, objectives, and strategies of the 2003 Rockbridge County Comprehensive Plan that are related to NFS land management.

Land Use Goals

Goal: Enhance, protect and preserve the ambiance and environmental quality of Rockbridge while promoting a greater awareness of the scenic beauty and other positive attributes of the County. Maintain areas in their rural state and attempt to protect sensitive and unique land resources from degradation. Agricultural areas are to be maintained, and incompatible land uses (such as commercial and industrial development, dense residential development and their related public improvements) shall be discouraged in rural areas.
Objective: Promote the conservation of open space within the County and actively promote the long-term preservation and maintenance of valuable natural resource areas through public acquisition, continued support for and implementation of use-value taxation, increased regulatory control over and fees associated with new development and other cooperative efforts.
Strategy:

4. Recognizing projected levels of natural resource demand, allocate sufficient land areas within the Future Land Use Plan for open space, as well as agricultural, forestry and recreational uses.

5. Potential natural resource sites should be identified and managed for sustainable use.

6. The preservation and enhancement of agriculture and forestry is a fundamental cornerstone of the social, environmental, economic and cultural character of Rockbridge County. The Plan shall establish Rural Preservation Planning Areas for the purpose of delineating and guiding land use policies for these areas.

9. Woodlands and open spaces along County road corridors should be preserved.

10. Endorse the Virginia Department of Forestry's recommended forest management practices.

11. Identify specific measures to aid the County in its ongoing efforts to preserve rivers and streams for the purpose of preserving their natural beauty and environmental attributes, while maximizing recreation potential and conservation opportunities, and locate specific geographic areas where these measures may be applied.

12. Discourage the development of permanent structures in areas situated within the one hundred-year-floodplain.

15. Protect the quality and reliability of the regional aquifer by establishing guidelines for the judicious use of groundwater supplies.

16. Regulate development in karst areas in order to reduce the hazards of ground subsidence and collapse and the hazard of groundwater pollution.

Objective: Create a rational balance between the management and preservation of the County's rural areas and the accommodation of fiscally responsible growth and economic development.
Strategy:

6. Develop and implement procedures that will promote the conservation of environmentally sensitive land areas that would be adversely impacted by new development and redevelopment activities.

Goal: Protect and enhance both existing and future development in Rockbridge County through pro-active growth management programs, including the implementation of modern zoning strategies and progressive community design guidelines.
Objective: Protect and enhance the unique qualities of Rockbridge County's small County atmosphere, as well as its sense of history and place.
Strategy:

1. Promote development opportunities that respect, preserve and protect the County's ambience, historic properties, riverfront areas and sensitive environmental areas.

10. Develop economically feasible strategies for minimizing the visual impact of electrical power lines, telephone lines, television cables on principal, and entrance corridor viewsheds.

11. Explore the potential for establishing a Mountaintop Development Ordinance, which would be designed to protect valuable ridgelines and scenic viewsheds from future development using a threshold elevation to be established by the Board of Supervisors.

14. Encourage development applicants to dedicate right-of-way within their projects to accommodate "hiker-biker paths."

ROCKINGHAM COUNTY

The following summarizes the goals, strategies and policies of the 2007 Rockingham Comprehensive Plan that are related to NFS land management.

The County may pursue the development of trail systems within the environmental reserve to connect the National Park and Forest to the towns and planned growth areas (Plan pages 2-13 and 2-19).

Goal 1. Preserve the Quality of Natural Resources. (surface water, groundwater, air, soil, quiet, night sky)
Strategy 1.1: Protect water quality.
Policies and Implementation Actions:

1.1.2. Continue to participate in TMDL (total maximum daily [pollutant] load) water quality studies for impaired streams.

1.1.9. Promote the setting aside of floodplain lands as open space during the development process to form the backbone of a countywide greenway system for flood protection, water quality protection, wildlife habitat preservation, and passive recreation.

Strategy 1.2: Protect community water supply sources.
Policies and Implementation Actions:

1.2.4. Expand cooperation with other water providers to address regional needs.

1.2.7 Encourage, through the development approval process, the establishment of buffers 100 feet in width along major stream corridors and tributaries, defined as those watersheds which drain an area of one square mile or greater. Such buffers should be maintained in a natural condition with little or no clearing, grading or other land disturbing activity, except for that necessary to locate any essential utility lines or similar public facilities. Provide for such buffers to be created through the clustering of development density so as to maintain a reasonable overall development potential for tracts affected by the stream buffer policy.

Strategy 1.3: Protect environmentally sensitive areas.
Policies and Implementation Actions:

1.3.3. Incorporate BMPs into land development regulations in both the Zoning and Subdivision Ordinances.

1.3.4. Identify and protect habitats of rare and threatened species.

1.3.7 Encourage all roadways and utility lines to be designed and located to fit the existing topography and to avoid areas with slopes of greater than 15%.

1.3.8 Maintain natural drainage channels wherever possible as new development occurs, with particular focus on those areas with slopes greater than 15%.

1.3.9 Encourage the maximum retention of existing vegetation and topography as a site is developed, in both urban and rural areas. Encourage existing features to be incorporated into the development design to the maximum extent possible.

1.3.10 Encourage the long term conservation of forest resources through the balanced and multiple use of forest resources for recreation, tourism, scenic value, flood control, timber production and wildlife management.

1.3.11 Encourage property owners who wish to harvest their timber resources to develop a Forest Management Plan in cooperation with the Virginia Department of Forestry.

Strategy 1.5: Identify and quantify air quality and noise concerns.
Policies and Implementation Actions:

1.5.5 Encourage the use of alternative travel modes such as rail, bicycle and pedestrian through a variety of methods including mixed use and clustered developments, recreational trail systems and pedestrian-friendly street designs.

Goal 2. Preserve the Scenic Beauty of the Landscape. (farm fields, vistas, mountains, forests, open land, parks and recreation areas)
Strategy 2.2: Protect visual resources.
Policies and Implementation Actions:

2.2.2. Based on a scenic resources inventory, consider designation of appropriate roads as Virginia Byways.

2.2.5 Consider the impact on views in land use decisions.

Goal 5. Achieve a Strong and Compatible Tourist Industry.

Strategy 5.1 Capitalize on the economic assets of natural beauty and historic resources.
Policies and Implementation Actions:

5.1.1. Identify and assess the value of historical, recreational and natural environmental assets to the tourism economy.

5.1.3. Determine measures to protect views.

5.1.4. Explore ways to direct visitors of the National Park to other attractions in the County.

5.1.5. Work with area tourist attractions, such as Massanutten Resort, on tourism promotion.

Goal 6: Achieve a Balance of Compatible Land Uses and Communities in which people can live, work and play.
Strategy 6.2: Achieve coordinated development with adjoining localities.
Policies and Implementation Actions:

6.2.3. Consult between localities when development plans will have impacts across boundaries.

6.2.4. Work with adjoining localities to plan for economic development.

Goal 11. Preserve/Improve Accessibility of Non-Motorized Traffic (pedestrians, bicycles, horses, buggies).
Strategy 11.1 Promote alternative non-motor vehicle modes to roadways.
Policies and Implementation Actions:

11.1.1. Encourage the use of bicycles in the design of new roads and developments.

11.1.3 Develop a greenway plan identifying priority trails, connections, opportunities, and constraints.

Goal 12. Preserve Historic Buildings and Sites
Strategy 12.1: Promote the preservation of historic resources through the development review process and through voluntary measures.
Policies and Implementation Actions:

12.1.2 Encourage the adaptive reuse and rehabilitation of existing historic structures for new, compatible uses, while retaining the integrity of the structure.

12.1.3 Encourage the preservation of historic structures and sites by incorporating them into the design of new development projects.

12.1.6 Foster a strong and complementary relationship between tourism promotion and historic preservation efforts, including the promotion and awareness of the County's historic resources through the economic development efforts associated with the tourism industry.

12.1.7 Encourage the use of conservation easements to preserve land and structures of scenic and/or historic significance.

12.1.8 Work with Federal, State, Regional and neighboring local officials to coordinate and reinforce efforts to promote historic preservation efforts and programs.

SHENANDOAH COUNTY

The following summarizes the goals, objectives, and strategies of the 2005 Shenandoah County Comprehensive Plan that are related to NFS land management.

1. Natural Resources

Goal - Preserve and enhance the natural environment of the County.
Objective A - Protect the natural environment from damage due to development activity.

Strategy 1) - Protect the natural resources and respect development limitations of slope, soils, geology, and water resources.

Objective B - Provide for development according to the carrying capacity of the environment.

Strategy 1) - Through the use of overlay zones, limit development in areas identified as having high potential for groundwater pollution; protect sinkholes.

Objective C - Preserve and adopt specific measures to protect the Shenandoah River, other streams, and the County's ground water.

Strategy 3) - Identify priority watersheds; identify and adopt specific measures to protect sinkholes, streams and wetland areas.

2. Regional Setting & History

Goal - Protect and promote the historic resources in Shenandoah County.
Objective A - Preserve individual properties and sites throughout the county.

Strategy 1) - Complete additional surveys and nomination of eligible properties and rural historic districts to the Virginia and National registers. In addition to many individual historic homes and buildings, Shenandoah County contains several unincorporated villages that may be eligible for historic designation.

Strategy 3) - Publicize historic features of Shenandoah County and tax incentives and other preservation programs available to assist property owners with preservation initiatives. Encourage private preservation of historic resources.

Objective B - Protect and enhance battlefield sites throughout the County.

Strategy 1) - Support the implementation of Shenandoah Valley Civil War Battlefields National Historic District preservation plans in the County:

3. Land Use

Goal - Guide and direct growth into and around the towns and public service areas, while preserving the rural and open space character of the balance of the County.
Objective B - Maintain the rural and open space character of areas outside of the public service areas.

Strategy 4) - Encourage rural property owners to place their land in agricultural or forestal districts.

Strategy 5) - Encourage the use of conservation, scenic, historic and other voluntary easements to permanently preserve land.

Strategy 6) - Consider the purchase of development rights of strategically located high quality rural property.

Objective C - Guide future commercial land uses to locate where there is access to major transportation corridors and where public utility services are available.

Strategy 2) - Provide for adequate access and for avoiding congestion along roadways.

Strategy 3) - Coordinate placement of utilities with developers and the towns/service authorities.

Objective D - Guide future industrial land uses to locate near the interstate corridor and interchanges where public utility services are available and adequate transportation facilities exist:

Strategy 2) - Provide for adequate access and for avoiding congestion along roadways, accommodating safe and efficient movement of people and goods.

Strategy 3) - Coordinate placement of utilities with developers and the towns/service authorities.

Strategy 5) - Encourage light non-polluting industry and business that will benefit the economy and ecology of the County.

Strategy 7) - Ensure there is adequate ground or surface water to support any new industry.

4. Economy

Goal - Create a business climate conducive to economic activity and encourage a diversity of business and industry in the County.
Objective A - Encourage the development of existing and new commercial and industrial activities.

Strategy 2) - Encourage light, non-polluting industries and businesses that will benefit the economy and ecology of the County.

Objective B - Support travel and tourist related activities.

Strategy 1) - Promote tourism and destination marketing.

Strategy 2) - Encourage the protection of scenic beauty and historic sites.

Strategy 3) - Enhance recreational facilities.

Strategy 4) - Support the implementation of the Shenandoah Valley Battlefields National Historic District, the interpretation of Civil War sites and related tourism and travel activities.

7. Transportation

Goal - Provide a safe and efficient transportation system throughout the County.
Objective A - Integrate transportation planning with land use planning.

Strategy 1) - Coordinate land use planning and decisions with transportation planning.

Objective B - Improve the secondary road system in the County while maintaining the rural character of the County:

Strategy 1) - Widen rights-of-way and roadways only where necessary for safety.

Strategy 2) - Improve existing roadway surfaces with pave-in-place.

Strategy 3) - Develop better drainage along roads where flooding occurs.

SPECIFIC IMPLEMENTATION ACTIONS
Water Resources Recommendations
Objective A. Efficiency in use of existing supplies and facilities

1. Develop a county-wide water conservation plan with emphasis on public education and the nurturing of an ethic which promotes the voluntary conservation of water resources as a way of life in Shenandoah County.

Objective B. Appropriate development of new supplies or facilities

1. Maintain and improve as necessary existing public water supplies and wastewater facilities
4. As a member of the Regional Water Resources Policy Committee, support planning for augmenting the flow of the North Fork by 2015. Impoundment of a significant amount of water for release as needed during periods of extreme drought is indicated.

Objective C. Protection of Water Resources

1. Address nonpoint source pollution by promotion of agricultural, urban, forestry, and other BMPs; cooperation with the Natural Resources Conservation Service and Cooperative Extension Service to implement BMPs; promotion of techniques to reduce agricultural and household chemical use; and appropriate enforcement of the Erosion and Sediment Control Law.

4. Use available local tools to protect groundwater from contamination by underground storage tanks, animal wastes, biosolids, excessive fertilizer and pesticide use (both agricultural and residential), or other threats as identified.

6. Locate sinkholes and sinkhole dumps, and implement sinkhole protection with a sinkhole ordinance.

9. Support the efforts of the U.S. Forest Service and the Virginia Department of Game and Inland Fisheries to mitigate the acidification of coldwater streams.

11. Encourage riparian landowners to maintain streambank vegetation and minimize disturbances in riparian areas in order to protect stream habitat and water quality. Encourage landowners to apply to have riparian land placed in the Conservation Reserve Program or conservation easements.

WARREN COUNTY

The following summarizes the goals and objectives of the 2005 Warren County Comprehensive Plan that are related to NFS land management.

Environment and Natural Resources

Goal: To preserve and improve the environmental quality of Warren County through measures which protect natural resources and environmentally sensitive air, lands, and waters.

Objectives:

A. Institute measures to protect the quality of surface waters within the County, including the Shenandoah River's North and South forks, creeks, runs, and smaller tributaries of the Shenandoah River, as well as, watershed and associated tributaries which drain into the environmentally sensitive Potomac River and the Chesapeake Bay.

B. Protect and conserve fragile ground water resources within the County's unique hydrology (i.e. karst terrain and thin soils).

D. Protect County wetland resources, including springs.

E. Protect and conserve public and private forest resources to prevent soil erosion and damage to views, vistas, and watershed areas.

F. Protect the important natural function of rivers, streams, and floodplains by encouraging appropriate use and preservation of natural vegetation.

G. Minimize runoff and sedimentation associated with agricultural and development activities (including industrial, residential, and commercial activities) particularly in steep slope areas.

H. Identify and protect important plant and wildlife habitats, including aquatic life.

J. Coordinate environmental quality protection efforts with the establishment of public parks, natural recreation areas, and natural resource regeneration and preservation.

K. Improve environmental quality on a site-by-site basis through the establishment of performance standards for environmentally sensitive areas.

L. Educate Warren County residents about the implications of mankind's actions upon the natural environment.

M. Preserve Warren County's' natural beauty, while making natural features accessible to County residents.

Implementation

Coordination With Other Agencies - The increased pressure on animal habitats in the National Park and in the County makes it essential that greenways and travel corridors, in cooperation with the National Park and the National Forest, be established in appropriate areas. This would help increase the area's animal carrying capacity which is so important to tourists, conservationists, and hunters.

Extend bike and hiking paths – Cooperate with the Town of Front Royal to extend Front Royal's biking and hiking paths into the County, along the south fork of the Shenandoah River and along Routes 55 E., 340 S and 522 S. Greenways should be established in sufficient width to assure preservation of natural tree growth and seasonal beauty such as trillium, as well as dogwood and redbud trees with which the County is blessed. Such paths and greenways should lead visitors into areas which would expose them to the year round beauty of our mountains, the bursting forth of life in the spring, and the riot of fall color.

Preserve Natural Vegetation - Expressly prohibit site clear-cutting, thereby preserving natural vegetation and trees during development. Require the protection of mature trees and vegetation preservation during development. If tree removal is unavoidable, require replacement plantings. Encourage generally accepted good forest management practices when private logging operations are anticipated. Where vegetation is removed, require grass seeding for erosion control.

Recreation - Provide varied access to natural features through means such as biking and hiking paths and public access to the Shenandoah River and tying into existing bike paths. This will allow residents and visitors to enjoy the County's recreational opportunities. Views/Vistas, Tourism, and Rural Character - To preserve views from the Skyline Drive and vistas along County roads, both vital to tourism and rural character,

discourage clear cutting and unnecessary tree cover and other natural vegetation reduction by application of best management practices. Encourage cluster development and discourage strip development.

Growth Management and Land Use

Goal: To direct future development into an efficient and serviceable form that will preserve the County's predominately rural character.
Objectives:

D. Discourage growth in environmentally sensitive areas that have natural development constraints, such as wetlands, steep slopes, karst terrain, and flood plains.

H. Develop a preservation plan that identifies and protects historically significant areas, sites, and properties.

J. Maintain the County's rural character.

Implementation
Stream Buffer Zones - Designate stream buffer zones to protect water quality, establishing buffer zones along streams where commercial logging operations and other development activities are occurring.

Environmental Aspects of Land Use in Warren County

Goal: Develop Warren County land in accordance with local, state, and federal standards that provide the best possible quality of life.
Objectives:

B. Protect fragile groundwater and surface water resources.

E. Identify and seek to retain significant views and vistas along the Skyline Drive and County roads.

F. Encourage unnecessary reduction of tree cover and other natural vegetation while allowing for reasonable land use.

G. Encourage tree planting along public roads to preserve rural character and value.

I. Develop performance standards for karst and other sensitive areas.

J. Prevent dumping in sinkholes and provide incentives for cleaning up such areas.

K. Maintain litter free public highways and other public areas.

Implementation
Drainage Preservation Easements - The preservation of natural drainage shall be incorporated into development plans for the proposed land area.

Rural Character and Agricultural Preservation

Goal: Preserve the County's rural character by preserving open space, as well as agricultural and forest lands.
Objectives:

E. Utilize natural topographic features and/or planting screens to shield development from public roads and adjoining properties, thereby preserving scenic vistas and rural character.

F. Avoid significant modification of the existing terrain and prohibit development of environmentally sensitive areas, such as floodplains and steep slopes exceeding 10%. Require special permits for development for slopes over 15%.

I. Designate some of the most scenic roads in the County as Scenic Highways and Byways, thereby preserving scenic rural views and vistas. The State has designated Route 55 East as a Scenic Highway. Other possible candidates include: Route 340 South, Route 522 South, Browntown Road, Morgan's Ford Road/Milldale Road, Rivermont Road, and Reliance Road.

Implementation

Views/Vistas, Tourism, and Rural Character - To preserve views from the Skyline Drive and vistas along County roads, both vital to tourism and rural character, discourage clear cutting and unnecessary tree cover and other natural vegetation reduction by application of best management practices. Encourage cluster development and discourage strip development.

Forest Land Management and Preservation

Goal: To preserve the community's rural character and preserve forest land, and other environmentally sensitive areas, by managing and maintaining forest resources during the development process.
Objectives:

A. Adopt performance standards and a review process for the commercial and noncommercial forest cutting of any area exceeding one acre.

B. Develop standards to protect ridgelines.

C. Provide limited forest cutting in stream, wetland, and river areas.

Implementation
Ordinance Revision – Continue to require as part of the County's Zoning Ordinance that commercial forest activities, including sale of trees, in residential areas be conducted in accordance with the guidelines established in the Virginia Department of Forestry' s latest edition of *Logger's Guide*. To prevent clear-cutting, there shall be no cutting of trees with a diameter of eight inches or less (25-inch circumference). No commercial forest cutting in residential areas should occur without County review.
Stream Buffer Zones - Designate stream buffer zones to protect water quality. Establish buffer zones along streams where commercial logging operations and other development activities are occurring.
Timber Resources - Commercial and non-commercial forest cutting should be conducted to ensure long term forest viability and to minimize negative environmental impacts, particularly along streams, rivers, and wetlands. Water resources can be protected by providing buffer zones along these environmental features.

Public Lands

Goal: Utilize public lands as a resource in maintaining the County's rural character.
Objectives:

C. Monitor State and Federal agencies development plans and work with those agencies to ensure activities consistent with the County's rural character.

D. Maintain the Shenandoah River's scenic nature by minimizing development within the floodplain. Designate the river as a greenway for recreational and flood control purposes.

Implementation
Shenandoah National Park and George Washington National Forest assist Warren County in providing resource management providing the County with open space and aid in maintaining the community' s rural character. These areas also serve as an economic development tool of the tourist industry. Each year, thousands of people visit these federal lands and many contribute to the local economy during their visit. Continued cooperation between the County and the federal agencies overseeing these lands is crucial in meeting many of this plan's goals.

Historic Preservation

Goal I: To mitigate the impact on historic structures and properties imposed by new development.
Goal II: To maintain the Warren County historical assets that preserve the County's character.
Objectives:

C. Preserve the heritage, contributions, and interests manifested by the Native American Cultures.

D. Provide opportunities for County residents and visitors to interact with historic and cultural influences that would enhance their appreciation of these County life qualities.

Implementation

Historically Significant Open Spaces - Encourage and assist property owners to voluntarily place scenic easements on lands associated with historic buildings, sites, and archaeological resources representing all of the County' s historical time periods and cultures.
State and Federal Programs - Support state and federal programs, such as the National Register of Historic Places, which fosters incentives for structures' protection or restoration.
Support Archaeological Research - Support archaeological research through preservation and through encouraging developers to allow archaeologists a limited time to excavate the proposed site before development begins.
Tourism - Promote the County's historic sites through tourism, via such items as pamphlets distributed by the Chamber of Commerce and by other organizations.

Parks and Recreation

Goal I: To provide a variety of quality recreational opportunities in Warren County.
Goal III: Expand recreation activities and sites to all areas of the County.
Objectives:

E. Coordinate natural resource protection efforts with future County park, open space, and recreational land use opportunities.

F. Provide adequate waterfront recreation access to County residents.

G. Work with state to improve existing river access points.

Q. Provide for the preservation of open and wooded space, and selected flood plain areas, as greenways.

Implementation
ISTEA - Apply for ISTEA program grants for the acquisition and development of trails and greenways.
Nature Trails (hiking, cross country skiing and biking) - These needs can be met through Warren County's and Front Royal's joining adjacent counties to produce Greenways and Trails. These trails would link park lands, conservation areas, scenic landscapes, and historic/cultural sites. Initial projects would extend the Town's proposed trails plan into the County to link State and Federal Parks with the Town's existing facilities. Such a project could use existing rights-of-way (i.e. road shoulders).
Scenic Byways - Support the Virginia Scenic Byways and Scenic Rivers programs.
Tourism - Capitalize on the area's tourism through publication of recreational site locations and activities, public waterfront access locations, and Community programs and events.
Waterfront Access - Acquire land along both forks of the Shenandoah River to ensure public access to the river.

Economic Development

Goal I: Maintain an effective business environment which fosters the growth and prosperity of existing industries.
Goal III: Develop a comprehensive plan to attract tourists.
Objectives:

C. Increase the number of group tours and festivals in the community.

D. Attract the individual leisure traveler.

E. Attract Shenandoah National Park visitors.

Implementation
Tourism - Continue to emphasize and promote tourism as an industry. This should be accomplished through coordination with local, regional, and State tourism development Boards and agencies.

Stormwater Management

Goal: To prevent Stormwater Runoff from site development through maintaining pre-development conditions.
Objectives:

B. Minimize erosion potential from development or construction sites.

C. Assure that existing and proposed culverts and bridges are adequate.

D. Increase water recharge into the ground through using retention and detention ponds.

F. Reduce stream bank erosion to maintain stream channels for their biological functions as well as for drainage.

HARDY COUNTY, WEST VIRGINIA

The following summarizes the goals and objectives of the October 2010 (Draft 6) Hardy County Comprehensive Plan that are related to NFS land management.

Goal: The goals of the land use section of the Hardy County Comprehensive Plan are: 1) to promote logical, efficient, and well-organized land use patterns; 2) to guide and promote attractive, sustainable growth; and 3) to eliminate and reduce conflicts among various land uses.

Recommendations

Planning and Research

Identify and protect scenic views, especially those along Corridor H.

Research and identify the need for development, preservation, protection, and planning for recreational and civic uses, such as camp grounds, shooting ranges, and equestrian parks.

Regulations

Preserve the rural look and feel of county by developing guidelines and programs that protect agricultural land, existing forests, waterways, water sources and scenic views along Corridor H.

Develop guidelines for hillside development and/or preservation.

Resist development in floodplains.

Protect and preserve the county's surface and groundwater resources.

Goal: The goal of the rural section of the Hardy County Comprehensive Plan is to ensure that rural lands in Hardy County are protected, preserved and emphasized in all current and future development decisions, both for the economic and cultural good of the County.

Recommendations

Planning and Research

All rural residents and property owners are encouraged to learn about their rights and responsibilities in a Right to Farm County. These include obligations under State law regarding maintenance of fences and irrigation ditches, controlling weeds, keeping livestock and pets under control, using property in accordance with zoning, and other aspects of using and maintaining property.

All normal and non-negligent agricultural operations may not be considered nuisances in Hardy County.

Regulations

Preserve the rural look and feel of county by developing guidelines and programs that protect agricultural land, existing forests, waterways, water sources and scenic views along Corridor H.

Define buffer areas, including setbacks, between agriculture and other uses, such as residential.

Recommend that the County Commission consider guidelines for hillside development and/or preservation.

Recommend that the County Commission consider guidelines for viewshed protection and preservation, while still allowing for the development of private property.

Preserve all A-1 river bottom cropland for farming, and prevent the encroachment of non-agricultural uses in the A-1 areas, where soils recognized nationally as important to the production of food lie predominantly within the county's flood zones..

Preserve and encourage existing hunting and fishing activities through the preservation of, and guidelines for, tree stands, public stream access and other hunting and fishing activities and amenities.

Goal: The goals of the recreation section of the Hardy County Comprehensive Plan are: 1) to promote the importance of open public space for recreational and leisure activities as a development concept; 2) to protect and improve the county's existing recreation facilities and support opportunities for enhancement; and 3) to increase the economic, social and environmental viability of the county's recreational facilities as a means of encouraging tourism as an economic development strategy.

Recommendations

Coordination and Communication

Work with the Convention and Visitor's Bureau (CVB) to evaluate the need and opportunity for additional, expanded or improved recreational facilities and plan for their provision.

Planning and Research

Investigate the feasibility of creating a committee to assist in the planning and funding of recreational improvements, both indoor and outdoor.

Seek funding for, or a volunteer to, coordinate recreational services, needs, and opportunities through the county.

Locate and develop property for camping and recreational vehicle parks.

Develop a comprehensive, year-round recreational program for teens, seniors and other age groups.

Undertake a study in the Planning Commission for the appropriateness of guidelines for the preservation of scenic views.

Regulations

Consider the development of guidelines by the County Commission that ensure the preservation of scenic views.

Preserve and encourage existing hunting and fishing activities through the preservation of, and guidelines for, tree stands, public stream access and other hunting and fishing activities and amenities.

Consider the appropriateness of a buffer around the perimeter of registered hunting clubs and properties in Hardy County. The County Zoning Ordinance should include a definition of hunt clubs and whether they should be regulated.

Goal: The goal of the tourism section of the Hardy County Comprehensive Plan is to promote travel and tourism in Hardy County and throughout the Potomac Highlands region, so that the economic benefit from tourism will enhance the local commercial vitality and quality of life.

Recommendations

Coordination and Communication

Work with the CVB to Discover, develop, and promote Hardy County's attractions and events as a tourism destination.

Work with the CVB and Chamber of Commerce to promote and educate residents and businesses about tourism opportunities and positive impacts.

Work with other jurisdictions in the Potomac Highlands region to effectively and efficiently promote travel and tourism.

Planning and Research

Adopt strategies to promote tourism as a means of expanding Hardy County's tax base.

Locate and develop property for camping and recreational vehicle parks.

Recognize the value of heritage tourism, and its role in growing our local tourism industry.

The County Commission should consider taking measures that preserve and encourage existing hunting and fishing activities through the preservation of, and guidelines for, timber stands, public stream access and other hunting and fishing activities and amenities.

Policies

The County should support and encourage emerging motorcycle and bicycling interests in the County.

The County should involve the youth in planning recreation and tourism activities and events.

HAMPSHIRE COUNTY, WEST VIRGINIA

The following summarizes the goals, objectives, and strategies of the 2009 Hampshire County Comprehensive Plan that are related to NFS land management.

Goals Statement

Retain the rural character of the county by preserving natural, scenic, and open space resources; enhancing the tax base in appropriate locations; and assuring the continued desirability of the county as a place to live, work and play.

Objectives

- Discourage development in areas not suitable for on-site sewage disposal and which cannot feasibly be served by publicly owned waste management.
- Encourage proper utilization of creek valleys, open areas, and steep slopes as open space.
- Plan land uses and densities in a manner that preserves open land, manages traffic, maintains the quality of life in the area, and creates manageable tax structures.

Strategies

- Develop and adopt a countywide policy in collaboration with the public service districts, which describes and enforces the boundaries of water and sewer service extensions in these areas. (6-12 months)
- Encourage property owners to take full advantage of easements which regulate land use, e.g., agriculture, open space, and timber management. (6-12 months)
- Determine the necessity for and advisability of implementing various forms of land use regulation, subject to approval by county voters, to designate and preserve areas for industrial, commercial, residential, agricultural, recreational and other uses, with the goal of encouraging the use of land in a manner consistent with its most appropriate use. (24-36 months)

Goals Statement

Sustain and enhance the economic vitality of the county, while maintaining the rural character.

Objectives

- Enhance the quality of life in Hampshire County through economic mobility.
- Encourage linkages to major open spaces such as the South Branch of the Potomac River, North River, Little Cacapon River, and Cacapon River, and the regional transportation system, to increase the attractiveness of the region as a residential and business location.
- Foster county and business community cooperation in promoting economic development, community attractiveness, and activities and events.

Strategies

- Collaborate with the Central Hampshire Public Service District to develop a 20-year county water and sewer plan. (6-12 months)
- Encourage creation of business base to support other business, such as food service, recreation facilities, outlet shops, rental properties, and other amenities. (12-24 months)
- Support efforts to protect and promote existing tourism-related activities. (12- 24 months)
- Determine the necessity for and advisability of implementing various forms of land use regulation, subject to approval by county voters, to designate and preserve areas for industrial, commercial, residential, agricultural, recreational, and other uses, with the goal of encouraging the use of land in a manner consistent with its most appropriate use. (24-36 months)

Goals Statement

Protect, preserve and enhance the natural and scenic resources of Hampshire County for current and future generations, and provide for physical access by county residents for recreational and educational uses. Identify, preserve, and enhance the historic, architectural, and cultural resources of the county.

Objectives

- Protect and retain water resources within the County to assure the quantity and quality of surface and groundwater for recreational use, wildlife habitats, fire protection, and water supply. Of particular concern will be the South Branch of the Potomac River, North River, Little Cacapon River, and Cacapon River, their tributaries, wetlands and floodplains, and the steep slopes draining into the rivers and creeks.
- Protect groundwater and surface water from pollution and excessive withdrawal.
- Protect and manage woodlands within the County.
- Protect the steep slopes within the County.
- Protect watersheds for Central Hampshire PSD, Capon Bridge municipal water supply, and Romney municipal water supply.

Strategies

- Improve programs focusing on management of sewage and solid waste. (12-18 months)
- Programs focusing in stabilization of water corridors and floodplain restoration. (12-18 months)
- Protection incentives for maintaining existing large blocks of forested areas. (12-24 months)
- Implement timber resource management in new subdivisions in forested terrain. (12-24 months)
- Encourage participation on conservation easements pertaining to particular land use, i.e., timber, agriculture, open space, and special flood hazard areas. (12-24 months)
- Determine the necessity for and advisability of implementing various forms of land use regulation, subject to approval by county voters, to designate and preserve areas for industrial, commercial, residential, agricultural, recreational, and other uses, with the goal of encouraging the use of land in a manner consistent with its most appropriate use. (18-24 months)
- Conduct a comprehensive county-wide water resource study. (24-36 months)
- Work in conjunction with federal, state, and local agencies to ensure water quality management practices are implemented. (36-60 months)

Goals Statement

Provide leisure opportunities to the residents of Hampshire County in an unobtrusive and cost effective manner.

Objectives

- Acquire land and construct parks and facilities in currently unserved areas.
- Develop Hampshire County into a recreation and leisure destination.

Strategies

- Query residents to investigate wanted leisure activities. (6-12 months)
- Encourage continued and improved communication and coordination among the entities, agencies, and organizations involved in recreation and tourism activities. (6-12 months)
- Pursue innovative initiatives for increased leisure opportunities through the county. (12-24 months)
- Integrate a driving tour program for all eras of Hampshire County history to promulgate interest in preservation and tourism of the rich history of Hampshire County. (12-24 months)
- Work with private sector to establish support businesses to embellish the tourist industry in Hampshire County. (12-24 months)
- Support efforts to protect and promote existing recreation and tourism-related activities. (12-24 months)
- Utilize existing trail system on Nathanial and Short Mountains for tourism and recreational opportunities. (18-36 months)
- Develop tourism through Civil War Trails program. (18-36 months)
- Utilize the draw of the Potomac Eagle to attract tourists as a destination for extended periods of time with the development and information distribution about Hampshire County's other tourism opportunities. (18-36 months)
- Develop recreational facilities in the eastern portion of Hampshire County. (24-36 months)
- Develop and utilize the recreational opportunities on the Cacapon and Potomac Rivers to mirror those encountered on the South Branch of the Potomac. (24-36 months)
- Ensure leisure opportunities for all Hampshire County residents within close proximity to both residential and work locations. (24-36 months)
- Acquire land for future expansion of the Hampshire County Parks Department, utilizing subdivision regulations and land purchases. (24-48 months)
- Work in conjunction with the planning of subdivisions through the Planning Commission to ensure recreational opportunities for new planned developments. (24-48 months)

PENDLETON COUNTY, WEST VIRGINIA

No comprehensive plan was found from Pendleton County.

Summary of Comprehensive Plans

The county comprehensive plans share many of the same issues facing the GWNF. The following are some of the major issues covered in the comprehensive plans: water quality protection (surface and groundwater), scenery (particularly ridgetops), tourism (particularly ecotourism), protection of floodplains, maintaining a forestry industry, protecting the Chesapeake Bay watershed, historic preservation, trails and trail connections to other trail systems, conservation of open space, and maintaining the rural character of portions of the counties. Many of the comprehensive plans specifically note the GWNF in relation to recreation, scenery and open space conservation. The Current Forest Plan is compatible with the county plans and no areas were identified that are incompatible.

Summary of Public Survey Report of July 2002

Source: Cordell, Kenneth et al, July 2002, A Survey of Residents of the Greater Southern Appalachian Region to Describe: Public Use and Preferred Objectives for Southern Appalachian National Forests, Public Survey Report, George Washington and Jefferson National Forests.
Value Questions
The report describes **different values** that could be emphasized in the management of the George Washington and Jefferson National Forest. From the report, the following is the ranking of questions to those who responded 4 or 5, in other words important to extremely important end of the scale.

George Washington NF Positive %	Jefferson NF Positive %	How important is...
91%	95%	Protecting streams and other sources of clean water in managing our National Forests?
93%	94%	Maintaining national forests for future generations to use and enjoy in managing our National Forests?
86%	91%	Providing habitat and protection for abundant wildlife and fish in managing our National Forests?
86%	91%	Using and managing forest areas in ways that leave them natural in appearance in managing our National Forests?
84%	90%	Emphasizing planting and management of trees for healthy forests in managing our National Forests?
84%	85%	Protecting rare, unique, or endangered plant and animal species in managing our National Forests?
80%	83%	Providing information and educational services about forests, their management, and the natural life in them in managing our National Forests?
74%	81%	Providing quiet and natural places for personal renewal in managing our National Forests?
72%	77%	Providing access, facilities, and services for outdoor recreation in managing our National Forests?
72%	71%	Emphasizing planting and management of trees for an abundant timber supply in managing our National Forests?
54%	58%	Providing roads, accommodations, and services to help local tourism business in managing our National Forests?

The following questions received a wide diversity of responses. There was a fairly equal distribution of responses and no clear trend towards the 1's or the 5's.

How important is providing access to raw materials and products for local industries and communities in managing our National Forests? (Jefferson was 31-25-38; GW was 28-26-40, a little stronger to the positive)
How important is providing permits to ranchers for grazing of livestock such as cattle and sheep in managing our National Forests? (Jefferson was 26-23-45; GW was 27-24-44, definitely leaning towards the positive)
Objectives Questions

The report also describes **different objectives** that reflect different opinions regarding some specific options (or alternatives) people have risen concerning what we do on the George Washington and Jefferson National Forest. The following is the ranking of questions to those who responded 4 or 5, in other words important to extremely important end of the scale.

George Washington NF Positive %	Jefferson NF Positive %	How important is it to you that the ...National Forest ...
89%	95%	Protect areas that are the sources of water, such as streams, lakes, and watershed areas?
87%	92%	Protect areas that are important wildlife habitats?
80%	86%	Manage the Forest to provide habitat for wildlife and birds for people to see and photograph?
83%	85%	Protect old growth forest areas and allow natural processes to continue into the future?
70%	78%	Create open areas in the National Forest for certain wildlife species?
65%	74%	Use controlled fires on National Forest lands to reduce the threat of wildfires or to improve wildlife habitat conditions?
72%	71%	Develop and maintain trail systems that cross both public and private land for non-motorized recreation such as hiking or horseback riding?
68%	70%	Increase law enforcement?
64%	67%	Designate more areas as wilderness where only primitive and non-motorized uses are allowed?
59%	67%	Allow a diversity of uses such as grazing, recreation, and wildlife habitat?
57%	66%	Increase the total number of acres in the National Forest?
65%	66%	Restrict mining, oil drilling, and other mineral removals?
70%	65%	Allow different groups such as Native Americans to continue their cultural uses of forests such as firewood gathering, herb/berry/plant gathering, and ceremonial access?
61%	65%	Make management decisions concerning the use of the forest at the local level rather than at the national level?
57%	60%	Allow management activities near streams when they do not harm water quality?
55%	58%	Allow a recreation fee that goes back into National Forest management?
54%	52%	Manage the forest to increase populations of wildlife for hunting?
51%	47%	Limit the number of people who can visit a wilderness area to avoid crowding? (even though this was less than 50%, there was a clear trend to the positive – Jefferson has 10-20-47, GW has 20-25-51)
50%	46%	Limit the number of people that can use a river at one time to avoid crowding? (even though this was less than 50%, there was a clear trend to the positive – Jefferson has 22-26-46)
37%	42%	Allow trading of public lands for private lands, for example, to eliminate private holdings within National Forest boundaries, or to acquire unique natural areas? (even though this was less than 50%, there was a clear trend to the positive – Jefferson has 21-29-42, GW has 24-32-37)

The following is the ranking of questions to those who responded 1 or 2, in other words the "Not Important" to "Not at All Important" end of the scale.

George Washington NF Negative %	Jefferson NF Negative %	How important is it to you that the ...National Forest ...
52%	51%	Expand access for motorized off-highway vehicles on forests, such as 4-wheel drive vehicles?
51%	55%	Allow commercial leasing of oil and gas rights on the National Forest?
48%	48%	Allow recreational gold prospecting and dredging in streams on the National Forest lands?

The following questions received a wide diversity of responses. There was a fairly equal distribution of responses and no clear trend towards the 1's or the 5's.
How important is it to you that the National Forest, develop new paved roads for access for cars and recreational vehicles? (Jefferson has 41-26-31; GW has 43-25-27, a little stronger to the negative)
How important is it to you that the National Forest, allow harvesting and mining to help support communities dependant on grazing, minerals or timber? (Jefferson has 33-27-36; GW has 30-28-37, a little stronger to the positive)
How important is it to you that the National Forest, expand commercial recreation services and development for example, resort lodges, guides services, or outfitters? (Jefferson has 33-28-37; GW has 32-31-36, a little stronger to the positive)
Environmental Questions
Finally, the report asked how concerned people are with environmental issues. The following is the ranking of questions to those who responded 1 or 2, in other words somewhat to strongly agree.

George Washington NF Negative %	Jefferson NF Negative %	How important is it to you that the ...National Forest ...
91%	94%	Land that provides critical homes for plant and animal species should be protected.
71%	75%	The Endangered Species Act has not gone far enough and should be strengthened.
44%	51%	It is more important to protect streams for trout and other recreational fishing than for other fish species or aquatic life. (GW was 44-15-36)
76%	75%	There should be more controls on tourism and second home development.

The following is the ranking of questions to those who responded 4 or 5, in other words somewhat to strongly disagree.

George Washington NF Negative %	Jefferson NF Negative %	How important is it to you that the ...National Forest ...
63%	67%	There should be more timber production, mining, and other commercial uses of forests to boost the economy.

Socioeconomic Trends

The following socioeconomic overview will discuss the socioeconomic trends and changes in these 17 counties which contain Forest Service lands. The analysis area counties and composition are presented in table 1. This overview provides information on the role that social, economic and demographic changes have had on this large area and how they may relate to future forest planning activity.

In order to place this forest in its proper context, discussions are provided for several important variables. County and forest-wide average results are compared and contrasted to that of the states of Virginia and West Virginia.

For the counties under analysis, Augusta County has the highest percentage of national forest lands at over 30 percent. The total George Washington acreage is 22.5 percent of the 21 county area. Such a large share of some of these counties acreage is an indicator of the great reliance many counties have on Payments to States and Payments in Lieu of Taxes as substitutes for property tax.

Table 1: George Washington National Forest Boundary County Lands

County, State	County Square Miles	NF Area in Square Miles	GWNF Acres	% NF Area of County Area
Alleghany, VA	455	222	141,873	49%
Amherst, VA	479	90	57,877	19%
Augusta, VA	1,006	306	196,057	30%
Bath, VA	535	271	173,705	51%
Botetourt, VA	543	20	13,047	4%
Frederick, VA	425	8	4,885	2%
Highland, VA	416	91	58,267	22%
Nelson, VA	474	31	19,825	7%
Page, VA	314	42	27,082	13%
Rockbridge, VA	610	71	45,542	12%
Rockingham, VA	871	218	139,783	25%
Shenandoah, VA	513	119	76,057	23%
Warren, VA	216	10	6,290	5%
Hampshire, WV	642	5	3,518	1%
Hardy, WV	584	81	52,047	14%
Monroe, WV	474	1	428	<1%
Pendleton, WV	698	77	49,106	11%
VIRGINIA	287,148	1,500	960,290	1%
WEST VIRGINIA	162,684	164	105,099	0%
TOTAL	449,832	1,665	1,065,389	0%

Source: USDA Forest Service "Land Areas of the NF System", 2007,

http://www.fs.fed.us/land/staff/lar/2007/lar07index.html

Characteristics of an area, such as the growth of population and its various racial and ethnic components, can be used to determine how dynamic and subject to change an area may be.

A static area will imply few possible factors affecting change, but a dynamic growing population may produce many conflicting concerns for land managers to consider. Certain areas of the National Forest System and surrounding lands, which are seen to be attractive to urban dwellers for recreation and second or retirement home residence, may cause conflict with traditional residents of the area. In the following subheading we will discuss economic and demographic characteristics that may assist land managers in identifying issues for current and future projects.

Demographic Indicators

Information about population characteristics helps describe the general nature of a community or area. An analysis of population trends can help determine if changes are occurring for specific groups defined by age, gender, education level, or ethnicity, thereby influencing the nature of social and economic relationships in the community.

Population

Virginia's population, presented in table 2, increased from 5,346,818 in the 1980 Census to 7,078,515 in the 2000 Census. The increase between 1980 and 1990 was a 15.7 percent and 14.4 percent between 1990 and 2000. Meanwhile as represented in table 2a, West Va. had a very different change. Population decreased from 1,949,644 in 1980 to 1,8,08,344 in 2000. Population decreased from 1980 to 1990 by 8.0 percent and increased from 1990 to 2000 by 0.8 percent. Much of this growth in Virginia is spurred by growth in the major cities in the state, especially in northern Virginia-Washington, DC area. West Va., meanwhile, does not have many large cities to spur growth and the economy is relatively less diversified than that of Virginia.

Table 2: Population Change for Virginia 1980-2000

Year	Total Population	Population Change	Percent Change from prior period
1980	5,346,818	-	-
1990	6,187,358	840,540	15.7%
2000	7,078,515	891,157	14.4%

Source: U.S. Census Bureau from USDA NRIS HD Model

Table 2a: Population Change for West Va. 1980-2000

Year	Total Population	Population Change	Percent Change from prior period
1980	1,949,644	-	-
1990	1,793,477	-156,167	-8.0%
2000	1,808,344	14,867	0.8%

Source: U.S. Census Bureau from USDA NRIS HD Model

Table 3 below shows the population trends for all GW NF counties combined. The trends show a growth of more than half the rate of Virginia between 1980 and 1990 (8.9 percent versus 15.7 percent) and slightly more than Virginia's growth rate between 1990 and 2000 (15.7 percent versus 14.4 percent).

Table 3: Population Change for GW NF

1980	1990	2000	% Change 1980-1990	% Change 1990-2000
441,922	481,105	556,747	8.9%	15.7%

Source: U.S. Census Bureau from USDA NRIS HD Model

GW NF Boundary Counties Total Population 1980-2000					
County	1980	1990	2000	Change 1980-1990	Change 1990-2000
VA, Alleghany County	14,333	13,176	12,926	-8.1%	-1.9%
Covington City	9,063	6,991	6,303	-22.9%	-9.8%
Total Alleghany Co.	23,396	20,167	19,229	-13.8%	-4.7%
VA, Amherst County	29,122	28,578	31,894	-1.9%	11.6%
VA, Augusta County	53,732	54,677	65,615	1.8%	20.0%
Staunton City	21,857	24,461	23,853	11.9%	-2.5%

Waynesboro City	15,329	18,549	19,520	21.0%	5.2%
Total Augusta Co.	75,589	79,138	89,468	4.7%	13.1%
VA, Bath County	5,860	4,799	5,048	-18.1%	5.2%
VA, Botetourt County	23,270	24,992	30,496	7.4%	22.0%
VA, Frederick County	34,150	45,723	59,209	33.9%	29.5%
Winchester City	20,217	21,947	23,585	8.6%	7.5%
Total Frederick Co.	54,367	67,670	82,794	24.5%	22.3%
VA, Highland County	2,937	2,635	2,536	-10.3%	-3.8%
VA, Nelson County	12,204	12,778	14,445	4.7%	13.0%
VA, Page County	19,401	21,690	23,177	11.8%	6.9%
VA, Rockbridge County	17,911	18,350	20,808	2.5%	13.4%
Buena Vista City	6,717	6,406	6,349	-4.6%	-0.9%
Lexington City	7,292	6,959	6,867	-4.6%	-1.3%
Total Rockbridge Co.	24,628	24,756	27,157	0.5%	9.7%
VA, Rockingham County	57,038	57,482	67,725	0.8%	17.8%
Harrisonburg City	19,671	30,707	40,468	56.1%	31.8%
Total Rockingham Co.	76,709	88,189	108,193	15.0%	22.7%
VA, Shenandoah County	27,559	31,636	35,075	14.8%	10.9%
VA, Warren County	21,200	26,142	31,584	23.3%	20.8%
WV, Hampshire County	14,867	16,498	20,203	11.0%	22.5%
WV, Hardy County	10,030	10,977	12,669	9.4%	15.4%
WV, Monroe County	12,873	12,406	14,583	-3.6%	17.5%
WV, Pendleton County	7,910	8,054	8,196	1.8%	1.8%
Total Forest	441,922	481,105	556,747	8.9%	15.7%
Virginia	**5,346,818**	**6,187,358**	**7,078,515**	**15.7%**	**14.4%**
West Va.	**1,949,644**	**1,793,477**	**1,808,344**	**-8.0%**	**0.8%**
Source: U.S. Census, NRIS HD Model					

Ethnicity

Table 4 below shows the population of the forest and Virginia and West Va. by race for 1980, 1990, and 2000. In 2000, 92 percent of the population in the counties that contain NF land was white, as compared to 72 and 95 percent for Virginia and West Va., respectively. Since 1980, forest county share has decreased in white inhabitants by only slightly more than one percent. This is contrasted with Virginia's share decreasing from 79 percent to 72 percent and West Va.'s share of whites only decreasing from 96 to 95 percent.

Several counties have increased their share of Hispanics from 1980. The trend for the forest has gone from less than one percent to over two percent. The largest increases occurred in Rockingham and Shenandoah Counties. In these two counties the share of Hispanics increased from less than one percent in 1980 to over five percent in Rockingham and over three percent in Shenandoah by 2000. This is contrasted with 2000 Hispanic share of 4.7 and 0.7 in Virginia and West Va., respectively.

Blacks make up much less of the share of population on the forest than that of Virginia in 2000 (5.4 and 19.6 percent, respectively). Black share has remained fairly constant on both the forest and Virginia over the three Census periods. West Va., on the other hand, has had a steady black share of slightly more than three percent of the population over these three periods. Most forest boundary county share of black population has been less than one percent. Amherst and Nelson Counties had the highest share in 2000 with approximately 20 and 15 percent, respectively.

Table 4: Racial Composition of GW NF in Virginia and West Va.*

	Race	1980	1990	2000
GW NF	Hispanic	0.6%	0.7%	2.3%
	Black	5.7%	5.5%	5.4%
	White	93.9%	93.7%	91.8%
Virginia	Hispanic	1.5%	2.5%	4.7%
	Black	18.9%	18.8%	19.6%
	White	79.1%	77.5%	72.3%
West Va.	Hispanic	0.7%	0.4%	0.7%
	Black	3.3%	3.1%	3.2%
	White	96.2%	96.2%	95.0%

Source: U.S. Census Bureau from USDA NRIS HD Model
*Percentages do not add to 100% because other ethnic categories are not included

GW NF Boundary Counties Population Characteristics 1980-2000*									
County	Title	1980	% of Total	1990	% of Total	% Change 1980 to 1990	2000	% of Total	% Change 1990 to 2000
Alleghany County	Hispanic Population	80	0.6%	20	0.2%	-75.0%	47	0.4%	135.0%
	Population Black	356	2.5%	351	2.7%	-1.4%	317	2.5%	-9.7%
	Population White	13,923	97.1%	12,766	96.9%	-8.3%	12,454	96.3%	-2.4%
	Total Population	14,333		13,176		-8.1%	12,926		-1.9%
Covington city	Hispanic Population	100	1.1%	26	0.4%	-74.0%	40	0.6%	53.8%
	Population Black	1,209	13.3%	970	13.9%	-19.8%	828	13.1%	-14.6%
	Population White	7,824	86.3%	5,966	85.3%	-23.7%	5,298	84.1%	-11.2%
	Total Population	9,063		6,991		-22.9%	6,303		-9.8%
Total Alleghany County	Hispanic Population	180	0.8%	46	0.2%	-74.4%	87	0.5%	89.1%
	Population Black	1,565	6.7%	1,321	6.6%	-15.6%	1,145	6.0%	-13.3%
	Population White	21,747	93.0%	18,732	92.9%	-13.9%	17,752	92.3%	-5.2%
	Total Population	23,396		20,167		-13.8%	19,229		-4.7%
Amherst County	Hispanic Population	213	0.7%	211	0.7%	-0.9%	306	1.0%	45.0%
	Population Black	5,963	20.5%	5,759	20.2%	-3.4%	6,311	19.8%	9.6%
	Population White	22,925	78.7%	22,691	79.4%	-1.0%	24,772	77.7%	9.2%
	Total Population	29,122		28,578		-1.9%	31,894		11.6%
Augusta County	Hispanic Population	300	0.6%	295	0.5%	-1.7%	620	0.9%	110.2%
	Population Black	2,031	3.8%	2,075	3.8%	2.2%	2,360	3.6%	13.7%
	Population White	51,478	95.8%	52,358	95.8%	1.7%	62,347	95.0%	19.1%
	Total Population	53,732		54,677		1.8%	65,615		20.0%
Staunton city	Hispanic Population	116	0.5%	169	0.7%	45.7%	265	1.1%	56.8%
	Population Black	2,461	11.3%	3,062	12.5%	24.4%	3,328	14.0%	8.7%
	Population White	19,295	88.3%	21,172	86.6%	9.7%	19,866	83.3%	-6.2%
	Total Population	21,857		24,461		11.9%	23,853		-2.5%
Waynesboro city	Hispanic Population	91	0.6%	188	1.0%	106.6%	643	3.3%	242.0%
	Population Black	1,294	8.4%	1,789	9.6%	38.3%	1,945	10.0%	8.7%
	Population White	13,964	91.1%	16,538	89.2%	18.4%	16,877	86.5%	2.0%

GW NF Boundary Counties Population Characteristics 1980-2000*									
County	Title	1980	% of Total	1990	% of Total	% Change 1980 to 1990	2000	% of Total	% Change 1990 to 2000
	Total Population	15,329		18,549		21.0%	19,520		5.2%
Total Augusta County	Hispanic Population	507	0.6%	652	0.7%	28.6%	1,528	1.4%	134.4%
	Population Black	5,786	6.4%	6,926	7.1%	19.7%	7,633	7.0%	10.2%
	Population White	84,737	93.2%	90,068	92.2%	6.3%	99,090	90.9%	10.0%
	Total Population	90,918		97,687		7.4%	108,988		11.6%
Bath County	Hispanic Population	37	0.6%	31	0.6%	-16.2%	18	0.4%	-41.9%
	Population Black	553	9.4%	251	5.2%	-54.6%	317	6.3%	26.3%
	Population White	5,284	90.2%	4,490	93.6%	-15.0%	4,659	92.3%	3.8%
	Total Population	5,860		4,799		-18.1%	5,048		5.2%
Botetourt County	Hispanic Population	128	0.6%	107	0.4%	-16.4%	181	0.6%	69.2%
	Population Black	1,124	4.8%	1,035	4.1%	-7.9%	1,073	3.5%	3.7%
	Population White	22,093	94.9%	23,818	95.3%	7.8%	28,944	94.9%	21.5%
	Total Population	23,270		24,992		7.4%	30,496		22.0%
Frederick County	Hispanic Population	129	0.4%	304	0.7%	135.7%	1,004	1.7%	230.3%
	Population Black	484	1.4%	794	1.7%	64.0%	1,550	2.6%	95.2%
	Population White	33,559	98.3%	44,492	97.3%	32.6%	56,240	95.0%	26.4%
	Total Population	34,150		45,723		33.9%	59,209		29.5%
Winchester city	Hispanic Population	114	0.6%	307	1.4%	169.3%	1,527	6.5%	397.4%
	Population Black	1,795	8.9%	2,199	10.0%	22.5%	2,470	10.5%	12.3%
	Population White	18,262	90.3%	19,473	88.7%	6.6%	19,355	82.1%	-0.6%
	Total Population	20,217		21,947		8.6%	23,585		7.5%
Total Frederick County	Hispanic Population	243	0.4%	611	0.9%	151.4%	2,531	3.1%	314.2%
	Population Black	2,279	4.2%	2,993	4.4%	31.3%	4,020	4.9%	34.3%
	Population White	51,821	95.3%	63,965	94.5%	23.4%	75,595	91.3%	18.2%
	Total Population	54,367		67,670		24.5%	82,794		22.3%
Highland County	Hispanic Population	20	0.7%	7	0.3%	-65.0%	13	0.5%	85.7%
	Population Black	6	0.2%	0	0.0%	-100.0%	2	0.1%	NM
	Population White	2,919	99.4%	2,635	99.7%	-9.7%	2,517	99.3%	-4.5%

GW NF Boundary Counties Population Characteristics 1980-2000*									
County	Title	1980	% of Total	1990	% of Total	% Change 1980 to 1990	2000	% of Total	% Change 1990 to 2000
	Total Population	2,937		2,642		-10.0%	2,536		-4.0%
Nelson County	Hispanic Population	99	0.8%	101	0.8%	2.0%	305	2.1%	202.0%
	Population Black	2,916	23.9%	2,406	18.8%	-17.5%	2,151	14.9%	-10.6%
	Population White	9,261	75.9%	10,209	79.9%	10.2%	11,939	82.7%	16.9%
	Total Population	12,204		12,778		4.7%	14,445		13.0%
Page County	Hispanic Population	110	0.6%	91	0.4%	-17.3%	251	1.1%	175.8%
	Population Black	499	2.6%	439	2.0%	-12.0%	501	2.2%	14.1%
	Population White	18,833	97.1%	21,085	97.2%	12.0%	22,311	96.3%	5.8%
	Total Population	19,401		21,690		11.8%	23,177		6.9%
Rockbridge County	Hispanic Population	108	0.6%	42	0.2%	-61.1%	120	0.6%	185.7%
	Population Black	581	3.2%	482	2.6%	-17.0%	617	3.0%	28.0%
	Population White	17,294	96.6%	17,787	96.9%	2.9%	19,856	95.4%	11.6%
	Total Population	17,911		18,350		2.5%	20,808		13.4%
Buena Vista city	Hispanic Population	42	0.6%	0	0.0%	-100.0%	64	1.0%	NM
	Population Black	265	3.9%	282	4.4%	6.4%	305	4.8%	8.2%
	Population White	6,439	95.9%	6,059	94.6%	-5.9%	5,940	93.6%	-2.0%
	Total Population	6,717		6,406		-4.6%	6,349		-0.9%
Lexington city	Hispanic Population	60	0.8%	41	0.6%	-31.7%	109	1.6%	165.9%
	Population Black	896	12.3%	811	11.7%	-9.5%	713	10.4%	-12.1%
	Population White	6,322	86.7%	6,028	86.6%	-4.7%	5,906	86.0%	-2.0%
	Total Population	7,292		6,959		-4.6%	6,867		-1.3%
Total Rockbridge County	Hispanic Population	210	0.7%	83	0.3%	-60.5%	293	0.9%	253.0%
	Population Black	1,742	5.5%	1,575	5.0%	-9.6%	1,635	4.8%	3.8%
	Population White	30,055	94.2%	29,874	94.2%	-0.6%	31,702	93.2%	6.1%
	Total Population	31,920		31,715		-0.6%	34,024		7.3%
Rockingham County	Hispanic Population	415	0.7%	597	1.0%	43.9%	2,221	3.3%	272.0%
	Population Black	788	1.4%	849	1.5%	7.7%	924	1.4%	8.8%
	Population White	55,976	98.1%	56,107	97.6%	0.2%	65,406	96.6%	16.6%

GW NF Boundary Counties Population Characteristics 1980-2000*									
County	Title	1980	% of Total	1990	% of Total	% Change 1980 to 1990	2000	% of Total	% Change 1990 to 2000
	Total Population	57,038		57,482		0.8%	67,725		17.8%
Harrisonburg city	Hispanic Population	134	0.7%	527	1.7%	293.3%	3,580	8.8%	579.3%
	Population Black	874	4.4%	2,020	6.6%	131.1%	2,394	5.9%	18.5%
	Population White	18,622	94.7%	27,964	91.1%	50.2%	34,334	84.8%	22.8%
	Total Population	19,671		30,707		56.1%	40,468		31.8%
Total Rockingham County	Hispanic Population	549	0.7%	1,124	1.3%	104.7%	5,801	5.4%	416.1%
	Population Black	1,662	2.2%	2,869	3.3%	72.6%	3,318	3.1%	15.7%
	Population White	74,598	97.2%	84,071	95.3%	12.7%	99,740	92.2%	18.6%
	Total Population	76,709		88,189		15.0%	108,193		22.7%
Shenandoah County	Hispanic Population	191	0.7%	276	0.9%	44.5%	1,194	3.4%	332.6%
	Population Black	374	1.4%	394	1.2%	5.3%	412	1.2%	4.6%
	Population White	27,103	98.3%	31,037	98.1%	14.5%	33,533	95.6%	8.0%
	Total Population	27,559		31,636		14.8%	35,075		10.9%
Warren County	Hispanic Population	194	0.9%	268	1.0%	38.1%	494	1.6%	84.3%
	Population Black	1,189	5.6%	1,191	4.6%	0.2%	1,526	4.8%	28.1%
	Population White	19,887	93.8%	24,732	94.6%	24.4%	29,280	92.7%	18.4%
	Total Population	21,200		26,142		23.3%	31,584		20.8%
Hampshire County WV	Hispanic Population	64	0.4%	53	0.3%	-17.2%	112	0.6%	111.3%
	Population Black	107	0.7%	146	0.9%	36.4%	167	0.8%	14.4%
	Population White	14,714	99.0%	16,291	98.7%	10.7%	19,807	98.0%	21.6%
	Total Population	14,867		16,498		11.0%	20,203		22.5%
Hardy County WV	Hispanic Population	71	0.7%	27	0.2%	-62.0%	84	0.7%	211.1%
	Population Black	203	2.0%	211	1.9%	3.9%	244	1.9%	15.6%
	Population White	9,816	97.9%	10,719	97.6%	9.2%	12,273	96.9%	14.5%
	Total Population	10,030		10,977		9.4%	12,669		15.4%
Monroe County WV	Hispanic Population	116	0.9%	21	0.2%	-81.9%	72	0.5%	242.9%
	Population Black	204	1.6%	119	1.0%	-41.7%	872	6.0%	632.8%
	Population White	12,611	98.0%	12,238	98.6%	-3.0%	13,514	92.7%	10.4%

GW NF Boundary Counties Population Characteristics 1980-2000*									
County	Title	1980	% of Total	1990	% of Total	% Change 1980 to 1990	2000	% of Total	% Change 1990 to 2000
	Total Population	12,873		12,406		-3.6%	14,583		17.5%
Pendleton County WV	Hispanic Population	62	0.8%	20	0.2%	-67.7%	73	0.9%	265.0%
	Population Black	171	2.2%	170	2.1%	-0.6%	174	2.1%	2.4%
	Population White	7,713	97.5%	7,870	97.7%	2.0%	7,896	96.3%	0.3%
	Total Population	7,910		8,054		1.8%	8,196		1.8%
Forest Total	Hispanic Population	2,994	0.6%	3,729	0.7%	24.5%	13,343	2.3%	257.8%
	Population Black	26,343	5.7%	27,805	5.5%	5.5%	31,501	5.4%	13.3%
	Population White	436,117	93.9%	474,525	93.7%	8.8%	535,324	91.8%	12.8%
	Total Population	464,543		506,620		9.1%	583,134		15.1%
Virginia	Hispanic Population	79,868	1.5%	155,353	2.5%	94.5%	329,540	4.7%	112.1%
	Population Black	1,008,668	18.9%	1,163,068	18.8%	15.3%	1,390,293	19.6%	19.5%
	Population White	4,229,798	79.1%	4,793,278	77.5%	13.3%	5,120,110	72.3%	6.8%
	Total Population	5,346,818		6,187,358		15.7%	7,078,515		14.4%
West Va.	Hispanic Population	12,707	0.7%	7,892	0.4%	-37.9%	12,279	0.7%	55.6%
	Population Black	65,051	3.3%	55,398	3.1%	-14.8%	57,232	3.2%	3.3%
	Population White	1,874,751	96.2%	1,726,023	96.2%	-7.9%	1,718,777	95.0%	-0.4%
	Total Population	1,949,644		1,793,477		-8.0%	1,808,344		0.8%
Source: U.S. Census, NRIS HD Model									
*Percentages do not add to 100% because other minorities present or due to rounding.									

Age

Youth population share among the forest boundary counties, Virginia and West Va. has fallen from 1980 to 2000. During 2000, the forest had a youth population share that was approximately two percent less than Virginia and about one-half percent more than West Va.

Aging population, on the other hand, has grown in all three areas over the three census periods. During 2000, the forest had an elderly population share that was 3.4 percent more than Virginia and 1.3 percent less than West Va.

Table 5 below shows the share of population as represented by youth (age 17 or less) and the elderly (age 62 or greater). The youth share on the forest from 1980 to 2000 has fallen (from 27 to 23 percent. Meanwhile, the elderly share of population has risen on the forest from 15 to 17 percent. This may mean that the fertility rate has decreased over time and that adults are living longer, rather than any significant demographic changes.

Table 5: Population Age of GW NF, Virginia, W. Virginia

Forest	1980 % of Area	1990 % of Area	2000 % of Area
Age 17 or less	26.7	23.1	22.8
Age 62 or Greater	14.8	16.5	16.8
Virginia			
Age 17 or less	27.6	24.3	24.6
Age 62 or Greater	11.8	13.1	13.4
West Va.			
Age 17 or less	28.7	24.8	22.3
Age 62 or Greater	15.0	18.1	18.1

Source: U.S. Census Bureau from USDA NRIS HD Model

GW NF Young and Old Population Characteristics								
		1980	% of County/State	1990	% of County/State	2000	% of County/State	% Change 1980 to 2001
VA, Alleghany County	Pop0to4	963	6.7%	768	5.8%	721	5.6%	-25.1%
	Pop5to9	1,126	7.9%	846	6.4%	846	6.5%	-24.9%
	Pop10to14	1,337	9.3%	961	7.3%	850	6.6%	-36.4%
	Pop15to17	893	6.2%	580	4.4%	534	4.1%	-40.2%
	Population 0 - 17	4,319	30.1%	3,155	23.9%	2,951	22.8%	-31.7%
	Pop62to64	383	2.7%	465	3.5%	402	3.1%	5.0%
	Pop65to74	1,006	7.0%	1,129	8.6%	1,101	8.5%	9.4%
	Pop75to84	432	3.0%	552	4.2%	717	5.5%	66.0%
	Pop85Plus	80	0.6%	115	0.9%	207	1.6%	158.8%
	Population 62+	1,901	13.3%	2,261	17.2%	2,427	18.8%	27.7%
	Total Population	14,333		13,176		12,926		-9.8%

GW NF Young and Old Population Characteristics								
		1980	% of County/State	1990	% of County/State	2000	% of County/State	% Change 1980 to 2001
Covington city	Pop0to4	493	5.4%	406	5.8%	395	6.3%	-19.9%
	Pop5to9	555	6.1%	381	5.4%	389	6.2%	-29.9%
	Pop10to14	706	7.8%	392	5.6%	355	5.6%	-49.7%
	Pop15to17	467	5.2%	228	3.3%	213	3.4%	-54.4%
	Population 0 - 17	2,221	24.5%	1,407	20.1%	1,352	21.5%	-39.1%
			0.0%		0.0%		0.0%	
	Pop62to64	337	3.7%	289	4.1%	167	2.6%	-50.4%
	Pop65to74	1,069	11.8%	814	11.6%	623	9.9%	-41.7%
	Pop75to84	436	4.8%	591	8.5%	462	7.3%	6.0%
	Pop85Plus	100	1.1%	142	2.0%	189	3.0%	89.0%
	Population 62+	1,942	21.4%	1,836	26.3%	1,441	22.9%	-25.8%
	Total Population	9,063		6,991		6,303		-30.5%
Total Alleghany County	Pop0to4	1,456	6.2%	1,174	5.8%	1,116	5.8%	-23.4%
	Pop5to9	1,681	7.2%	1,227	6.1%	1,235	6.4%	-26.5%
	Pop10to14	2,043	8.7%	1,353	6.7%	1,205	6.3%	-41.0%
	Pop15to17	1,360	5.8%	808	4.0%	747	3.9%	-45.1%
	Population 0 - 17	6,540	28.0%	4,562	22.6%	4,303	22.4%	-34.2%
	Pop62to64	720	3.1%	754	3.7%	569	3.0%	-21.0%
	Pop65to74	2,075	8.9%	1,943	9.6%	1,724	9.0%	-16.9%
	Pop75to84	868	3.7%	1,143	5.7%	1,179	6.1%	35.8%
	Pop85Plus	180	0.8%	257	1.3%	396	2.1%	120.0%
	Population 62+	3,843	16.4%	4,097	20.3%	3,868	20.1%	0.7%
	Total Population	23,396		20,167		19,229		-17.8%
VA, Amherst County	Pop0to4	1,841	6.3%	1,802	6.3%	1,820	5.7%	-1.1%
	Pop5to9	2,112	7.3%	1,867	6.5%	2,075	6.5%	-1.8%
	Pop10to14	2,386	8.2%	1,788	6.3%	2,235	7.0%	-6.3%
	Pop15to17	1,607	5.5%	1,157	4.0%	1,356	4.3%	-15.6%
	Population 0 - 17	7,946	27.3%	6,614	23.1%	7,486	23.5%	-5.8%
	Pop62to64	718	2.5%	670	2.3%	905	2.8%	26.0%
	Pop65to74	1,927	6.6%	1,977	6.9%	2,520	7.9%	30.8%
	Pop75to84	885	3.0%	1,098	3.8%	1,415	4.4%	59.9%
	Pop85Plus	216	0.7%	280	1.0%	462	1.4%	113.9%

GW NF Young and Old Population Characteristics								
		1980	% of County/State	1990	% of County/State	2000	% of County/State	% Change 1980 to 2001
	Population 62+	3,746	12.9%	4,025	14.1%	5,302	16.6%	41.5%
	Total Population	29,122		28,578		31,894		9.5%
VA, Augusta County	Pop0to4	3,387	6.3%	3,541	6.5%	3,715	5.7%	9.7%
	Pop5to9	3,978	7.4%	3,938	7.2%	4,372	6.7%	9.9%
	Pop10to14	4,400	8.2%	3,640	6.7%	4,687	7.1%	6.5%
	Pop15to17	3,207	6.0%	2,260	4.1%	2,793	4.3%	-12.9%
	Population 0 - 17	14,972	27.9%	13,379	24.5%	15,567	23.7%	4.0%
	Pop62to64	1,393	2.6%	1,503	2.7%	1,873	2.9%	34.5%
	Pop65to74	3,771	7.0%	3,897	7.1%	4,868	7.4%	29.1%
	Pop75to84	1,630	3.0%	1,907	3.5%	2,705	4.1%	66.0%
	Pop85Plus	459	0.9%	387	0.7%	856	1.3%	86.5%
	Population 62+	7,253	13.5%	7,694	14.1%	10,302	15.7%	42.0%
	Total Population	53,732		54,677		65,615		22.1%
Staunton city	Pop0to4	1,161	5.3%	1,377	5.6%	1,241	5.2%	6.9%
	Pop5to9	1,245	5.7%	1,413	5.8%	1,285	5.4%	3.2%
	Pop10to14	1,367	6.3%	1,299	5.3%	1,331	5.6%	-2.6%
	Pop15to17	1,071	4.9%	1,015	4.1%	872	3.7%	-18.6%
	Population 0 - 17	4,844	22.2%	5,104	20.9%	4,729	19.8%	-2.4%
	Pop62to64	692	3.2%	630	2.6%	628	2.6%	-9.2%
	Pop65to74	1,992	9.1%	2,349	9.6%	2,113	8.9%	6.1%
	Pop75to84	972	4.4%	1,421	5.8%	1,601	6.7%	64.7%
	Pop85Plus	326	1.5%	343	1.4%	586	2.5%	79.8%
	Population 62+	3,982	18.2%	4,743	19.4%	4,928	20.7%	23.8%
	Total Population	21,857		24,461		23,853		9.1%
Waynesboro city	Pop0to4	948	6.2%	1,258	6.8%	1,282	6.6%	35.2%
	Pop5to9	999	6.5%	1,238	6.7%	1,351	6.9%	35.2%
	Pop10to14	1,157	7.5%	1,052	5.7%	1,306	6.7%	12.9%
	Pop15to17	877	5.7%	680	3.7%	725	3.7%	-17.3%
	Population 0 - 17	3,981	26.0%	4,228	22.8%	4,664	23.9%	17.2%

GW NF Young and Old Population Characteristics								
		1980	% of County/State	1990	% of County/State	2000	% of County/State	% Change 1980 to 2001
	Pop62to64	525	3.4%	657	3.5%	535	2.7%	1.9%
	Pop65to74	1,286	8.4%	1,926	10.4%	1,737	8.9%	35.1%
	Pop75to84	490	3.2%	990	5.3%	1,297	6.6%	164.7%
	Pop85Plus	130	0.8%	209	1.1%	407	2.1%	213.1%
	Population 62+	2,431	15.9%	3,782	20.4%	3,976	20.4%	63.6%
	Total Population	15,329		18,549		19,520		27.3%
Total Augusta County	Pop0to4	5,496	6.0%	6,176	6.3%	6,238	5.7%	13.5%
	Pop5to9	6,222	6.8%	6,589	6.7%	7,008	6.4%	12.6%
	Pop10to14	6,924	7.6%	5,991	6.1%	7,324	6.7%	5.8%
	Pop15to17	5,155	5.7%	3,955	4.0%	4,390	4.0%	-14.8%
	Population 0 - 17	23,797	26.2%	22,711	23.2%	24,960	22.9%	4.9%
	Pop62to64	2,610	2.9%	2,790	2.9%	3,036	2.8%	16.3%
	Pop65to74	7,049	7.8%	8,172	8.4%	8,718	8.0%	23.7%
	Pop75to84	3,092	3.4%	4,318	4.4%	5,603	5.1%	81.2%
	Pop85Plus	915	1.0%	939	1.0%	1,849	1.7%	102.1%
	Population 62+	13,666	15.0%	16,219	16.6%	19,206	17.6%	40.5%
	Total Population	90,918		97,687		108,988		19.9%
VA, Bath County	Pop0to4	337	5.8%	253	5.3%	222	4.4%	-34.1%
	Pop5to9	394	6.7%	336	7.0%	306	6.1%	-22.3%
	Pop10to14	474	8.1%	234	4.9%	343	6.8%	-27.6%
	Pop15to17	310	5.3%	164	3.4%	191	3.8%	-38.4%
	Population 0 - 17	1,515	25.9%	987	20.6%	1,062	21.0%	-29.9%
	Pop62to64	170	2.9%	167	3.5%	180	3.6%	5.9%
	Pop65to74	491	8.4%	487	10.1%	515	10.2%	4.9%
	Pop75to84	258	4.4%	228	4.8%	250	5.0%	-3.1%
	Pop85Plus	44	0.8%	44	0.9%	79	1.6%	79.5%
	Population 62+	963	16.4%	926	19.3%	1,024	20.3%	6.3%
	Total Pop	5,860		4,799		5,048		-13.9%
VA, Botetourt County	Pop0to4	1,433	6.2%	1,423	5.7%	1,749	5.7%	22.1%

GW NF Young and Old Population Characteristics								
		1980	% of County/State	1990	% of County/State	2000	% of County/State	% Change 1980 to 2001
	Pop5to9	1,801	7.7%	1,653	6.6%	1,892	6.2%	5.1%
	Pop10to14	1,980	8.5%	1,625	6.5%	2,194	7.2%	10.8%
	Pop15to17	1,362	5.9%	1,107	4.4%	1,303	4.3%	-4.3%
	Population 0 - 17	6,576	28.3%	5,808	23.2%	7,138	23.4%	8.5%
			0.0%		0.0%		0.0%	
	Pop62to64	587	2.5%	711	2.8%	905	3.0%	54.2%
	Pop65to74	1,536	6.6%	1,920	7.7%	2,474	8.1%	61.1%
	Pop75to84	730	3.1%	923	3.7%	1,205	4.0%	65.1%
	Pop85Plus	173	0.7%	230	0.9%	333	1.1%	92.5%
	Population 62+	3,026	13.0%	3,784	15.1%	4,917	16.1%	62.5%
	Total Pop	23,270		24,992		30,496		31.1%
VA, Frederick County	Pop0to4	2,483	7.3%	3,487	7.6%	3,825	6.5%	54.0%
	Pop5to9	2,744	8.0%	3,469	7.6%	4,529	7.6%	65.1%
	Pop10to14	3,168	9.3%	3,338	7.3%	4,654	7.9%	46.9%
	Pop15to17	2,203	6.5%	1,922	4.2%	2,595	4.4%	17.8%
	Population 0 - 17	10,598	31.0%	12,216	26.7%	15,603	26.4%	47.2%
			0.0%		0.0%		0.0%	
	Pop62to64	745	2.2%	1,102	2.4%	1,520	2.6%	104.0%
	Pop65to74	1,827	5.3%	2,840	6.2%	3,667	6.2%	100.7%
	Pop75to84	744	2.2%	1,164	2.5%	2,011	3.4%	170.3%
	Pop85Plus	216	0.6%	303	0.7%	625	1.1%	189.4%
	Population 62+	3,532	10.3%	5,409	11.8%	7,823	13.2%	121.5%
	Total Pop	34,150		45,723		59,209		73.4%
VA, Winchester city	Pop0to4	1,227	6.1%	1,492	6.8%	1,432	6.1%	16.7%
	Pop5to9	1,135	5.6%	1,272	5.8%	1,457	6.2%	28.4%
	Pop10to14	1,345	6.7%	1,284	5.9%	1,381	5.9%	2.7%
	Pop15to17	959	4.7%	682	3.1%	842	3.6%	-12.2%
	Population 0 - 17	4,666	23.1%	4,730	21.6%	5,112	21.7%	9.6%
	Pop62to64	631	3.1%	612	2.8%	535	2.3%	-15.2%
	Pop65to74	1,791	8.9%	1,893	8.6%	1,825	7.7%	1.9%
	Pop75to84	978	4.8%	1,106	5.0%	1,235	5.2%	26.3%
	Pop85Plus	284	1.4%	336	1.5%	371	1.6%	30.6%
	Population 62+	3,684	18.2%	3,947	18.0%	3,966	16.8%	7.7%
	Total Pop	20,217		21,947		23,585		16.7%

GW NF Young and Old Population Characteristics								
		1980	% of County/State	1990	% of County/State	2000	% of County/State	% Change 1980 to 2001
Total Frederick County	Pop0to4	3,710	6.8%	4,979	7.4%	5,257	6.3%	41.7%
	Pop5to9	3,879	7.1%	4,741	7.0%	5,986	7.2%	54.3%
	Pop10to14	4,513	8.3%	4,622	6.8%	6,035	7.3%	33.7%
	Pop15to17	3,162	5.8%	2,604	3.8%	3,437	4.2%	8.7%
	Population 0 - 17	15,264	28.1%	16,946	25.0%	20,715	25.0%	35.7%
	Pop62to64	1,376	2.5%	1,714	2.5%	2,055	2.5%	49.3%
	Pop65to74	3,618	6.7%	4,733	7.0%	5,492	6.6%	51.8%
	Pop75to84	1,722	3.2%	2,270	3.4%	3,246	3.9%	88.5%
	Pop85Plus	500	0.9%	639	0.9%	996	1.2%	99.2%
	Population 62+	7,216	13.3%	9,356	13.8%	11,789	14.2%	63.4%
	Total Population	54,367		67,670		82,794		52.3%
VA, Highland County	Pop0to4	212	7.2%	147	5.6%	94	3.7%	-55.7%
	Pop5to9	165	5.6%	154	5.8%	139	5.5%	-15.8%
	Pop10to14	183	6.2%	176	6.7%	168	6.6%	-8.2%
	Pop15to17	127	4.3%	94	3.6%	103	4.1%	-18.9%
	Population 0 - 17	687	23.4%	571	21.7%	504	19.9%	-26.6%
	Pop62to64	128	4.4%	95	3.6%	108	4.3%	-15.6%
	Pop65to74	296	10.1%	297	11.3%	265	10.4%	-10.5%
	Pop75to84	135	4.6%	170	6.5%	207	8.2%	53.3%
	Pop85Plus	33	1.1%	43	1.6%	45	1.8%	36.4%
	Population 62+	592	20.2%	605	23.0%	625	24.6%	5.6%
	Total Population	2,937		2,635		2,536		-13.7%
VA, Nelson County	Pop0to4	750	6.1%	804	6.3%	759	5.3%	1.2%
	Pop5to9	857	7.0%	895	7.0%	805	5.6%	-6.1%
	Pop10to14	983	8.1%	911	7.1%	968	6.7%	-1.5%
	Pop15to17	718	5.9%	507	4.0%	601	4.2%	-16.3%
	Population 0 - 17	3,308	27.1%	3,117	24.4%	3,133	21.7%	-5.3%
	Pop62to64	384	3.1%	454	3.6%	471	3.3%	22.7%
	Pop65to74	1,160	9.5%	1,167	9.1%	1,410	9.8%	21.6%
	Pop75to84	514	4.2%	613	4.8%	777	5.4%	51.2%
	Pop85Plus	151	1.2%	237	1.9%	233	1.6%	54.3%

GW NF Young and Old Population Characteristics								
		1980	% of County/State	1990	% of County/State	2000	% of County/State	% Change 1980 to 2001
	Population 62+	2,209	18.1%	2,471	19.3%	2,891	20.0%	30.9%
	Total Population	12,204		12,778		14,445		18.4%
VA, Page County	Pop0to4	1,324	6.8%	1,381	6.4%	1,286	5.5%	-2.9%
	Pop5to9	1,374	7.1%	1,452	6.7%	1,515	6.5%	10.3%
	Pop10to14	1,565	8.1%	1,408	6.5%	1,563	6.7%	-0.1%
	Pop15to17	1,101	5.7%	855	3.9%	959	4.1%	-12.9%
	Population 0 - 17	5,364	27.6%	5,096	23.5%	5,323	23.0%	-0.8%
	Pop62to64	575	3.0%	682	3.1%	682	2.9%	18.6%
	Pop65to74	1,558	8.0%	1,949	9.0%	2,017	8.7%	29.5%
	Pop75to84	752	3.9%	1,024	4.7%	1,236	5.3%	64.4%
	Pop85Plus	207	1.1%	276	1.3%	391	1.7%	88.9%
	Population 62+	3,092	15.9%	3,931	18.1%	4,326	18.7%	39.9%
	Total Population	19,401		21,690		23,177		19.5%
VA, Rockbridge County	Pop0to4	1,098	6.1%	1,120	6.1%	1,123	5.4%	2.3%
	Pop5to9	1,197	6.7%	1,149	6.3%	1,231	5.9%	2.8%
	Pop10to14	1,427	8.0%	1,146	6.2%	1,387	6.7%	-2.8%
	Pop15to17	1,170	6.5%	783	4.3%	888	4.3%	-24.1%
	Population 0 - 17	4,892	27.3%	4,198	22.9%	4,629	22.2%	-5.4%
	Pop62to64	530	3.0%	681	3.7%	717	3.4%	35.3%
	Pop65to74	1,341	7.5%	1,651	9.0%	1,942	9.3%	44.8%
	Pop75to84	558	3.1%	763	4.2%	1,027	4.9%	84.1%
	Pop85Plus	143	0.8%	114	0.6%	290	1.4%	102.8%
	Population 62+	2,572	14.4%	3,209	17.5%	3,976	19.1%	54.6%
	Total Population	17,911		18,350		20,808		16.2%
Buena Vista city	Pop0to4	424	6.3%	324	5.1%	392	6.2%	-7.5%
	Pop5to9	511	7.6%	338	5.3%	391	6.2%	-23.5%
	Pop10to14	595	8.9%	436	6.8%	404	6.4%	-32.1%
	Pop15to17	374	5.6%	297	4.6%	239	3.8%	-36.1%
	Population 0 - 17	1,904	28.3%	1,395	21.8%	1,426	22.5%	-25.1%

GW NF Young and Old Population Characteristics								
		1980	% of County/State	1990	% of County/State	2000	% of County/State	% Change 1980 to 2001
	Pop62to64	195	2.9%	229	3.6%	206	3.2%	5.6%
	Pop65to74	482	7.2%	572	8.9%	542	8.5%	12.4%
	Pop75to84	201	3.0%	326	5.1%	352	5.5%	75.1%
	Pop85Plus	47	0.7%	127	2.0%	140	2.2%	197.9%
	Population 62+	925	13.8%	1,254	19.6%	1,240	19.5%	34.1%
	Total Population	6,717		6,406		6,349		-5.5%
Lexington city	Pop0to4	262	3.6%	184	2.6%	205	3.0%	-21.8%
	Pop5to9	280	3.8%	223	3.2%	195	2.8%	-30.4%
	Pop10to14	332	4.6%	248	3.6%	213	3.1%	-35.8%
	Pop15to17	262	3.6%	167	2.4%	142	2.1%	-45.8%
	Population 0 - 17	1,136	15.6%	822	11.8%	755	11.0%	-33.5%
	Pop62to64	154	2.1%	174	2.5%	155	2.3%	0.6%
	Pop65to74	513	7.0%	602	8.7%	529	7.7%	3.1%
	Pop75to84	299	4.1%	311	4.5%	419	6.1%	40.1%
	Pop85Plus	82	1.1%	121	1.7%	178	2.6%	117.1%
	Population 62+	1,048	14.4%	1,208	17.4%	1,281	18.7%	22.2%
	Total Population	7,292		6,959		6,867		-5.8%
Total Rockbridge County	Pop0to4	1,784	5.6%	1,628	5.1%	1,720	5.1%	-3.6%
	Pop5to9	1,988	6.2%	1,710	5.4%	1,817	5.3%	-8.6%
	Pop10to14	2,354	7.4%	1,830	5.8%	2,004	5.9%	-14.9%
	Pop15to17	1,806	5.7%	1,247	3.9%	1,269	3.7%	-29.7%
	Population 0 - 17	7,932	24.8%	6,415	20.2%	6,810	20.0%	-14.1%
	Pop62to64	879	2.8%	1,084	3.4%	1,078	3.2%	22.6%
	Pop65to74	2,336	7.3%	2,825	8.9%	3,013	8.9%	29.0%
	Pop75to84	1,058	3.3%	1,400	4.4%	1,798	5.3%	69.9%
	Pop85Plus	272	0.9%	362	1.1%	608	1.8%	123.5%
	Population 62+	4,545	14.2%	5,671	17.9%	6,497	19.1%	42.9%
	Total Population	31,920		31,715		34,024		6.6%
VA, Rockingham County	Pop0to4	3,951	6.9%	3,920	6.8%	4,246	6.3%	7.5%

GW NF Young and Old Population Characteristics								
		1980	% of County/State	1990	% of County/State	2000	% of County/State	% Change 1980 to 2001
	Pop5to9	3,923	6.9%	4,079	7.1%	4,691	6.9%	19.6%
	Pop10to14	4,362	7.6%	3,822	6.6%	4,947	7.3%	13.4%
	Pop15to17	3,137	5.5%	2,262	3.9%	2,795	4.1%	-10.9%
	Population 0 - 17	15,373	27.0%	14,083	24.5%	16,679	24.6%	8.5%
	Pop62to64	1,439	2.5%	1,685	2.9%	1,766	2.6%	22.7%
	Pop65to74	3,552	6.2%	4,402	7.7%	5,051	7.5%	42.2%
	Pop75to84	1,769	3.1%	2,417	4.2%	3,252	4.8%	83.8%
	Pop85Plus	566	1.0%	801	1.4%	1,128	1.7%	99.3%
	Population 62+	7,326	12.8%	9,305	16.2%	11,197	16.5%	52.8%
	Total Population	57,038		57,482		67,725		18.7%
VA, Harrisonburg city	Pop0to4	799	4.1%	1,450	4.7%	1,905	4.7%	138.4%
	Pop5to9	857	4.4%	1,295	4.2%	1,715	4.2%	100.1%
	Pop10to14	860	4.4%	1,312	4.3%	1,612	4.0%	87.4%
	Pop15to17	664	3.4%	754	2.5%	1,005	2.5%	51.4%
	Population 0 - 17	3,180	16.2%	4,811	15.7%	6,237	15.4%	96.1%
	Pop62to64	405	2.1%	496	1.6%	506	1.3%	24.9%
	Pop65to74	1,205	6.1%	1,668	5.4%	1,740	4.3%	44.4%
	Pop75to84	679	3.5%	1,115	3.6%	1,456	3.6%	114.4%
	Pop85Plus	240	1.2%	405	1.3%	571	1.4%	137.9%
	Population 62+	2,529	12.9%	3,684	12.0%	4,273	10.6%	69.0%
	Total Population	19,671		30,707		40,468		105.7%
Total Rockingham County	Pop0to4	4,750	6.2%	5,370	6.1%	6,151	5.7%	29.5%
	Pop5to9	4,780	6.2%	5,374	6.1%	6,406	5.9%	34.0%
	Pop10to14	5,222	6.8%	5,134	5.8%	6,559	6.1%	25.6%
	Pop15to17	3,801	5.0%	3,016	3.4%	3,800	3.5%	0.0%
	Population 0 - 17	18,553	24.2%	18,894	21.4%	22,916	21.2%	23.5%
	Pop62to64	1,844	2.4%	2,181	2.5%	2,272	2.1%	23.2%
	Pop65to74	4,757	6.2%	6,070	6.9%	6,791	6.3%	42.8%
	Pop75to84	2,448	3.2%	3,532	4.0%	4,708	4.4%	92.3%
	Pop85Plus	806	1.1%	1,206	1.4%	1,699	1.6%	110.8%
	Population 62+	9,855	12.8%	12,989	14.7%	15,470	14.3%	57.0%

GW NF Young and Old Population Characteristics								
		1980	% of County/State	1990	% of County/State	2000	% of County/State	% Change 1980 to 2001
	Total Population	76,709		88,189		108,193		41.0%
VA, Shenandoah County	Pop0to4	1,639	5.9%	1,930	6.1%	1,948	5.6%	18.9%
	Pop5to9	1,855	6.7%	2,066	6.5%	2,250	6.4%	21.3%
	Pop10to14	2,157	7.8%	1,878	5.9%	2,311	6.6%	7.1%
	Pop15to17	1,558	5.7%	1,157	3.7%	1,302	3.7%	-16.4%
	Population 0 - 17	7,209	26.2%	7,031	22.2%	7,811	22.3%	8.4%
	Pop62to64	840	3.0%	1,025	3.2%	1,123	3.2%	33.7%
	Pop65to74	2,506	9.1%	2,970	9.4%	3,302	9.4%	31.8%
	Pop75to84	1,219	4.4%	1,743	5.5%	2,119	6.0%	73.8%
	Pop85Plus	362	1.3%	552	1.7%	662	1.9%	82.9%
	Population 62+	4,927	17.9%	6,290	19.9%	7,206	20.5%	46.3%
	Total Population	27,559		31,636		35,075		27.3%
VA, Warren County	Pop0to4	1,359	6.4%	2,042	7.8%	2,100	6.6%	54.5%
	Pop5to9	1,570	7.4%	1,959	7.5%	2,356	7.5%	50.1%
	Pop10to14	1,707	8.1%	1,475	5.6%	2,363	7.5%	38.4%
	Pop15to17	1,223	5.8%	910	3.5%	1,264	4.0%	3.4%
	Population 0 - 17	5,859	27.6%	6,386	24.4%	8,083	25.6%	38.0%
	Pop62to64	679	3.2%	609	2.3%	763	2.4%	12.4%
	Pop65to74	1,786	8.4%	2,051	7.8%	2,134	6.8%	19.5%
	Pop75to84	641	3.0%	1,025	3.9%	1,360	4.3%	112.2%
	Pop85Plus	153	0.7%	336	1.3%	399	1.3%	160.8%
	Population 62+	3,259	15.4%	4,021	15.4%	4,656	14.7%	42.9%
	Total Population	21,200		26,142		31,584		49.0%
WV, Hampshire County	Pop0to4	1,079	7.3%	1,150	7.0%	1,241	6.1%	15.0%
	Pop5to9	1,207	8.1%	1,132	6.9%	1,397	6.9%	15.7%
	Pop10to14	1,383	9.3%	1,337	8.1%	1,554	7.7%	12.4%
	Pop15to17	924	6.2%	777	4.7%	889	4.4%	-3.8%
	Population 0 - 17	4,593	30.9%	4,396	26.6%	5,081	25.1%	10.6%
	Pop62to64	408	2.7%	555	3.4%	586	2.9%	43.6%
	Pop65to74	1,182	8.0%	1,439	8.7%	1,687	8.4%	42.7%
	Pop75to84	518	3.5%	653	4.0%	946	4.7%	82.6%
	Pop85Plus	141	0.9%	169	1.0%	307	1.5%	117.7%

GW NF Young and Old Population Characteristics								
		1980	% of County/State	1990	% of County/State	2000	% of County/State	% Change 1980 to 2001
	Population 62+	2,249	15.1%	2,816	17.1%	3,526	17.5%	56.8%
	Total Population	14,867		16,498		20,203		35.9%
WV, Hardy County	Pop0to4	664	6.6%	710	6.5%	755	6.0%	13.7%
	Pop5to9	719	7.2%	717	6.5%	867	6.8%	20.6%
	Pop10to14	830	8.3%	719	6.6%	881	7.0%	6.1%
	Pop15to17	584	5.8%	494	4.5%	451	3.6%	-22.8%
	Population 0 - 17	2,797	27.9%	2,640	24.1%	2,954	23.3%	5.6%
	Pop62to64	296	3.0%	354	3.2%	360	2.8%	21.6%
	Pop65to74	862	8.6%	991	9.0%	1,074	8.5%	24.6%
	Pop75to84	415	4.1%	545	5.0%	618	4.9%	48.9%
	Pop85Plus	110	1.1%	148	1.3%	192	1.5%	74.5%
	Population 62+	1,683	16.8%	2,038	18.6%	2,244	17.7%	33.3%
	Total Population	10,030		10,977		12,669		26.3%
WV, Monroe County	Pop0to4	931	7.2%	739	6.0%	723	5.0%	-22.3%
	Pop5to9	1,004	7.8%	944	7.6%	800	5.5%	-20.3%
	Pop10to14	1,112	8.6%	788	6.4%	894	6.1%	-19.6%
	Pop15to17	758	5.9%	609	4.9%	516	3.5%	-31.9%
	Population 0 - 17	3,805	29.6%	3,080	24.8%	2,933	20.1%	-22.9%
	Pop62to64	404	3.1%	445	3.6%	416	2.9%	3.0%
	Pop65to74	1,116	8.7%	1,234	9.9%	1,222	8.4%	9.5%
	Pop75to84	591	4.6%	672	5.4%	791	5.4%	33.8%
	Pop85Plus	166	1.3%	194	1.6%	229	1.6%	38.0%
	Population 62+	2,277	17.7%	2,545	20.5%	2,658	18.2%	16.7%
	Total Population	12,873		12,406		14,583		13.3%
WV, Pendleton County	Pop0to4	592	7.5%	527	6.5%	440	5.4%	-25.7%
	Pop5to9	542	6.9%	612	7.6%	503	6.1%	-7.2%
	Pop10to14	622	7.9%	487	6.0%	545	6.6%	-12.4%
	Pop15to17	395	5.0%	288	3.6%	301	3.7%	-23.8%
	Population 0 - 17	2,151	27.2%	1,914	23.8%	1,789	21.8%	-16.8%
	Pop62to64	251	3.2%	272	3.4%	258	3.1%	2.8%
	Pop65to74	728	9.2%	735	9.1%	775	9.5%	6.5%
	Pop75to84	379	4.8%	485	6.0%	494	6.0%	30.3%
	Pop85Plus	107	1.4%	171	2.1%	191	2.3%	78.5%
	Population 62+	1,465	18.5%	1,663	20.6%	1,718	21.0%	17.3%

GW NF Young and Old Population Characteristics								
		1980	% of County/State	1990	% of County/State	2000	% of County/State	% Change 1980 to 2001
	Total Population	7,910		8,054		8,196		3.6%
Total Forest	Pop0to4	29,357	6.3%	32,235	6.4%	33,619	5.8%	14.5%
	Pop5to9	32,150	6.9%	33,428	6.6%	37,357	6.4%	16.2%
	Pop10to14	36,438	7.8%	31,756	6.3%	39,146	6.7%	7.4%
	Pop15to17	25,951	5.6%	19,749	3.9%	22,879	3.9%	-11.8%
	Population 0 - 17	123,896	26.7%	117,168	23.1%	133,001	22.8%	7.3%
	Pop62to64	12,869	2.8%	14,562	2.9%	15,767	2.7%	22.5%
	Pop65to74	34,983	7.5%	40,960	8.1%	45,133	7.7%	29.0%
	Pop75to84	16,225	3.5%	21,842	4.3%	27,952	4.8%	72.3%
	Pop85Plus	4,536	1.0%	6,083	1.2%	9,071	1.6%	100.0%
	Population 62+	68,613	14.8%	83,447	16.5%	97,923	16.8%	42.7%
	Total Population	464,543		506,613		583,134		25.5%
Virginia	Pop0to4	360,686	6.7%	440,939	7.1%	461,982	6.5%	28.1%
	Pop5to9	387,524	7.2%	424,996	6.9%	495,084	7.0%	27.8%
	Pop10to14	431,051	8.1%	399,442	6.5%	495,955	7.0%	15.1%
	Pop15to17	295,073	5.5%	238,950	3.9%	285,241	4.0%	-3.3%
	Population 0 - 17	1,474,334	27.6%	1,504,327	24.3%	1,738,262	24.6%	17.9%
	Pop62to64	125,552	2.3%	146,345	2.4%	156,451	2.2%	24.6%
	Pop65to74	318,296	6.0%	403,382	6.5%	432,456	6.1%	35.9%
	Pop75to84	145,877	2.7%	200,837	3.2%	272,611	3.9%	86.9%
	Pop85Plus	41,131	0.8%	58,385	0.9%	87,266	1.2%	112.2%
	Population 62+	630,856	11.8%	808,949	13.1%	948,784	13.4%	50.4%
	Total Population	5,346,818		6,187,358		7,078,515		32.4%
West Va.	Pop0to4	145,583	7.5%	106,545	5.9%	101,805	5.6%	-30.1%
	Pop5to9	152,802	7.8%	120,332	6.7%	111,150	6.1%	-27.3%
	Pop10to14	157,489	8.1%	134,284	7.5%	116,182	6.4%	-26.2%
	Pop15to17	103,762	5.3%	83,045	4.6%	73,256	4.1%	-29.4%
	Population 0 - 17	559,636	28.7%	444,206	24.8%	402,393	22.3%	-28.1%
	Pop62to64	54,249	2.8%	56,422	3.1%	50,375	2.8%	-7.1%
	Pop65to74	147,298	7.6%	156,926	8.7%	148,463	8.2%	0.8%
	Pop75to84	71,161	3.6%	87,748	4.9%	96,653	5.3%	35.8%
	Pop85Plus	19,409	1.0%	24,130	1.3%	31,779	1.8%	63.7%
	Population 62+	292,117	15.0%	325,226	18.1%	327,270	18.1%	12.0%
	Total Population	1,949,644		1,793,477		1,808,344		-7.2%
Source: USDA Human Dimensions Model; U.S. Census								

Population Density

US aggregated population density was about 80 persons per square mile (in 2000) in contrast to Virginia's and West Va.'s, which have a population density of 179 and 75 persons per square mile, respectively. Population density is dependent in part on the amount of land available for settlement and on transportations systems. The population density (Table 6) of the counties that comprise the GW NF was 455 as of the 2000 Census. This larger density on the forest is caused in large part by the higher population densities of Alleghany (384), Augusta (372), Frederick (822), Rockbridge (1,880), and Rockingham (912) counties. Highland County had a very low density of 6.1 persons per square mile in 2000.

The increased density is the result of the very vigorous population increase in the 1990 decade both for the forest and Virginia. West Va.'s absence of significant population growth caused the density to change marginally. The relatively low densities of the states compared to the forest reflect a greater proportion of rural areas at the state level.

Table 6: Population Density

Geographic Area	Land Area in Square Miles	Population Density 1990*	Population Density 2000*
GW NF	8,712	416.0	454.8
Virginia	287,148	156.3	178.8
West Va.	162,684	74.5	75.1

Source: U.S. Census Bureau from USDA NRIS HD Model
*weighted average for the GW NF

In terms of regional neighbors to the George Washington, there are several major population concentrations within two hours drive of the forest including Washington, DC and its northern Virginia suburbs, as well as urban areas within forest boundary counties such as Harrisonburg, Staunton, and Winchester. These growing areas suggest that this national forest may provide increasing opportunities for recreation, fishing and hunting for the population in the northern Virginia area. This will have implications for land use and regulations.

Population projection is often times a hard task to accomplish with accuracy. The states of Virginia and West Va. have made projections to 2030 for each of its counties. Table 7 shows the population and percentage change for the GW NF and both states.

GW NF Boundary Counties Population Per Square Mile 1990, 2000						
County	1990 Density	1990 Population	Weighted Average 1990	2000 Density	2000 Population	Weighted Average 2000
VA, Alleghany County	29.5	13,176	389,347	29.1	12,926	375,776
Covington city	1,575.8	6,991	11,016,731	1,111.6	6303	7,006,668
Total Alleghany Co.	565.6	20,167	11,406,078	383.9	19,229	7,382,445
VA, Amherst County	60.1	28,578	1,718,423	67.1	31,894	2,140,720
VA, Augusta County	56.3	54,677	3,076,578	67.6	65,615	4,436,836
Staunton city	1,237.8	24,461	30,277,870	1,210.2	23,853	28,866,850
Waynesboro city	1,320.6	18,549	24,496,066	1,270.8	19,520	24,806,667
Total Augusta Co.	421.5	79,138	33,354,448	372.2	89,468	33,303,686
VA, Bath County	9.0	4,799	43,299	9.5	5,048	47,912
VA, Botetourt County	46.1	24,992	1,150,900	56.2	30,496	1,713,791
VA, Frederick County	110.3	45,723	5,042,584	142.8	59,209	8,455,022

GW NF Boundary Counties Population Per Square Mile 1990, 2000						
County	1990 Density	1990 Population	Weighted Average 1990	2000 Density	2000 Population	Weighted Average 2000
Winchester city	2,351.8	21,947	51,614,038	2,527.9	23,585	59,619,745
Total Frederick Co.	837.2	67,670	56,656,622	822.2	82,794	68,074,767
VA, Highland County	6.3	2,635	16,695	6.1	2,536	15,465
VA, Nelson County	27.0	12,778	345,642	30.6	14,445	441,745
VA, Page County	69.7	21,690	1,511,997	74.5	23,177	1,726,524
VA, Rockbridge County	30.6	18,350	561,506	34.7	20,808	722,067
Buena Vista city	938.2	6,406	6,010,181	929.6	6,349	5,901,874
Lexington city	2,790.5	6,959	19,418,807	2,757.8	6,867	18,938,028
Total Rockbridge Co.	1,902.7	13,365	25,428,988	1,879.5	13,216	24,839,902
VA, Rockingham County	67.5	57,482	3,881,707	79.6	67,725	5,388,798
Harrisonburg city	1,748.1	30,707	53,680,285	2,304.6	40,468	93,260,764
Total Rockingham Co.	652.7	88,189	57,561,992	911.8	108,193	98,649,563
VA, Shenandoah County	61.8	31,636	1,953,824	68.5	35,075	2,401,905
VA, Warren County	122.3	26,142	3,197,578	147.8	31,584	4,667,988
WV, Hampshire County	25.7	16,498	424,104	31.5	20,203	636,043
WV, Hardy County	18.8	10,977	206,523	21.7	12,669	275,122
WV, Monroe County	26.2	12,406	325,119	30.8	14,583	449,255
WV, Pendleton County	11.5	8,054	92,931	11.7	8,196	96,256
Forest Totals		469,714	195,395,165	4,926	542,806	246,863,088
Forest Weighted Average	416.0			454.8		
Virginia	156.3			178.8		
West Va.	74.5			75.1		
Source: U.S. Census, NRIS Human Dimensions Module						

Population Projections

Only Alleghany and Highland Counties are expected to lose population to 2030. From 2000 to 2030 Virginia is expected to increase by 31 percent and West Va. by 16%; the forest county area is expected to increase by 27 percent. Frederick County is expected to be the fastest growing county with about 51 percent increase from 2000 to 2030.

Growth of Virginia will be somewhat faster than the other two areas because of having more urban areas and the more vigorous economic activity associated with them. West Va.'s projected population growth is only half of that of Virginia and about 12 percent less than the George Washington boundary counties for the 2000 to 2030 period. The increasing urban nature of some of the GW NF counties promotes their rate of growth.

Table 7: Population Projections to 20030- Percentage increase

	2000 to 2010	2010 to 2020	2020 to 2030	2000 to 2030
GW NF	11.0	7.2	6.7	27.0
Virginia	11.5	9.0	7.8	31.0
West Va.	4.8	5.1	4.9	15.5

Source: States of Virginia & West Va.

GW NF Population Projections 2010 - 2030								
	April 2000	**April 2010**	**Expected % Change 2000 to 2010**	**April 2020**	**Expected % Change 2010 to 2020**	**April 2030**	**Expected % Change 2020 to 2030**	**Expected % Change 2000 to 2030**
Alleghany County, VA	17,215	16,400	-4.73%	16,000	-2.44%	16,000	0.00%	-7.06%
Covington City	6,303	6,000	-4.81%	5,800	-3.33%	5,700	-1.72%	-9.57%
Total Alleghany County	23,518	22,400	-4.75%	21,800	-2.68%	21,700	-0.46%	-7.73%
Amherst County, VA	31,894	32,900	3.15%	33,900	3.04%	34,900	2.95%	9.42%
Augusta County, VA	65,615	71,300	8.66%	76,100	6.73%	80,900	6.31%	23.29%
Staunton City	23,853	22,500	-5.67%	22,000	-2.22%	21,800	-0.91%	-8.61%
Waynesboro City	19,520	20,100	2.97%	20,500	1.99%	20,800	1.46%	6.56%
Total Augusta County	108,988	113,900	4.51%	118,600	4.13%	123,500	4.13%	13.32%
Bath County, VA	5,048	5,100	1.03%	5,300	3.92%	5,400	1.89%	6.97%
Botetourt County, VA	30,496	34,000	11.49%	37,500	10.29%	41,100	9.60%	34.77%
Frederick County, VA	59,209	72,300	22.11%	84,300	16.60%	96,100	14.00%	62.31%
Winchester City	23,585	26,000	10.24%	27,700	6.54%	29,300	5.78%	24.23%
Total Frederick County	82,794	98,300	18.73%	112,000	13.94%	125,400	11.96%	51.46%
Highland County, VA	2,536	2,500	-1.42%	2,400	-4.00%	2,400	0.00%	-5.36%
Nelson County, VA	14,445	15,100	4.53%	15,900	5.30%	16,600	4.40%	14.92%
Page County, VA	23,177	24,000	3.55%	24,700	2.92%	25,400	2.83%	9.59%
Rockbridge County, VA	20,808	21,800	4.77%	22,700	4.13%	23,600	3.97%	13.42%
Buena Vista City	6,349	6,100	-3.92%	6,000	-1.64%	6,000	0.00%	-5.50%
Lexington City	6,867	6,900	0.48%	6,900	0.00%	6,900	0.00%	0.48%
Total Rockbridge Cty	34,024	34,800	2.28%	35,600	2.30%	36,500	2.53%	7.28%
Rockingham County, VA	67,725	86,900	28.31%	92,800	6.79%	98,700	6.36%	45.74%
Harrisonburg City	40,468	46,600	15.15%	50,800	9.01%	54,800	7.87%	35.42%
Total Rockingham Co.	108,193	133,500	23.39%	143,600	7.57%	153,500	6.89%	41.88%
Shenandoah Cty, VA	35,075	39,100	11.48%	43,000	9.97%	47,100	9.53%	34.28%
Warren County, VA	31,584	36,300	14.93%	40,800	12.40%	45,200	10.78%	43.11%
Hampshire, WV	20,203	22,688	12.30%	24,538	8.15%	26,105	6.39%	29.21%
Hardy, WV	12,669	13,511	6.65%	14,283	5.71%	14,897	4.30%	17.59%
Monroe, WV	14,583	15,486	6.19%	16,243	4.89%	16,820	3.55%	15.34%
Pendleton, WV	8,196	8,569	4.55%	9,021	5.27%	9,504	5.35%	15.96%
Forest Total	**587,423**	**652,154**	**11.02%**	**699,185**	**7.21%**	**746,026**	**6.70%**	**27.00%**
Virginia Total	**7,078,515**	**7,892,900**	**11.51%**	**8,601,900**	**8.98%**	**9,275,101**	**7.83%**	**31.03%**
West Va. Total	**1,808,344**	**1,895,921**	**4.84%**	**1,991,686**	**5.05%**	**2,089,105**	**4.89%**	**15.53%**
Source: State of Virginia and West Va.								

Rural Areas

A rural area is defined as towns and areas with less than 2,500 persons. The rural nature of the area is contrasted with the states in the table below. The GW NF counties are becoming less rural over time. In 1980, 70 percent of these areas were considered rural. The land area has changed to about 58 percent rural in 2000. Compared with Virginia and West Va., the decrease in rural area was from 34 to 27 percent in Virginia and 64 to 54 percent of land area in West Va. from 1980 to 2000. Thus, urbanization has occurred at a faster pace on the forest than either state.

Table 8: Percentage of Population in Rural Areas

	1980	1990	2000
GW NF	70.3	66.4	57.6
Virginia	34.0	30.6	27.0
West Va.	63.8	63.9	53.9

Source: U.S. Census Bureau from USDA NRIS HD Model

Population change and characteristics on the forest boundary counties from 1980 to 2000 has not been very different than that of Virginia, but much faster than West Va.. Growth in population was somewhat faster in the 1990 decade for all three areas. Growth for the forest area, projected to 2030, is expected to be slightly more for Virginia and much more than the growth for West Va.. Because the George Washington counties have several urban areas, their growth in population will tend to be similar to that of Virginia's.

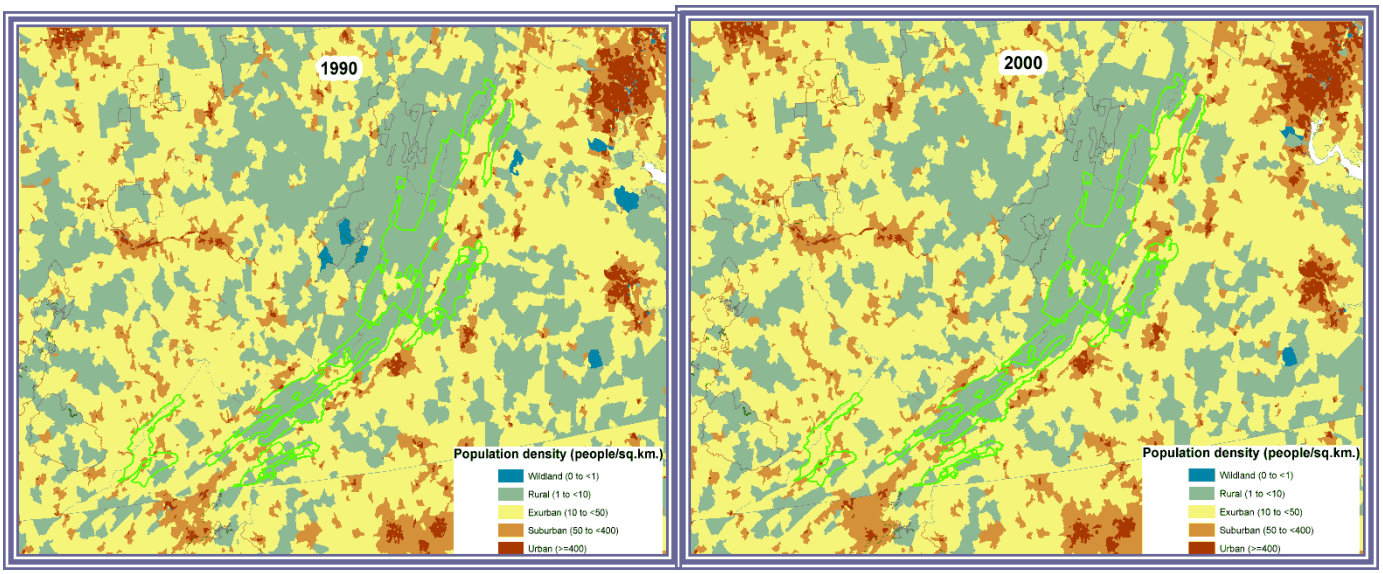
GW NF Boundary Counties Percent Rural Population 1980, 1990, 2000									
County	1980 Population Rural	1980 Population	1980 % Rural	1990 Population Rural	1990 Population	1990 % Rural	2000 Population Rural	2000 Population	2000 % Rural
VA, Alleghany County	14,333	14,333	100.0%	13,176	13,176	100.0%	9,378	12,926	72.6%
Covington city	0	9,063	0.0%	0	6,991	0.0%	0	6,303	0.0%
Total Alleghany Co.	14,333	23,396	61.3%	13,176	20,167	65.3%	9,378	19,229	48.8%
VA, Amherst County	14,976	29,122	51.4%	16,338	28,578	57.2%	20,112	31,894	63.1%
VA, Augusta County	50,950	53,732	94.8%	42,781	54,677	78.2%	51,153	65,615	78.0%
Staunton city	0	21,857	0.0%	139	24,461	0.6%	207	23,853	0.9%
Waynesboro city	0	15,329	0.0%	0	18,549	0.0%	448	19,520	2.3%
Total Augusta Co.	50,950	90,918	56.0%	42,920	97,687	43.9%	51,808	108,988	47.5%
VA, Bath County	5,860	5,860	100.0%	4,799	4,799	100.0%	5,048	5,048	100.0%
VA, Botetourt County	23,162	23,270	99.5%	22,126	24,992	88.5%	20,473	30,496	67.1%
VA, Frederick County	34,150	34,150	100.0%	45,723	45,723	100.0%	29,171	59,209	49.3%
Winchester city	0	20,217	0.0%	0	21,947	0.0%	0	23,585	0.0%
Total Frederick Co.	34,150	54,367	62.8%	45,723	67,670	67.6%	29,171	82,794	35.2%
VA, Highland County	2,937	2,937	100.0%	2,635	2,635	100.0%	2,536	2,536	100.0%
VA, Nelson County	12,204	12,204	100.0%	12,778	12,778	100.0%	14,445	14,445	100.0%
VA, Page County	15,817	19,401	81.5%	17,103	21,690	78.9%	18,354	23,177	79.2%
VA, Rockbridge County	17,911	17,911	100.0%	18,350	18,350	100.0%	20,044	20,808	96.3%
Buena Vista city	0	6,717	0.0%	0	6,406	0.0%	192	6,349	3.0%
Lexington city	0	7,292	0.0%	0	6,959	0.0%	0	6,867	0.0%
Total Rockbridge Co.	17,911	31,920	56.1%	18,350	31,715	57.9%	20,236	34,024	59.5%
VA, Rockingham County	53,749	57,038	94.2%	53,578	57,482	93.2%	45,478	67,725	67.2%
Harrisonburg city	0	19,671	0.0%	0	30,707	0.0%	61	40,468	0.2%
Total Rockingham Co.	53,749	76,709	70.1%	53,578	88,189	60.8%	45,539	108,193	42.1%
VA, Shenandoah County	24,932	27,559	90.5%	24,598	31,636	77.8%	26,743	35,075	76.2%
VA, Warren County	10,074	21,200	47.5%	14,262	26,142	54.6%	17,702	31,584	56.0%

WV, Hampshire County	14,867	14,867	100.0%	16,498	16,498	100.0%	20,203	20,203	100.0%
WV, Hardy County	10,030	10,030	100.0%	10,977	10,977	100.0%	12,669	12,669	100.0%
WV, Monroe County	12,873	12,873	100.0%	12,406	12,406	100.0%	13,081	14,583	89.7%
WV, Pendleton County	7,910	7,910	100.0%	8,054	8,054	100.0%	8,196	8,196	100.0%
Forest Total	326,735	464,543	70.3%	336,321	506,613	66.4%	335,694	583,134	57.6%
Virginia	34.0%			30.6%			27.0%		
West Va.	63.8%			63.9%			53.9%		
Source: U.S. Census, NRIS HD Model									

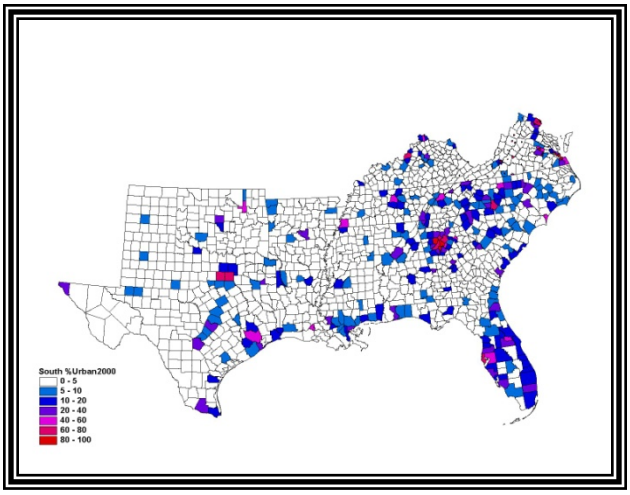
Stein et al.* (2007) identified national forests and grasslands across the United States most likely to be affected by increased housing density on rural private lands outside the external boundaries (proclamation boundary) of National Forest System lands. Stein estimated that between 2000 and 2030, a substantial increase in housing density will occur on more than 21.7 million acres of rural private land (8 percent of all private land) located within 10 miles of national forests and grasslands across the conterminous United States. In the East, almost all national forests are projected to experience moderate or high increases in residential development. The George Washington and Jefferson (GWJ) National Forests is projected to experience increased housing density between now and the year 2030 on 10% to 24.9% of its adjacent private lands located within 10 miles of the Forest. Stein et al (2007) project that, by 2030, the GWJ will have the most area of increases in housing density of all national forests or grasslands, with projected changes on more than 1.4 million adjacent private rural acres.

*Stein, Susan M.; Alig, Ralph J.; White, Eric M.; Comas, Sara J.; Carr, Mary; Eley, Mike; Elverum, Kelly; O'Donnell, Mike; Theobald, David M.; Cordell, Ken; Haber, Jonathan; Beauvais, Theodore W. 2007. National forests on the edge: development pressures on America's national forests and grasslands. Gen. Tech. Rep. PNWGTR-728. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 26 p.

The following two figures show historical population density (people per square kilometer) from 1990 to 2000 in an around the GWJ.

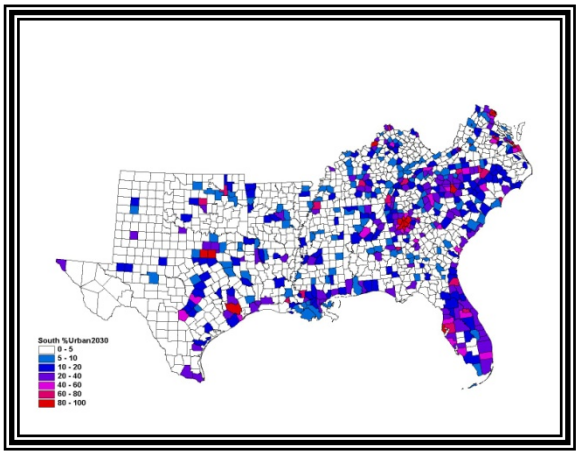


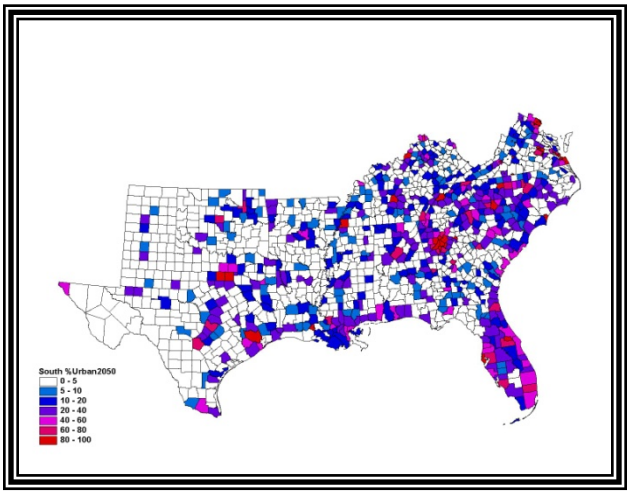
Finally the following figures show projected percent urban land from 2000 to 2050.



Percent Urban Land in Year 2000

Percent Urban Land in Year 2030





Percent Urban Land in Year 2050

Economic Indicators

When giving an overview of the economic characteristics of an area, indicators such as per capita income, unemployment rates, poverty rates, transfer payments, and household composition are used to measure economic progress and viability. Below for each of these variables is a contrast between the forest and the states.

Per capita income is a relative measure of the wealth of an area. It constitutes the personal income from all sources divided by the population of that area. For the George Washington analysis area, the per capita income average was $12,263 and $18,568 in 1990 and 2000, respectively (see table 9 below). In 2000, the per capita income rate was about $5,400 less than that of Virginia and $2,100 more than West Va..

While West Va.'s per capita income was significantly lower than the forest area or that of Virginia in both 1990 and 2000, its rate of growth was slightly faster over the 1990 decade than either of the other two areas. Income grew at a slightly slower pace (0.1 percent per year annual growth adjusted for inflation) for the forest than that of Virginia and 0.3 percent less than the rate of West Va. over the 1990 decade.

Alleghany County had the fastest growing per capita income (5.1 percent) over the 1990 decade. Per capita income there was about the same as the forest average and nearly $5,300 less than Virginia in 2000.

Table 9: Per Capita Income

Forest	1990 Per Capita Income	1990 Per Capita Income in 2004 $$*	2000 Per Capita Income	2000 Per Capita Income in 2004 $$*	Real Avg. Annual Change 1990-2000
GW NF	$12,263	$17,781	$18,568	$20,424	1.4%
Virginia	$15,713	$22,784	$23,975	$26,373	1.5%
West Va.	$10,520	$15,254	$16,477	$18,125	1.7%

Source: U.S. Census Bureau from USDA NRIS HD Model

*Real rates of increase were determined by inflating 1990 per capita income to 2000 with the Consumer Price Index Deflator

GW NF Boundary Counties Per Capita Income 1990 and 2000									
COUNTY	1990 Per Capita Income	1990 Per Capita Income in 2004 $'s	1990 Population	1990 Weighted Average	2000 Per Capita Income	2000 Per Capita Income in 2004 $'s	2000 Population	2000 Weighted Average	2004 $'s Real Average Annual Change1990-2000
VA, Alleghany County	$11,606	$16,829	13,176	$152,920,656	$19,635	$21,599	12,926	$253,802,010	2.5%
Covington city	$10,814	$15,680	6,991	$75,600,674	$16,758	$18,434	6,303	$105,625,674	1.6%
Total Alleghany Co.	$11,331	$16,431	20,167	$228,521,330	$18,692	$20,561	19,229	$359,427,684	5.1%
VA, Amherst County	$11,185	$16,218	28,578	$319,644,930	$16,952	$18,647	31,894	$540,667,088	1.4%
VA, Augusta County	$12,751	$18,489	54,677	$697,186,427	$19,744	$21,718	65,615	$1,295,502,560	1.6%
Staunton city	$12,912	$18,722	24,461	$315,840,432	$19,161	$21,077	23,853	$457,047,333	1.2%
Waynesboro city	$13,469	$19,530	18,549	$249,836,481	$17,932	$19,725	19,520	$350,032,640	0.1%
Total Augusta Co.	$12,928	$18,745	97,687	$1,262,863,340	$19,292	$21,221	108,988	$2,102,582,533	4.1%
VA, Bath County	$11,369	$16,485	4,799	$54,559,831	$23,092	$25,401	5,048	$116,568,416	4.4%
VA, Botetourt County	$13,810	$20,025	24,992	$345,139,520	$22,218	$24,440	30,496	$677,560,128	2.0%
VA, Frederick County	$13,671	$19,823	45,723	$625,079,133	$21,080	$23,188	59,209	$1,248,125,720	1.6%
Winchester city	$14,214	$20,610	21,947	$311,954,658	$20,500	$22,550	23,585	$483,492,500	0.9%
Total Augusta Co.	$13,847	$20,078	67,670	$937,033,791	$20,915	$23,006	82,794	$1,731,618,220	4.2%
VA, Highland County	$10,828	$15,701	2,635	$28,531,780	$15,976	$17,574	2,536	$40,515,136	1.1%
VA, Nelson County	$11,419	$16,558	12,778	$145,911,982	$14,445	$15,890	16,321	$235,756,845	-0.4%
VA, Page County	$11,304	$16,391	21,690	$245,183,760	$16,321	$17,953	23,177	$378,271,817	0.9%
VA, Rockbridge County	$11,287	$16,366	18,350	$207,116,450	$18,356	$20,192	20,808	$381,951,648	2.1%
Buena Vista city	$10,241	$14,849	6,406	$65,603,846	$16,377	$18,015	6,349	$103,977,573	2.0%
Lexington city	$10,077	$14,612	6,959	$70,125,843	$16,497	$18,147	6,867	$113,284,899	2.2%
Total Rockbridge Co.	$10,810	$15,675	31,715	$342,846,139	$16,497	$17,612	34,024	$599,214,120	5.0%
VA, Rockingham County	$12,647	$18,338	57,482	$726,974,854	$18,795	$20,675	67,725	$1,272,891,375	1.2%

GW NF Boundary Counties Per Capita Income 1990 and 2000									
COUNTY	1990 Per Capita Income	1990 Per Capita Income in 2004 $'s	1990 Population	1990 Weighted Average	2000 Per Capita Income	2000 Per Capita Income in 2004 $'s	2000 Population	2000 Weighted Average	2004 $'s Real Average Annual Change1990-2000
Harrisonburg city	$11,607	$16,830	30,707	$356,416,149	$14,898	$16,388	40,468	$602,892,264	-0.3%
Total Rockingham Co.	$12,285	$17,813	88,189	$1,083,391,003		$17,337	108,193	$1,875,783,639	3.5%
VA, Shenandoah County	$12,686	$18,395	31,636	$401,334,296	$19,755	$21,731	35,075	$692,906,625	1.7%
VA, Warren County	$13,580	$19,691	26,142	$355,008,360	$19,841	$21,825	31,584	$626,658,144	1.0%
WV, Hampshire County	$9,996	$14,494	16,498	$164,914,008	$14,851	$16,336	20,203	$300,034,753	1.2%
WV, Hardy County	$10,096	$14,639	10,977	$110,823,792	$15,859	$17,445	12,669	$200,917,671	1.8%
WV, Monroe County	$8,959	$12,991	12,406	$111,145,354	$17,435	$19,179	14,583	$254,254,605	4.0%
WV, Pendleton County	$9,391	$13,617	8,054	$75,635,114	$15,805	$17,386	8,196	$129,537,780	2.5%
Totals			506,613	$6,212,488,330			585,010	10,862,275,204	
Forest Average	**$12,263**	**$17,781**			**$18,568**	**$20,424**			**1.4%**
Virginia	**$15,713**	**$22,784**			**$23,975**	**$26,373**			**1.5%**
West Va.	**$10,520**	**$15,254**			**$16,477**	**$18,125**			**1.7%**
Source: U.S. Census, NRIS HD Model									

Another indicator or relative economic prosperity is the percent of the workforce out of work. Unemployment rates change dramatically over time, depending in large part on the national economy. Some areas, however, have protracted unemployment problems because of educational attainment and lack of skills.

Table 10 below shows in 2001 the George Washington counties had slightly less unemployment, 3.1 percent, than Virginia (3.5 percent) and significantly less than West Va. (4.9 percent). The forest unemployment rate was calculated as a weighted average (weighted by unemployment rate and number of unemployed) of all counties in the area. This is in contrast to six years earlier when the forest analysis area had an unemployment rate that was almost one percent more than that of Virginia and more than 2 percent less than West Va. Even in 1998 the average unemployment rate for the forest analysis area decreased to 3.5 percent, about one-half percent greater than that of the Virginia and over 3.5 percent less than West Va.. It is not apparent that the 2001-2002 national recession had taken effect in either the forest area or West Va. areas because unemployment rates in 2001 were still on a downward path from previous years. Virginia, on the other hand, did have an increased unemployment rate in 2001 from the previous year of over 1 percent.

Table 10: Unemployment Rate 1995 – 2001*

	1995	1998	2001
GW NF	5.3	3.5	3.1
Virginia	4.5	2.9	3.5
West Va.	7.9	6.6	4.9

Source: U.S. Bureau of Labor Statistics from USDA NRIS HD Model

*Forest area rates are weighted averages by unemployed for each county.

GW NF Boundary Counties Unemployment Rate 1995-2001													
County	1995	1995 Unemployment	1995 Weighted Avg UI	1996	1997	1998	1998 Unemployment	1998 Weighted Avg UI	1999	2000	2001	2001 Unemployment	2001 Weighted Avg UI
VA, Alleghany County	6.4	551	3,526	5.6	6	5.2	444	2,309	5.9	3.1	3.8	307	1,167
Covington city	9.7	328	3,182	8	8.8	5.7	194	1,106	7.5	4.5	5.4	177	956
Weighted Ave. Alleghany Co.	7.6	879	6,708			5.4	638	3,415			4.4	484	2,122
VA, Amherst County	3.7	552	2,042	3.9	3.3	2.3	326	750	1.8	1.6	3.8	567	2,155
VA, Augusta County	5.9	1,798	10,608	3.9	3.1	2.2	696	1,531	2.4	1.7	2.8	916	2,565
Staunton city	5.1	584	2,978	4.8	3.5	2.4	270	648	2.3	1.8	2.5	295	738
Weighted Average Amherst Co.	5.7	2,382	13,587			2.3	966	2,179			2.7	1211	3,302
VA, Bath County	9.4	251	2,359	7	6.6	6.2	143	887	4.7	3.3	4.6	115	529
VA, Botetourt County	2.6	412	1,071	2.5	3.1	2.4	402	965	1.8	1.2	2.4	407	977
VA, Frederick County*	4.4	1,313	5,777	4.1	3.6	2.6	842	2,189	2.1	1.6	2.6	893	2,322
VA, Highland County	8.5	116	986	8.8	6.7	3.4	43	146	2.6	2.9	2.3	30	69
VA, Nelson County	3.7	255	944	4.1	3.9	2.9	201	583	2.2	2.3	3.5	254	889
VA, Page County	7.5	902	6,765	7.1	5.8	4.9	574	2,813	4	2.5	3.3	406	1,340
VA, Rockbridge County	5	487	2,435	4.4	3.3	2.2	215	473	2.1	1.7	2.7	297	802
Buena Vista city	4.5	188	846	4.4	4	2.9	90	261	2.8	2.2	3.5	120	420
Lexington city	4.5	78	351	4.4	4	2.9	52	151	2.8	2.2	3.5	52	182
Weighted Ave. Rockbridge Co.	4.5	266	1,197			2.9	142	412			3.5	172	602
VA, Rockingham County	3.1	1,138	3,528	2.7	1.8	1.3	477	620	1.3	0.9	1.9	750	1,425
VA, Harrisonburg city	4.5	424	1,908	4.4	4	2.9	249	722	2.8	2.2	3.5	380	1,330
Weighted Ave. Rockingham Co.	3.5	1,562	5,436			1.8	726	1,342			2.4	1130	2,755
VA, Shenandoah County	5.8	1,050	6,090	5	3.4	2.7	469	1,266	2.8	1.3	2.1	374	785
VA, Warren County	5.7	858	4,891	5.1	4.4	2.9	424	1,230	2.7	1.9	2.8	451	1,263
WV, Hampshire County	4	310	1,240	4.6	5.8	6.1	531	3,239	4.8	4.2	4.5	432	1,944
WV, Hardy County	4.4	304	1,338	4.1	4	4.2	292	1,226	4	2.6	2.7	217	586
WV, Monroe County	7	352	2,464	5.9	5.7	5.5	285	1,568	4.3	4.3	4	221	884
WV, Pendleton County	4.8	183	878	4.1	3.6	3.7	139	514	4.6	10.1	3.1	131	406
Total		17,523	93,135				9,830	32,544				10,789	32,514
Forest Wide Weighted Average	5.3					3.5					3.1		
Virginia	4.5			4.4	4	2.9			2.8	2.2	3.5		
West Va.	7.9			7.5	6.9	6.6			6.6	5.5	4.9		
Source: U.S. Census, NRIS HD Model													
* No data available for Winchester City													

Poverty for the George Washington, Virginia, and West Va. is represented in the following table:

Table 11: Percent of Individuals in Poverty 1980 - 2000

	1980	1990	2000
GW NF	12.4	11.1	10.9
Virginia	14.8	13.0	12.3
West Va.	15.0	19.7	17.9

Source: U.S. Census Bureau from USDA NRIS HD Model
*Forest area rates are weighted averages by population for each county.

The weighted average poverty rate for the George Washington counties over time has been less than the poverty rate of either state. However, this difference has been closing from the 1980 to the 2000 decade for Virginia. Meanwhile, poverty rates in West Va. rose significantly from 1980 to 1990 and decreased marginally in 2000.

Of the forest boundary counties, the poverty rate in 2000 was the lowest for Botetourt County (5.1 percent) and the highest in Rockingham County (16.4 percent).

GW NF Boundary Counties Percent of Individuals in Poverty 1980, 1990, 2000									
County	1980 Percent Poverty	1980 Population	1980 Weighted Average	1990 Percent Poverty	1990 Population	1990 Weighted Average	2000 Percent Poverty	2000 Population	2000 Weighted Average
VA, Alleghany County	10	14,333	143,330	9.7	13,176	127,807	7.1	12,926	91,775
Covington city	12.4	9,063	112,381	13.1	6,991	91,582	12.9	6,303	81,309
Total Alleghany Co.	10.9	23,396	255,711	10.9	20,167	219,389	9.0	19,229	173,083
VA, Amherst County	10	29,122	291,220	9.8	28,578	280,064	10.7	31,894	341,266
VA, Augusta County	10	53,732	537,320	7.2	54,677	393,674	5.8	65,615	380,567
Staunton city	9.9	21,857	216,384	11.7	24,461	286,194	11.7	23,853	279,080
Waynesboro city	9	15,329	141,027	11	18,549	211,459	13	19,520	249,856
Total Augusta Co.	9.8	90,918	894,731	9.1	97,687	891,327	8.3	108,988	909,503
VA, Bath County	12.7	5,860	74,422	14.2	4,799	68,146	7.8	5,048	39,374
VA, Botetourt County	7.7	23,270	179,179	6.2	24,992	154,950	5.2	30,496	158,579
VA, Frederick County	9.8	34,150	334,670	7.1	45,723	324,633	6.4	59,209	378,938
Winchester city	14.9	20,217	301,233	11.3	21,947	248,001	13.2	23,585	311,322
Total Frederick Co.	11.7	54,367	635,903	8.5	67,670	572,634	8.3	82,794	690,260
VA, Highland County	15.1	2,937	44,349	13.6	2,635	35,836	12.6	2,536	31,954
VA, Nelson County	18.6	12,204	226,994	15.2	12,778	194,226	12.1	14,445	174,785
VA, Page County	14.9	19,401	289,075	11.8	21,690	255,942	12.5	23,177	289,713
VA, Rockbridge County	14.7	17,911	263,292	13.6	18,350	249,560	9.6	20,808	199,757
Buena Vista city	9	6,717	60,453	14.4	6,406	92,246	10.4	6,349	66,030
Lexington city	18.5	7,292	134,902	18.2	6,959	126,654	21.6	6,867	148,327
Total Rockbridge Co.	14.4	31,920	458,647	14.8	31,715	468,460	12.2	34,024	414,114
VA, Rockingham County	10.7	57,038	610,307	6.9	57,482	396,626	8.2	67,725	555,345
Harrisonburg city	16.4	19,671	322,604	21.5	30,707	660,201	30.1	40,468	1,218,087
Total Rockingham Co.	12.2	76,709	932,911	12.0	88,189	1,056,826	16.4	108,193	1,773,432
VA, Shenandoah County	12.3	27,559	338,976	11	31,636	347,996	8.2	35,075	287,615
VA, Warren County	10.7	21,200	226,840	7.7	26,142	201,293	8.5	31,584	268,464
WV, Hampshire County	16.9	14,867	251,252	18.2	16,498	300,264	16.3	20,203	329,309

GW NF Boundary Counties Percent of Individuals in Poverty 1980, 1990, 2000									
County	1980 Percent Poverty	1980 Population	1980 Weighted Average	1990 Percent Poverty	1990 Population	1990 Weighted Average	2000 Percent Poverty	2000 Population	2000 Weighted Average
WV, Hardy County	20.8	10,030	208,624	14.6	10,977	160,264	13.1	12,669	165,964
WV, Monroe County	20.9	12,873	269,046	21	12,406	260,526	16.2	14,583	236,245
WV, Pendleton County	20.3	7,910	160,573	17	8,054	136,918	11.4	8,196	93,434
Forest Totals		464,543	5,738,453		506,613	5,605,062		583,134	6,377,092
Forest Weighted Average	12.4			11.1			10.9		
Virginia	11.8			10.2			9.6		
West Va.	15			19.7			17.9		
Source: U.S. Census, NRIS HD Model									

The growth rate of transfer payments from the federal government to the states and their citizens can be another indicator of relative poverty in an area. Transfer payments are payments to persons for which no current services are performed. As a component of personal income, they are payments by government and business to individuals and nonprofit institutions. Although most transfer payments are made in cash, they also include payments for services such as Medicare, Medicaid, and food stamps. There is often an inverse relationship between earnings and transfer payments. A high dependency in an economy on transfer payments can reflect few employment opportunities or a popular retirement area.

Table 12 below displays the analysis area average and the states receipts of transfer payments from the federal government. The growth rate in federal transfer payments for the George Washington analysis area was slightly less than that Virginia and almost one percent more than West Va. from 1970 to 2003 (4.6 vs. 4.9 and 3.8 percent per year). The largest growth rate (5.3 percent occurred in Hampshire County, West Va. and the lowest rate (3.3 percent) was in Highland County, Virginia. These compound annual growth rates between 1970 and 2003 are in real 2004 dollars.

Table 12: Federal Transfer Payments to Individuals (in 2004 $'s)

	1970 (Billion $'s)	1980 (Billion $'s)	1990 (Billion $'s)	2000 (Billion $'s)	2003 (Billion $'s)	Real Annual Change '70-'03*
GW NF**	$.571	$1.142	$1.529	$2.177	$2.544	4.6%
Virginia	$5.742	$11.925	$16.273	$23.684	$27.547	4.9%
West Va.	$3.514	$6.479	$7.822	$10.221	$12.189	3.8%

Source: U.S. Bureau of Economic Analysis from USDA NRIS HD Model
*Real rates of increase were determined by inflating 1970 dollars to 2000 with the Consumer Price Index Deflator
**Forest area rates are weighted averages by population for each county.

Although the forest growth rate as a whole is only 0.3 percent less than Virginia's, this growth rate over 33 years is a significant deviation from the average in dollar terms. These transfer payments provide some economic stabilization, especially for less prosperous counties in the area. Hampshire County's high transfer payment rate and high poverty rate at 16.3 percent in 2000 go together to indicate it is one of this area's less prosperous counties.

GW NF Boundary Counties Total Transfer Payments 1970-2000 in $1000 of 2004 $'s*																		
County	1970 Adjusted	1975 Adjusted	1980 Adjusted	1985 Adjusted	1990 Adjusted	1991 Adjusted	1992 Adjusted	1993 Adjusted	1994 Adjusted	1995 Adjusted	1996 Adjusted	1997 Adjusted	1998 Adjusted	1999 Adjusted	2000 Adjusted	2001 Adjusted	2002 Adjusted	Real Average Rate of Change 1970-2003
Alleghany + Covington, Virginia	$49,728	$84,349	$93,911	$101,705	$111,074	$114,714	$120,574	$118,939	$119,802	$123,810	$124,271	$123,061	$124,694	$125,035	$128,127	$136,139	$137,678	3.2%
Amherst, Virginia	$30,223	$57,438	$64,223	$74,337	$77,050	$81,546	$88,266	$90,997	$92,151	$97,263	$102,766	$103,907	$106,821	$110,307	$113,850	$124,405	$130,683	4.6%
Augusta, Staunton + Waynesboro, Virginia	$100,137	$196,792	$220,623	$276,348	$302,305	$318,029	$349,404	$355,230	$360,824	$380,191	$393,065	$398,184	$404,353	$411,877	$429,633	$468,857	$489,069	5.0%
Bath, Virginia	$9,380	$15,332	$18,251	$18,832	$19,079	$20,165	$22,883	$23,374	$22,187	$22,564	$23,212	$23,804	$23,638	$24,326	$24,195	$26,271	$27,281	3.4%
Botetourt, Virginia	$28,319	$45,353	$52,794	$58,314	$66,129	$68,852	$74,836	$76,580	$82,705	$87,943	$92,303	$94,349	$97,577	$101,723	$106,523	$114,362	$118,231	4.5%
Frederick + Winchester, Virginia	$59,395	$104,479	$115,883	$135,691	$164,958	$175,614	$196,557	$197,099	$205,401	$218,755	$230,460	$235,605	$242,992	$251,105	$265,033	$291,967	$305,384	5.2%
Highland, Virginia	$4,495	$7,227	$8,054	$8,473	$8,110	$8,561	$9,881	$9,883	$10,307	$10,802	$11,389	$11,504	$11,388	$11,576	$12,130	$12,845	$12,895	3.3%
Nelson, Virginia	$18,170	$31,056	$35,129	$39,737	$46,951	$49,570	$57,472	$56,574	$55,863	$56,637	$59,700	$61,916	$62,488	$63,316	$66,307	$72,354	$73,102	4.4%
Page, Virginia	$27,277	$48,333	$53,084	$65,333	$67,764	$70,246	$78,123	$77,635	$81,004	$85,151	$88,036	$89,601	$92,504	$92,764	$95,603	$102,725	$108,327	4.4%
Rockbridge, Buena Vista + Lexington, Virginia	$41,712	$72,043	$76,388	$85,166	$103,320	$107,358	$118,411	$120,406	$116,801	$122,482	$126,686	$129,040	$132,466	$133,599	$138,116	$149,551	$155,917	4.2%
Rockingham + Harrisonburg, Virginia	$70,177	$142,801	$149,686	$188,906	$225,756	$237,683	$256,836	$263,491	$262,973	$277,426	$290,426	$291,190	$296,252	$302,188	$315,851	$340,591	$352,199	5.1%
Shenandoah, Virginia	$34,850	$58,171	$69,978	$87,141	$96,529	$102,027	$109,674	$107,340	$104,795	$113,231	$122,504	$125,519	$128,970	$131,813	$136,414	$147,357	$155,198	4.7%
Warren, Virginia	$25,183	$47,999	$56,778	$66,275	$67,846	$75,067	$85,172	$84,378	$92,851	$96,124	$94,855	$94,655	$96,161	$98,832	$103,514	$111,949	$117,513	4.9%
WV, Hampshire County	$19,538	$30,762	$36,448	$48,185	$55,510	$60,865	$69,189	$72,195	$71,523	$74,122	$78,194	$80,091	$82,357	$83,358	$87,187	$95,893	$104,370	5.3%
WV, Hardy County	$14,026	$23,078	$26,358	$32,055	$35,073	$37,636	$41,271	$41,794	$40,405	$41,699	$43,765	$44,979	$46,081	$46,928	$48,418	$53,313	$58,484	4.5%
WV, Monroe County	$25,046	$35,718	$43,098	$49,903	$52,768	$53,808	$58,398	$60,416	$58,613	$59,868	$62,310	$64,134	$64,504	$65,041	$66,725	$73,263	$78,726	3.6%
WV, Pendleton County	$13,694	$19,070	$21,462	$25,286	$28,827	$33,106	$35,624	$37,317	$35,870	$35,697	$36,264	$36,928	$38,192	$38,087	$39,420	$42,494	$45,019	3.8%

GW NF Boundary Counties Total Transfer Payments 1970-2000 in $1000 of 2004 $'s*																		
County	1970 Adjusted	1975 Adjusted	1980 Adjusted	1985 Adjusted	1990 Adjusted	1991 Adjusted	1992 Adjusted	1993 Adjusted	1994 Adjusted	1995 Adjusted	1996 Adjusted	1997 Adjusted	1998 Adjusted	1999 Adjusted	2000 Adjusted	2001 Adjusted	2002 Adjusted	Real Average Rate of Change 1970-2003
Forest Boundary County Total	$571,348	$1,019,999	$1,142,147	$1,361,687	$1,529,050	$1,614,848	$1,772,570	$1,793,647	$1,814,074	$1,903,766	$1,980,206	$2,008,467	$2,051,438	$2,091,873	$2,177,044	$2,364,335	$2,470,077	4.6%
Virginia	$5,742,397	$10,343,022	$11,925,864	$14,144,610	$16,273,752	$17,122,165	$18,733,140	$19,223,417	$19,681,048	$20,690,266	$21,568,691	$21,827,530	$22,223,248	$22,748,632	$23,684,381	$25,670,585	$26,744,710	4.9%
West Va.	$3,513,987	$5,616,453	$6,478,662	$7,291,127	$7,821,519	$8,438,088	$9,394,142	$9,694,580	$9,495,271	$9,573,735	$9,766,264	$9,867,905	$10,052,960	$9,998,936	$10,220,767	$11,033,719	$11,834,394	3.8%
Source: U.S. Bureau of Census from USDA Forest Service NRIS Human Dimension Model																		
*Nominal data converted to 2004 $'s by the Consumer Price Index Price Deflators																		

Housing and Households

The following tables give information about housing and households. Housing and household growth are precipitated by population growth. Population growth is influenced greatly by employment growth.

Another factor indicating relative poverty and social disunity for an area is the percent of households with children present headed by a female. The greater percentage is, the more likely that these households may be in a poverty status. Table 13 below contrasts the female-head-of-households for the counties within the George Washington analysis area. For this area households headed by females with children has increased by a percent and one-half from 1990 to 2000.

Contrasted with the both state's higher incidence of single mother households, perhaps the George Washington's more traditional values (than may exist in more urban areas) may keep this to a relatively low level. Virginia's rate of female house-holders increased from nearly six percent to over eight percent. West Va. increased from over five percent to slightly more than six and one-half percent. Virginia's more large urban areas where traditional values are not followed as greatly may have had something to do with this greater increase than the more rural forest and West Va. areas. Also, the increase may be indicative of a higher divorce rate or less family support in more urban areas of Virginia.

Table 13: Female-Head-of-Households with Children Present

	1990	% of Total Households	2000	% of Total Households
GW NF*	7,906	4.2	12,890	5.7
Virginia	133,401	5.8	217,950	8.1
West Va.	36,673	5.3	48,732	6.6

Source: U.S. Bureau of Census, USDA NRIS HD Model
*Weighted by Number of Households

GW NF Boundary Counties Percentage of Female Head of Households with Children Present, 1990 and 2000						
	1990	1990	1990	2000	2000	
	Households	Female Head of Households	Percent of Households with Female Head of Households	Total Households	Female Head of Households	Percent of Households with Female Head of Households
		Children Present			Children Present	
Alleghany Co., VA	4,992	196	3.9%	5,149	214	4.2%
Covington City	2,990	113	3.8%	2,835	169	6.0%
Total Alleghany Co.	7,982	309	3.9%	7,984	383	4.8%
Amherst Co., VA	9,829	384	3.9%	11,941	839	7.0%
Augusta Co., VA	19,873	768	3.9%	24,818	2,134	8.6%
Staunton City	9,452	541	5.7%	9,676	667	6.9%
Waynesboro City	7587	524	6.9%	8,332	772	9.3%
Total Augusta Co.	36,912	1,833	5.0%	42,826	3,573	8.3%
Bath Co., VA	1,930	64	3.3%	2,053	84	4.1%
Botetourt Co., VA	9,110	242	2.7%	11,700	379	3.2%
Frederick Co., VA	16,515	606	3.7%	22,097	1,171	5.3%
Winchester City	9,096	569	6.3%	10,001	684	6.8%
Total Frederick Co.	25,611	1,175	4.6%	32,098	1,855	5.8%
Highland Co., VA	1,086	24	2.2%	1,131	36	3.2%
Nelson Co., VA	4,788	215	4.5%	5,887	292	5.0%
Page Co., VA	8,012	309	3.9%	9,305	515	5.5%
Rockbridge Co., VA	7,167	311	4.3%	8,486	411	4.8%
Buena Vista City	2,460	135	5.5%	2,547	209	8.2%
Lexington City	2,163	93	4.3%	2,232	87	3.9%
Total Rockbridge Co.	11,790	539	4.6%	13,265	707	5.3%
Rockingham Co., VA	20,877	647	3.1%	25,355	1,029	4.1%
Harrisonburg City	10,250	590	5.8%	13,133	752	5.7%
Total Rockingham Co.	31,127	1,237	4.0%	38,488	1,781	4.6%
Shenandoah Co.,VA	12,452	516	4.1%	14,296	709	5.0%
Warren Co., VA	9,940	414	4.2%	12,087	692	5.7%
Hampshire Co., WV	6,230	229	3.7%	7,955	449	5.6%
Hardy Co., WV	4,281	155	3.6%	5,204	251	4.8%
Monroe Co., WV	4,794	148	3.1%	5,447	212	3.9%
Pendleton Co., WV	3,073	113	3.7%	3,350	133	4.0%
Forest County Average	**188,947**	**7,906**	**4.2%**	**225,017**	**12,890**	**5.7%**
Virginia	**2,294,722**	**133,401**	**5.8%**	**2,699,173**	**217,950**	**8.1%**
West Va.	**688,727**	**36,673**	**5.3%**	**736,481**	**48,732**	**6.6%**
Source: U.S. Census: 1990 Data Tables P005 & P019						
2000 Data Tables P15 & P20						

Table 14 illustrates that average household size has changed moderately for the analysis area and the two states since 1990. This declining trend follows the overall U.S. trend to smaller households. The forest area declined five percent while Virginia's and West Va.'s declined six and eight percent, respectively. Household size is important because large families sometimes indicate less affluent conditions. From this metric there is no indication of overly large households. From 1990 to 2000 each of the counties had a smaller household size---the greatest reduction was Amherst County which went from 2.91 members to 2.51 members per household. For 2000, Rockingham County had the largest members per household at 2.58 and Highland County had the smallest at 2.24 members.

Table 14: Average Household Size

	1990 Household size	2000 Household size
GW NF*	2.61	2.48
Virginia	2.70	2.54
West Va.	2.60	2.40

Source: U.S. Bureau of Census, USDA NRIS HD Model
*Weighted by number of households

GW NF Counties Average Household Size - 1990 and 2000						
	1990	1990	1990 Weighted	2000	2000	2000 Weighted
COUNTY	Average Household Size	Households	Average Households	Average Household Size	Households	Average Households
Alleghany Co., Virginia	2.64	1,990	5,252	2.46	5,149	12,667
Covington city, Virginia	2.34	2,990	6,991	2.22	2,835	6,294
Total Alleghany Co., Virginia	2.46	4,980	12,243	2.37	7,984	18,960
Amherst Co., Virginia	2.91	11,950	34,745	2.51	11,941	29,972
Augusta Co., Virginia	2.75	19,920	54,806	2.56	24,818	63,534
Staunton city, Virginia	2.59	9,452	24,461	2.19	9,676	21,190
Waynesboro city, Virginia	2.44	7,587	18,549	2.31	8,332	19,247
Total Augusta Co., Virginia	2.65	36,959	97,816	2.43	42,826	103,971
Bath Co., Virginia	2.49	85,868	213,513	2.34	2,053	4,804
Botetourt Co., Virginia	2.74	159,786	438,350	2.56	11,700	29,952
Frederick Co., Virginia	2.77	290,200	803,440	2.64	22,097	58,336
Winchester city, Virginia	2.41	9,096	21,947	2.28	10,001	22,802
Total Frederick Co., Virginia	2.76	299,296	825,387	2.53	32,098	81,138
Highland Co., Virginia	2.43	1,650,774	4,005,332	2.24	1,131	2,533
Nelson Co., Virginia	2.66	4,852,666	12,884,700	2.42	5,887	14,247
Page Co., Virginia	2.71	8,012	21,690	2.46	9,305	22,890
Rockbridge Co., Virginia	2.56	7,167	18,350	2.43	8,486	20,621
Buena Vista city, Virginia	2.60	2,460	6,406	2.38	2,547	6,062
Lexington city, Virginia	3.22	2,163	6,959	2.06	2,232	4,598
Total Rockbridge Co., Virginia	2.69	11,790	31,715	2.36	13,265	31,281
Rockingham Co., Virginia	2.75	20,877	57,482	2.61	25,355	66,177
Harrisonburg city, Virginia	3.00	10,250	30,707	2.53	13,133	33,226
Total Rockingham Co., Virginia	2.83	31,127	88,189	2.58	38,488	99,403
Shenandoah Co., Virginia	2.54	12,452	31,636	2.42	14,296	34,596
Warren Co., Virginia	2.63	9,940	26,142	2.57	12,087	31,064
Hampshire Co., West Va.	2.65	6,230	16,498	2.49	7,955	19,808
Hardy Co., West Va.	2.56	4,281	10,977	2.42	5,204	12,594
Monroe Co., West Va.	2.59	4,794	12,406	2.41	5,447	13,127
Pendleton Co., West Va.	2.62	3,073	8,054	2.40	3,350	8,040
Totals		7,193,978	18,759,394		225,017	558,381
Forest Boundary County Average	2.61			2.48		
Virginia	2.70			2.54		
West Va.	2.60			2.40		
Source: U.S. Census, 1990 Tables P005 & P008; 2000 Tables P15 & P17						

Housing Vacancy rates for the analysis area and the state are given in Table 15 below. A drastic change in vacancies may indicate harsh economic conditions. Rates on the forest counties have decreased by just 0.2 percent since 1990. Meanwhile, Virginia's and West Va.'s vacancy rate changed marginally as well. Virginia's decrease by over one percent and West Va.'s increased by almost one percent over the decade. Virginia's vacancy rate was several percent less than either the forest or West Va. Several counties in both West Va. and Virginia had very high vacancies in both decades, possibly reflecting seasonal or vacation homes.

Table 15: Housing Vacancy Rates

	1990 Vacancy Rate	2000 Vacancy Rate
GW NF	11.8%	11.6%
Virginia	8.2%	7.1%
West Va.	11.9%	12.8%

Source: U.S. Bureau of Census, USDA NRIS HD Model

GW NF Boundary Counties Housing Units and Vacancies 1990 and 2000							
County	Percentage of Vacant Units	Total Number of Units	Number of Vacant Units	Percentage of Vacant Units	Total Number of Units	Number of Vacant Units	Percent Change in Harvest Units
	1990	1990	1990	2000			1990-2000
Alleghany County	9.8%	5,481	539	11.4%	5,812	663	6.0%
Covington city	8.3%	3,269	271	11.3%	3,195	360	-2.3%
Total Alleghany County	9.3%	8,750	810	11.4%	9,007	1,023	2.9%
Amherst County	7.3%	10,598	771	7.8%	12,958	1,017	22.3%
Augusta County	6.7%	21,202	1,421	7.2%	26,738	1,920	26.1%
Staunton city	5.7%	10,003	571	7.2%	10,427	751	4.2%
Waynesboro city	4.2%	7,902	334	6.0%	8,863	531	12.2%
Total Augusta County	5.9%	39,107	2,326	7.0%	46,028	3,202	17.7%
Bath County	27.0%	2,596	701	29.1%	2,896	843	11.6%
Botetourt County	6.5%	9,785	637	6.9%	12,571	871	28.5%
Frederick County	7.8%	17,864	1,394	5.2%	23,319	1,222	30.5%
Winchester city	7.4%	9,808	724	5.5%	10,587	586	7.9%
Total Frederick County	7.7%	27,672	2,118	5.3%	33,906	1,808	22.5%
Highland County	38.5%	1,759	678	37.9%	1,822	691	3.6%
Nelson County	31.9%	7,063	2,256	31.2%	8,554	2,667	21.1%
Page County	10.0%	8,948	893	11.9%	10,557	1,252	18.0%
Rockbridge County	9.7%	7,975	773	11.1%	9,550	1,064	19.7%
Buena Vista city	3.6%	2,494	90	6.2%	2,716	169	8.9%
Lexington city	6.0%	2,311	139	6.1%	2,376	144	2.8%
Total Rockbridge County	7.8%	12,780	1,002	9.4%	14,642	1,377	14.6%
Rockingham County	8.2%	22,614	1,864	7.2%	27,328	1,973	20.8%
Harrisonburg city	5.4%	10,900	590	4.1%	13,689	556	25.6%
Total Rockingham County	7.3%	33,514	2,454	6.2%	41,017	2,529	22.4%
Shenandoah County	17.9%	15,160	2,708	14.4%	16,709	2,413	10.2%
Warren County	12.0%	11,223	1,344	9.1%	13,299	1,212	18.5%
WV, Hampshire County	29.9%	8,817	2,635	28.9%	11,185	3,230	26.9%
WV, Hardy County	23.1%	5,573	1,287	26.9%	7,115	1,911	27.7%
WV, Monroe County	20.8%	5,994	1,245	25.0%	7,267	1,820	21.2%
WV, Pendleton County	32.2%	4,516	1,455	34.3%	5,102	1,752	13.0%
Forest Total	11.8%	213,855	25,320	11.6%	254,635	29,618	19.1%
Virginia	8.2%	2,496,334	204,504	7.1%	2,904,192	205,019	16.3%
West Va.	11.9%	781,295	92,738	12.8%	844,623	108,142	8.1%
Source: U.S.Census, USDA NRIS HD Model							

Median housing value is contrasted in Table 16. Housing values within the George Washington analysis area are substantially below that of Virginia and substantially above that of West Va.. Housing values are determined principally by the extent of demand. Population and employment growth play a factor in the extent of demand for housing. Population growth in the analysis area was about seven percent less than Virginia's and 17 percent greater than West Va.'s in the 1980 decade; and about one percent greater than Virginia's and 13 percent greater than West Va.'s growth over the 1990 decade.

Despite the population increase in the 1990 decade housing in the forest analysis area was still $28,000 (in 2004 dollars) less than that of Virginia in 2000 (whereas in 1990 the gap was $25,000 (in 2004 dollars)). Within Virginia, the influence of many urban areas, where more high paying jobs are found, support higher priced housing. Population and wage and salary growth on the forest boundary counties would have to greatly increase to warrant significant increases in housing values. Botetourt County had the highest median home values of $143,500 in 2000. Monroe County, West Va. had the lowest value of $71,200.

Table 16: Median Housing Values

	1990 Median Value	1990 Med. Value in 2004 $'s	2000 Med. Value in 2004 $'s	2000 Med. Value in 2004 $'s	Real Avg. Rate of Change 1990 -2000*
GW NF*	$61,003	$88,454	$100,106	$110,117	5.1%
Virginia	$90,400	$131,080	$125,400	$137,940	3.3%
West Va.	$47,600	$69,020	$72,800	$80,080	4.3%

Source: U.S. Bureau of Census, USDA NRIS HD Model

*Real rates of increase were determined by inflating 1990 per capita income to 2000 with the Consumer Price Index Deflator

GW NF Boundary Counties Median Housing Values 1990 and 2000*									
County	1990 Value	1990 Housing Units	Weighted Average	1990 Value in 2004 $'s	2000 Value	2000 Housing Units	Weighted Average	2000 Value in 2004 $'s	Percent Real Change 1990 to 2000
VA, Alleghany County	$50,200	5,481	$275,146,200	$72,790	$77,500	5,812	$450,430,000	$85,250	4.44%
Covington city	$38,500	3,269	$125,856,500	$55,825	$52,500	3,195	$167,737,500	$57,750	3.15%
Total Alleghany Co.	$45,829	8,750	$401,002,700	$66,452	$68,632	9,007	$618,167,500	$75,495	4.12%
VA, Amherst County	$56,800	10,598	$601,966,400	$82,360	$88,800	12,958	$1,150,670,400	$97,680	4.57%
VA, Augusta County	$70,000	21,202	$1,484,140,000	$101,500	$110,900	26,738	$2,965,244,200	$121,990	4.71%
Staunton city	$61,200	10,003	$612,183,600	$88,740	$87,500	10,427	$912,362,500	$96,250	3.64%
Waynesboro city	$68,300	7,902	$539,706,600	$99,035	$89,300	8,863	$791,465,900	$98,230	2.72%
Total Augusta Co.	$29,455	39,107	$1,151,890,200	$42,710	$101,440	46,028	$4,669,072,600	$111,584	13.16%
VA, Bath County	$45,700	2,596	$118,637,200	$66,265	$79,700	2,896	$230,811,200	$87,670	5.72%
VA, Botetourt County	$72,900	9,785	$713,326,500	$105,705	$130,500	12,571	$1,640,515,500	$143,550	6.00%
VA, Frederick County	$89,700	17,864	$1,602,400,800	$130,065	$118,300	23,319	$2,758,637,700	$130,130	2.81%
Winchester city	$88,100	9,808	$864,084,800	$127,745	$108,900	10,587	$1,152,924,300	$119,790	2.14%
Total Frederick Co.	$89,133	27,672	$2,466,485,600	$129,243	$115,365	33,906	$3,911,562,000	$126,901	2.61%
VA, Highland County	$52,300	1,759	$91,995,700	$75,835	$83,700	1,822	$152,501,400	$92,070	4.81%
VA, Nelson County	$50,400	7,063	$355,975,200	$73,080	$95,100	8,554	$813,485,400	$104,610	6.56%
VA, Page County	$62,500	8,948	$559,250,000	$90,625	$86,300	10,557	$911,069,100	$94,930	3.28%
VA, Rockbridge County	$55,100	7,975	$439,422,500	$79,895	$92,400	9,550	$882,420,000	$101,640	5.31%
Buena Vista city	$42,900	2,494	$106,992,600	$62,205	$72,900	2,716	$197,996,400	$80,190	5.45%
Lexington city	$73,100	2,311	$168,934,100	$105,995	$131,900	2,376	$313,394,400	$145,090	6.08%
Total Augusta Co.	$55,974	12,780	$715,349,200	$81,162	$95,193	14,642	$1,393,810,800	$104,712	5.45%
VA, Rockingham County	$71,500	22,614	$1,616,901,000	$103,675	$107,700	27,328	$2,943,225,600	$118,470	4.18%
Harrisonburg city	$88,300	10,900	$962,470,000	$128,035	$122,700	13,689	$1,679,640,300	$134,970	3.34%
Total Rockingham Co.	$76,964	33,514	$2,579,371,000	$111,598	$112,706	41,017	$4,622,865,900	$123,977	3.89%
VA, Shenandoah County	$74,100	15,160	$1,123,356,000	$107,445	$99,400	16,709	$1,660,874,600	$109,340	2.98%
VA, Warren County	$85,000	11,223	$953,955,000	$123,250	$108,800	13,299	$1,446,931,200	$119,680	2.50%
WV, Hampshire County	$51,400	8,817	$453,193,800	$74,530	$78,300	11,185	$875,785,500	$86,130	4.30%
WV, Hardy County	$47,900	5,573	$266,946,700	$69,455	$74,700	7,115	$531,490,500	$82,170	4.54%
WV, Monroe County	$41,800	5,994	$250,549,200	$60,610	$64,700	7,267	$470,174,900	$71,170	4.47%
WV, Pendleton County	$53,700	4,516	$242,509,200	$77,865	$76,600	5,102	$390,813,200	$84,260	3.62%
Forest Weighted Average	**$61,003**	**213,855**	**$13,045,759,600**	**$88,454**	**$100,106**	**254,635**	**$25,490,601,700**	**$110,117**	**5.08%**
Virginia	**$90,400**			**$131,080**	**$125,400**			**$137,940**	**3.33%**
West Va.	**$47,600**			**$69,020**	**$72,800**			**$80,080**	**4.34%**
Source: U.S. Bureau of Census, USDA NRIS HD Model									
*Nominal data converted to 2004 $'s by the Consumer Price Index Price Deflators									

Economy's Diversity

Analyzing the major sectors of an economy allows insight into how diverse and what industries may be driving its growth. Manufacturing is the most significant part of the George Washington boundary county area economy. The table below shows the Manufacturing sector, which includes lumber and wood products, furniture, and pulp and paper products; and an estimate of the wild land recreation industry. Share percentages of manufacturing and wild-land recreation's labor income (employee compensation plus proprietors' income) and employment are given for 1990 and 2000. Recreation is not a sector of an economy but comprises several of the services and retail industries.

Table 17: Economic Diversity in 2004 $'s

	1990 Employment % of Total Economy	2000 Employment % of Total Economy	% Average Annual Change '90-'00	1990 Labor Income % of Total Economy	2000 Labor Income % of Total Economy	% Real Average Annual Change '90-'00
Total Manufacturing	20.3	19.4	1.6	29.9	27.1	2.3
Wood Products	1.5	1.5	2.4	1.7	1.8	3.6
Wood Furniture & Fixtures	0.6	0.3	-4.3	0.7	0.4	-2.2
Paper & Pulp Products	0.9	0.9	1.7	2.1	1.7	1.5
Wild land Rec.	NA	NA	NA	4.2	2.7	3.9

Total Economy*	264,778**	323,524**	2.0	$6,626.8**	$9,191.0**	3.9

Source: IMPLAN 1990 and 2000 Data
*Real rates of change were determined by inflating 1990 & 2000 data to 2004 with the Gross National Product Price Index Deflator
**Represents dollar totals for category
NA = Not Available

Table 17 helps explain the economy's diversity of the George Washington area economy. The composition of this economy did not change significantly over the 1990 decade. The industrial sector that changed the most was Services with its share of employment increasing 3.5 percent. Other sectors lost or gained share only marginally.

The largest share of the local economy was the Manufacturing sector with its employment share at 19.4 percent of the economy's employment in 2000. This share only decreased by 0.9 percent from 1990, while labor income's share declined by almost three percentage points from 1990 to 2000. The George Washington's manufacturing share is relatively small for a rural area---more in line with the national average of about 18-19 percent.

Of the wood-manufacturing sector, wood products had a 1.8 percent share of the local economy's labor income in 2000. This is a 0.1 percent increase in percent share from 1990. The share of employment at 1.5 percent remained the same in both time periods.

Furniture and fixtures represented 0.4 percent of the local economy's labor income and 0.3 percent of its employment in 2000. Both employment and labor income decreased in growth by 0.3 percent from 1990.

Pulp and paper products in the George Washington counties lost share in labor income while employment's share showed no change over the 1990's decade. By 2000 employment share was slightly less than one percent of the economy while labor income was slightly less than two percent. While both employment and labor income shares decreased over the 1990 decade, there was actually an increase in jobs and income in these industries from 1990. This occurrence is most likely explained by productivity enhancements.

Wild-land recreation, which includes federal and state recreation areas, had an estimated 2.7 percent share of the total labor income of the George Washington area economy in 2000. While the wild-land share of the economy decreased for labor income from 1990, the actual dollar amount increased. This apparent inconsistency is explained by the fact that the total economy grew faster than the industries attributed to wild-land recreation. There are no estimates of employment for recreation.

Other than the slight decrease in importance of manufacturing, the composition of other sectors of the area economy has not changed greatly from 1990. Services increased from 20.7 to 24.2 percent in 2000 as measured by employment change, or a 3.6 percent annual increase. Other sector share changes include Wholesale and retail sales' employment change of 2.6 percent per year (changing from a 19.5 percent to 20.5 percent share), and Government whose share decreased slightly from 14.0 percent to 12.9 percent over the decade.

The entire economy's labor income grew at an average annual rate of 3.3 percent over the 1990 decade (based in constant 2004 dollars). Thus, the local economy has changed modestly in the last 10 years with services sector with the most change. The economy's main drivers are Manufacturing, Services and Wholesale and Retail Trade.

Aggregated Local Economy for GW NF — 1990 & 2000 Data; Primary Effects					
Copyright MIG 2003	Total	Percentage	Total		Percent
	Value Added*	of Total	Value Added*	Percentage	Annual Change
Industry	1990	1990	2000	of Total	1990-2000
Other Agriculture	$581.6	6.3%	$486.9	3.2%	-1.8%
Range	$47.5	0.5%	$65.8	0.4%	3.3%
Total Agriculture	$629.1	6.8%	$552.7	3.6%	-1.3%
Minerals	$94.7	1.0%	$59.6	0.4%	-4.5%
Construction	$462.6	5.0%	$940.5	6.2%	7.4%
Other Manufacturing	$2,405.5	26.2%	$2,824.1	18.6%	1.6%
Wood Products	$71.3	0.8%	$120.7	0.8%	5.4%
Pulp & Paper	44.670	0.5%	$79.3	0.5%	N/M
Furniture & Fixtures	$30.4	0.3%	$9.9	0.1%	0.0%
Total Wood Based Industries	$146.4	1.6%	$209.9	1.4%	3.7%
Total Manufacturing	$2,551.9	27.8%	$3,034.0	20.0%	1.7%
Transportation & Public Utilities	$1,172.2	12.8%	$1,524.0	10.0%	2.7%
Wholesale & Retail Trade	$1,319.9	14.4%	$3,390.4	22.3%	9.9%
Finance, Insurance, Real Estate	$1,181.6	12.9%	$2,150.7	14.1%	6.2%
Services	$1,210.8	13.2%	$2,097.6	13.8%	5.6%
Government	$545.5	5.9%	$1,443.9	9.5%	10.2%
Other Misc.	$18.2	0.2%	$9.8	0.1%	N/M
Totals	9186.5	100.0%	$15,203.2	100.0%	5.2%

Another way to indicate diversity of an economy is with the Shannon-Weaver Entropy Indexes of diversity. This process allows a relative measure of how diverse a county or a group of counties are with a single number. The entropy method measures diversity of a region against a uniform distribution of employment where the norm is equal-proportional employment in all industries. All indices range between 0 (no diversity) and 1.0 (perfect diversity). These two extremes would occur when there is only one industry in the economy (no diversity) and when all industries contribute equally to the region's employment (perfect diversity). In most cases diversity would be registered somewhere between 0 and 1.0. Another factor affecting the magnitude of the index is the number of industries in a local economy; the greater number the larger the index. Diversity is important because a diverse economy is less susceptible to harsh economic contractions either national or local.

The following table contrasts the change in diversity from 1990 to 2000 at the four digit SIC, or at the individual industry level. For a point of reference Virginia and West Va. serves as comparison guide.

Table 18: Shannon-Weaver Entropy Indexes

	1990 Index	2000 Index	Percent Change
GW NF*	.60128	.60883	1.17
Virginia	.70796	.70342	-0.64
West Va.	.69591	.69607	0.02

Source: USDA Forest Service, Information Monitoring Institute
*Weighted Average Estimate of Aggregated Counties. Weight is based on full-time and part-time employment in State's respective years.

The indexes measuring diversity indicate significantly more diversity in both states than in the analysis area during the 1990-decade. In 1990 the George Washington area had an index of .60128 versus Virginia's .70796 and West Va.'s .69591. However, the gap between the forest and the two states

changed little from 1990 to 2000. In 2000, while Virginia's diversity decreased by about 0.6 percent and West Va.'s remained essentially flat from 1990, the forest has increased nearly .08 or a 1.17 percent. Because the analysis area is comprised of only 17 counties, a less diverse condition can be expected versus a larger area, such as Virginia and West Va., which have more varied characteristics.

GW NF Boundary Counties Shannon-Weaver Entrophy Indicies*							
County	1990_4_Digit	1990 Employment**	Weighted Average	2000_4_Digit	2000 Employment**	Weighted Average	1990 – 2000 Percent Change
Alleghany + Covington	0.50222		6,258	0.56055		6,870	11.62%
Covington city	0.53355			0.52905			
Average for Alleghany Co.	0.51788	12,083		0.54480	12,610		5.20%
Amherst	0.56065	12,470	6,991	0.60047	13,159	7,902	7.10%
Augusta, Staunton + Waynesboro	0.61916		33,499	0.63608		38,889	2.73%
Staunton city	0.62946			0.60111			
Waynesboro city	0.58078			0.64586			
Average for Augusta Co.	0.60980	54,934		0.62768	61,957		2.93%
Bath	0.48622	2,864	1,393	0.46238	3,081	1,425	-4.90%
Botetourt	0.61812	7,542	4,662	0.64184	12,567	8,066	3.84%
Frederick + Winchester	0.61429		27,868	0.64403		36,093	4.84%
Winchester city	0.63373			0.60259			
Average for Frederick Co.	0.62401	44,659		0.62331	57,905		-0.11%
Highland	0.52655	1,306	688	0.57569	1,373	790	9.33%
Nelson	0.57614	4,607	2,654	0.58928	5,101	3,006	2.28%
Page	0.59040	8,564	5,056	0.60992	9,977	6,085	3.31%
Rockbridge, Buena Vista + Lexington	0.57543		8,934	0.55928		10,015	-2.81%
Buena Vista city	0.56963			0.52694			
Lexington city	0.56944			0.53166			
Average for Rockbridge Co.	0.57150	15,632		0.53930	18,570		-5.63%
Rockingham + Harrisonburg	0.60583		33,761	0.60417		42,566	-0.27%
Harrisonburg	0.63247			0.61647			
Average for Rockingham Co.	0.61915	54,528		0.61032	69,744		-1.43%
Shenandoah	0.63747	17,359	11,066	0.64092	19,743	12,654	0.54%
Warren	0.62415	10,153	6,337	0.64083	13,860	8,882	2.67%
Hampshire	0.58224	5,770	3,360	0.63118	6,774	4,276	8.41%
Hardy	0.50590	5,550	2,808	0.48865	7,770	3,797	-3.41%
Monroe	0.60589	3,791	2,297	0.58105	4,304	2,501	-4.10%
Pendleton	0.54430	3,636	1,979	0.59086	3,645	2,154	8.55%
Forest Boundary Counties Weighted Average	**0.60128**	**265,448**	**159,609**	**0.60833**	**322,140**	**195,969**	**1.17%**
Virginia	**0.70796**			**0.703418**			**-0.64%**
West Va.	**0.69591**			**0.696076**			**0.02%**
*Employment data from BEA is not available for each individual Census region in Virginia. Data is collected by total county count. Weighted average for each city in county is not possible because of this, so a simple average of indexes is performed for the index for the county total. Weighted average is taken from the resulting average index times the total employment for the county to get an average for the forest boundary counties.							
**Source: U.S. BEA, REIS, Fulltime and Part Time Employment							

As indicated by the analysis above of the George Washington boundary counties cumulative economy, the overall change during the 1990-decade was modest. In 2000 this economy was moderately diversified.

Economy's Trade

A principle way an economy grows is by export of goods and services. Most typically, manufacturing activity is thought of as providing most of this export related activity. However, services and retail trade can be considered "export" industries if significant visitors come in from outside in travel related activities to bring in new dollars to an economy. A manufacturing industry can be a net importer if it imports more of a commodity or service than it exports.

The chart below compares the exporting characteristics of the GW NF analysis area for 1990 and 2000.

Table 19: Exporting of Selected Industries in millions of 2000 dollars

	1990 Net Exports*	2000 Net Exports
Wood Furniture & Fixtures	$2.5	$12.5
Paper & Pulp Products	$459.8	$491.4
Wood Products	$0.0	$160.5
Total Manufacturing	$965.4	$1,817.1
Total of All Sectors	-$1,463.3	-$2,860.6

Source: IMPLAN 1990 and 2000 Data
*1990 Dollars Converted to 2000 Dollars via GDP Price Deflator; in millions of dollars

The data in Table 19 shows that the George Washington's local economy increased its net importing characteristic in 2000 by almost double from 1990. The 1990 decade saw the total economy's reliance on imports increase tremendously, thereby becoming more reliant on outside areas for its goods and services production. Such a characteristic caused dollars to leak out of the economy faster (and hence reduce having a greater multiplier capability) than if the economy were a net exporting one.

Meanwhile, all three segments of the Wood Products manufacturing showed net exporting increases. Total manufacturing also gained a significant share in net exporting, by almost doubling its amount in 1990. Other than Construction, Manufacturing, and Minerals, all other major sectors showed an increase of net imports from 1990.

Summary of GW NF Commodity Trade										
	1990 Exports				1990 Imports				1990 Net Exports	2000 Net Exports
	2000 $'s		2000 Exports		2000 $'s		2000 Imports		Exports Less Imports	Exports Less Imports
	(Million $'s)	% of Total	(Million $'s)	% of Total	(Million $'s)	% of Total	(Million $'s)	% of Total	(Million $'s)	(Million $'s)
Other Agriculture	$185.6	2.8%	$298.1	2.5%	$332.1	4.1%	$407.1	2.8%	-$146.5	-$109.0
Range	$167.9	2.5%	$79.1	0.7%	$47.9	0.6%	$6.3	0.0%	$120.0	$72.8
Total Agriculture	$353.5	5.3%	$377.2	3.2%	$380.0	4.6%	$413.5	2.8%	-$26.5	-$36.3
Minerals	$30.5	0.5%	$147.7	1.2%	$207.8	2.5%	$115.3	0.8%	-$177.3	$32.4
Construction	$149.6	2.2%	$233.4	2.0%	$0.1	0.0%	$3.3	0.0%	$149.6	$230.1
Lumber & Wood Products	$143.1	2.1%	$343.9	2.9%	$143.0	1.7%	$183.5	1.2%	$0.0	$160.5
Furniture & Fixtures	$55.0	0.8%	$41.5	0.4%	$52.5	0.6%	$29.0	0.2%	$2.5	$12.5
Pulp & Paper Products	$564.5	8.4%	$941.7	8.0%	$104.7	1.3%	$450.3	3.1%	$459.8	$491.4
Total Wood Products	$762.6	11.4%	$1,327.1	$0.1	$300.2	3.7%	$662.8	4.5%	$462.3	$664.3
Other Manufacturing	$3,971.3	59.1%	$7,947.3	67.1%	$3,468.3	42.4%	$6,794.5	46.2%	$503.0	$1,152.8
Total Manufacturing	$4,733.9	70.5%	$9,274.4	78.3%	$3,768.6	46.1%	$7,457.3	50.7%	$965.4	$1,817.1
Transportation, & Utilities	$161.7	2.4%	$138.4	1.2%	$709.5	8.7%	$1,000.8	6.8%	-$547.8	-$862.5
Wholesale & Retail Trade	$289.4	4.3%	$279.6	2.4%	$510.0	6.2%	$1,308.3	8.9%	-$220.6	-$1,028.8
Finance, Insurance, Real Estate	$367.5	5.5%	$581.4	4.9%	$1,059.8	13.0%	$1,827.8	12.4%	-$692.3	-$1,246.4
Services	$459.0	6.8%	$720.9	6.1%	$1,294.4	15.8%	$2,220.1	15.1%	-$835.4	-$1,499.1
Government	$88.5	1.3%	$4.5	0.0%	$53.6	0.7%	$42.8	0.3%	$34.9	-$38.3
Other Misc.	$83.0	1.2%	$81.6	0.7%	$196.3	2.4%	$310.5	2.1%	-$113.3	-$228.9
Total	$6,716.8	100.0%	$11,839.0	100.0%	$8,180.0	100.0%	$14,699.7	100.0%	-$1,463.3	-$2,860.6
In Millions of 2000 $'s										

In summary, the George Washington area economy became more reliant on imports during the 1990's. More dollars, therefore, flowed out of the economy than flowed in, decreasing the ability of enhancement of further economic activity through the multiplier effect. However, manufacturing including wood based industries were a net exporter of manufacturing goods, providing "new" monies for the local economy.

Federal Payments

The Payments in Lieu of Taxes (PILT) program is administered by the Bureau of Land Management. PILT payments are made to local governments that have federal lands within their borders to compensate for loss of property tax revenues. If the Forest Service's Payments to States funds from timber harvesting, mining, and recreation do not cover at least $1.75 per acre, PILT will make up the shortfall.

Trends in Payments to States and PILT are important to show a possible erosion of an area's tax base. The chart below shows the aggregated forest county changes from various years for data that was common between the two sources (all data has been updated to 2004 dollars).

Table 20: Payments to States Funds in $000 of 2004 $'s

	1985	1998	2004	Annual Avg. Percent Change
GW NF	$530.0	$699.0	$834.6	3.3
Virginia	$735.7	$730.9	$898.7	1.4
West Va.	$540.1	$2,060.8	$1,916.9	9.5

Source: USDA Forest Service
Data adjusted to 2004 Dollars via Gross Domestic Price Deflator

County revenues from the Forest Service have been variable since 1985, the first year of available data for Payments to States. The variation reflects predominantly national forest timber sales in each county. For the forest as a whole, real prices (inflation adjusted prices) have increased since 1985 by 3.3 percent per year. Meanwhile, Payments to States in total for Virginia and West Va. have increased 1.4 and 9.5 percent per year, respectively. The George Washington's share of Virginia and West Va. total payments has varied from almost 42 percent in 1985, to 25 percent in 1998, to almost 30 percent in 2004.

Most payments over the years shown went to Pendleton County, WV, which contains the fifth most national forest acreage. The next highest recipient has been Augusta County, which received not quite one-half the amount of Pendleton in 2004.

At the same time, PILT funds have increased to help offset somewhat the large acreage federal ownership of these counties' lands. While the magnitude of PILT payments is somewhat smaller than Payments to States, PILT payments have tended to increase over time as timber harvests have decreased on the GW NF. Inflation adjusted payments in the George Washington analysis area have grown from $904,486 in 1991 to $1,479,135 in 2004, a 4.2 percent real average annual increase. This rate of increase was in the middle of the PILT payment increase in the state of Virginia and West Va. over this period, 3.9 and 4.4 percent, respectively. Historically, PILT payments to George Washington National Forest boundary counties totaled about a third of the payments to Virginia and West Va. combined.

Table 20: Payments in Lieu of Taxes (000 of 2004 $'s)

	1991	1998	2004	Annual Avg. Percent Change
GW NF	$904.5	$839.5	$1,479.1	4.2
Virginia	$1,528.7	$1,343.0	$2,431.6	3.9
West Va.	$1,003.0	$999.2	$1,689.5	4.4

Source: U.S. Dept. of Interior
Data adjusted to 2004 Dollars via Gross Domestic Price Deflator

GW NF Boundary Counties Payments to States (000 of 2004 $'s* **)																		
GDP Deflator	1.57	1.53	1.49	1.44	1.39	1.33	1.29	1.26	1.23	1.2	1.18	1.15	1.13	1.12	1.04	1.02		
County Name	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**2002**	**2003**	**2004**	**Change 1985-1998**
VA, Alleghany County	$57.9	$51.1	$45.0	$52.0	$45.2	$41.8	$59.0	$70.3	$100.4	$106.2	$87.4	$82.5	$92.1	$62.8	$0.0	$0.0	$80.4	2.4%
VA, Amherst County	$22.8	$20.0	$17.7	$20.4	$18.3	$16.9	$24.0	$28.6	$40.8	$43.2	$35.5	$33.6	$37.5	$25.6	$32.9	$32.8	$32.6	2.6%
VA, Augusta County	$78.5	$69.2	$60.8	$70.3	$62.3	$57.5	$81.3	$96.9	$138.3	$146.3	$120.4	$113.7	$127.0	$86.8	$111.8	$111.3	$110.5	2.5%
VA, Bath County	$72.2	$63.6	$56.0	$64.7	$55.3	$51.1	$72.1	$85.9	$122.8	$129.8	$106.8	$101.0	$112.8	$76.9	$99.9	$99.5	$98.7	2.3%
VA, Botetourt County	$38.5	$26.2	$28.9	$24.9	$33.4	$38.8	$29.5	$41.6	$40.7	$56.8	$45.5	$42.3	$32.5	$35.5	$43.8	$43.3	$43.0	0.8%
VA, Frederick County	$1.9	$1.7	$1.5	$1.7	$1.7	$1.5	$2.1	$2.4	$3.4	$3.7	$3.1	$2.9	$3.3	$2.1	$2.8	$2.8	$2.8	2.8%
VA, Highland County	$23.6	$20.7	$18.2	$21.0	$18.6	$17.2	$24.1	$28.9	$41.2	$43.6	$35.9	$33.8	$37.9	$25.8	$33.3	$33.1	$32.9	2.4%
VA, Nelson County	$6.3	$5.5	$4.9	$6.3	$5.3	$5.7	$8.0	$9.6	$13.8	$14.6	$12.0	$11.4	$12.8	$8.7	$10.7	$10.7	$10.6	3.8%
VA, Page County	$11.1	$9.9	$8.6	$9.9	$8.6	$8.0	$11.2	$13.4	$19.2	$20.3	$16.6	$15.8	$17.6	$12.0	$15.5	$15.5	$15.4	2.3%
VA, Rockbridge County	$29.5	$23.6	$22.5	$23.3	$23.9	$24.7	$26.7	$33.9	$42.3	$48.8	$39.9	$37.3	$37.1	$29.5	$0.0	$0.0	$37.2	1.7%
VA, Rockingham County	$57.0	$50.3	$44.4	$51.1	$44.5	$41.1	$58.1	$69.3	$98.9	$104.5	$86.0	$81.3	$90.9	$61.9	$80.2	$79.8	$79.2	2.4%
VA, Shenandoah County	$31.6	$28.0	$24.6	$28.5	$24.0	$22.3	$31.5	$37.5	$53.5	$56.6	$46.6	$44.0	$49.2	$33.6	$0.0	$0.0	$43.1	2.3%
VA, Warren County	$2.5	$2.3	$2.1	$2.3	$1.9	$1.9	$2.6	$3.2	$4.4	$4.7	$3.9	$3.7	$4.1	$2.8	$0.0	$0.0	$0.0	-100.0%
WV, Hampshire County	$0.9	$0.8	$0.7	$0.9	$1.1	$1.1	$1.4	$1.8	$2.5	$2.6	$2.1	$2.1	$2.3	$1.6	$2.1	$2.1	$2.1	5.8%
WV, Hardy County	$20.1	$17.6	$15.6	$18.0	$16.5	$15.2	$21.5	$25.7	$36.7	$38.8	$31.9	$30.1	$33.7	$23.0	$33.6	$33.2	$33.0	3.6%
WV, Monroe County	$9.6	$6.1	$7.0	$5.8	$8.3	$10.0	$7.0	$10.2	$9.2	$13.2	$10.5	$9.7	$6.9	$8.3	$0.0	$0.0	$11.6	1.4%

GW NF Boundary Counties Payments to States (000 of 2004 $'s* **)																		
GDP Deflator	1.57	1.53	1.49	1.44	1.39	1.33	1.29	1.26	1.23	1.2	1.18	1.15	1.13	1.12	1.04	1.02		
County Name	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**2002**	**2003**	**2004**	**Change 1985-1998**
WV, Pendleton County	$66.1	$110.6	$73.3	$100.4	$100.9	$117.7	$129.9	$164.7	$115.4	$182.6	$222.9	$193.0	$227.0	$202.0	$205.8	$203.4	$201.8	8.3%
Forest Total	$530.0	$507.2	$432.0	$501.6	$470.0	$472.3	$589.9	$723.7	$883.4	$1,016.4	$907.1	$838.0	$924.5	$699.0	$672.4	$667.6	$834.6	3.3%
Virginia	$735.7	$566.9	$560.1	$560.0	$610.8	$649.3	$651.6	$845.0	$1,009.8	$1,200.1	$976.7	$913.3	$870.8	$730.9	$643.4	$638.7	$898.7	1.4%
West Va.	$540.1	$1,054.6	$680.0	$954.7	$986.1	$1,184.0	$1,262.1	$1,623.9	$980.6	$1,714.1	$2,218.5	$1,899.9	$2,246.3	$2,060.8	$1,900.0	$1,878.4	$1,916.9	9.5%
Forest as a % of																		
Virginia & W. Virginia	41.55%	31.28%	34.83%	33.11%	29.43%	25.76%	30.83%	29.32%	44.38%	34.88%	28.39%	29.79%	29.66%	25.04%	26.44%	26.52%	29.64%	
Source: NRIS Human Dimensions Model and USDA Forest Service Web Site																		
**1999 - 2001 data not available																		
*Deflated by GNP Price Deflator																		

GW NF Boundary Counties PILT Payments 1991-2004*														
GNP Deflator	1.29	1.26	1.23	1.2	1.18	1.15	1.13	1.12	1.11	1.08	1.06	1.04	1.02	
County	**1991 Funds 2004 $**	**1992 Funds 2004 $**	**1993 Funds 2004 $**	**1994 Funds 2004 $**	**1995 Funds 2004 $**	**1996 Funds 2004 $**	**1997 Funds 2004 $**	**1998 Funds 2004 $**	**1999 Funds 2004 $**	**2000 Funds 2004 $**	**2001 Funds 2004 $**	**2002 Funds 2004 $**	**2003 Funds 2004 $**	**Real Average Increase 1991-2001**
VA, Alleghany County	$93,307	$91,825	$72,322	$70,703	$66,906	$63,845	$78,076	$85,603	$85,856	$137,598	$151,491	$148,633	$161,822	**5.4%**
VA, Amherst County	$28,660	$28,157	$20,450	$20,380	$18,177	$17,959	$33,412	$17,407	$26,569	$44,434	$49,697	$48,759	$45,077	**3.9%**
VA, Augusta County	$138,203	$136,786	$109,668	$106,707	$102,402	$97,002	$120,482	$123,327	$129,120	$204,488	$223,999	$219,773	$213,822	**3.8%**
VA, Bath County	$114,281	$94,407	$70,335	$72,447	$69,334	$78,243	$78,980	$105,200	$89,606	$157,904	$185,735	$182,231	$151,133	**2.4%**
VA, Botetourt County	$50,329	$41,212	$49,199	$41,453	$51,927	$41,085	$48,866	$53,944	$60,313	$79,543	$87,843	$86,186	$87,819	**4.9%**
VA, Frederick County	$3,243	$3,192	$2,515	$2,467	$2,332	$2,224	$2,747	$3,014	$2,937	$4,731	$5,236	$5,138	$4,900	**3.6%**

VA, Highland County	$34,713	$34,189	$26,275	$25,829	$24,007	$23,130	$32,057	$29,128	$32,047	$52,031	$57,590	$56,503	$53,671	**3.8%**
VA, Nelson County	$20,208	$17,601	$14,365	$13,826	$13,674	$12,698	$14,604	$15,735	$16,137	$24,940	$26,993	$26,484	$26,837	**2.4%**
VA, Page County	$53,864	$52,744	$48,186	$45,674	$47,630	$43,270	$45,431	$47,652	$49,022	$71,720	$75,849	$74,418	$81,469	**3.6%**
VA, Rockbridge Cnty	$42,250	$38,826	$35,799	$33,610	$35,680	$31,511	$38,478	$41,474	$43,903	$65,010	$71,741	$70,387	$78,063	**6.1%**
VA, Rockingham Cnty	$127,324	$125,035	$105,015	$101,264	$100,153	$93,426	$108,265	$113,780	$116,463	$179,981	$195,141	$191,459	$191,327	**3.5%**
VA, Shenandoah Cnty	$49,263	$48,461	$38,061	$37,233	$35,169	$33,629	$41,654	$44,850	$45,471	$72,937	$80,305	$78,789	$85,780	**5.4%**
VA, Warren County	$19,533	$18,881	$17,556	$16,348	$16,480	$14,808	$15,240	$15,733	$16,254	$23,650	$24,832	$24,363	$27,131	**3.3%**
WV, Hampshire Cnty	$2,625	$2,410	$3,246	$3,038	$3,291	$2,934	$2,884	$2,951	$3,080	$4,291	$4,431	$4,347	$4,882	**5.4%**
WV, Hardy County	$38,590	$35,435	$47,736	$44,682	$48,398	$43,161	$42,462	$43,421	$45,371	$63,398	$65,459	$64,224	$72,126	**5.4%**
WV, Monroe County	$15,108	$14,081	$18,543	$17,350	$18,775	$16,761	$16,456	$16,848	$17,586	$24,493	$25,281	$24,804	$27,856	**5.3%**
WV, Pendleton County	$72,984	$60,750	$71,271	$69,002	$93,349	$73,034	$70,344	$79,437	$78,918	$115,868	$135,189	$132,638	$128,118	**4.9%**
Forest Total	$904,486	$843,990	$750,544	$722,012	$747,681	$688,718	$790,437	$839,503	$858,653	$1,327,018	$1,466,812	$1,439,136	$1,441,833	**4.2%**
Virginia	$1,528,651	$1,388,790	$1,362,514	$1,157,409	$1,262,490	$1,102,509	$1,257,168	$1,342,957	$1,436,223	$2,074,503	$2,276,181	$2,233,235	$2,342,625	**3.9%**
West Va.	$1,003,000	$931,802	$1,141,823	$1,022,072	$1,127,116	$991,651	$967,408	$999,176	$1,036,385	$1,448,172	$1,515,851	$1,487,250	$1,652,767	**4.4%**
Forest as a % of Va. & WV	35.7%	36.4%	30.0%	33.1%	31.3%	32.9%	35.5%	35.8%	34.7%	37.7%	38.7%	38.7%	36.1%	
		Source: NRIS Human Dimensions Model and USDI Bureau of Land Management Web Site												
		*Deflated by GNP Price Deflator												

Summary of Social and Economic Trends

National and local socioeconomic trends influence the ability of communities to adapt to changing circumstances. Trends identified in secondary and primary data analysis for the GW NF include demography, economy, attitudes, beliefs, and values.

Population growth in the 1980's and 1990's occurred at a relatively rapid, yet uneven, rate among the 17 counties. The area as a whole grew about 9 percent in the 1980's and 16 percent in the 1990's. These rates of growth were much less than Virginia and much more than West Va. in the 1980's and about one percent more than the Virginia in the 1990's. West Va. had negative growth in the 1980's and less than one percent growth in the 1990's. The population is expected to grow by another 11, 11.5 and five percent from 2000 to 2010 for the forest, Virginia and West Va., respectively.

The analysis area's rural characteristic decreased by about 4 percentage points to 66.4 percent from 1980 to 1990; and another 9 percent from 1990 to 2000, making the rural share about 58 percent in 2000. These counties have seen a moderate urbanization over the last 20 years. Urban growth means that demands on recreation resources as well as for land development have increased.

Virginia as a whole has maintained a rather steady share racial and ethnic population characteristics for the past 20 years. The black share of the state has remained at about 19 percent over the 1980, 1990, 2000 period. Meanwhile, the Hispanic population has increased from about two to a five percent share over this period. West Va.'s share of white, black and Hispanic has remained almost the same over these three census periods. The forest has changed little from 1980 to 2000. Hispanics, however, have gone from 0.6 to 2.3 percent in this 20 year period. There is about a five percent share of blacks which has remained essentially the same over these years. A recent increase in Hispanic residents to over two percent share in 2000 and an influx of Hispanic immigrants into the U.S over the last several years may translate into changes in community attitudes, values, and beliefs concerning forest management and recreation preferences.

The lack of dynamic changes in community culture, lifestyles, local economies, and social structures may result in few changes that cause social disruptions or tensions about new residents, new economic activities, or changes in forest management policies.

Current attitudes, beliefs, and values concerning forest management were gathered during a telephone survey conducted by the USFS Southern Research Station. A general summary of the findings gives insight to attitudes toward national forest management. Area residents participate in outdoor activities; the majority prefers viewing nature via walking or driving, and picnicking.

The George Washington survey showed forest management activities that are most ^important to the respondents included maintaining stream quality, providing habitat for fish and wildlife, and leave the forest in its natural appearance.

The public was also asked questions about their perceptions of the most important management activities on public lands. The largest share of the public's responses gave preference to forest management objectives that provide water sources, protect old growth forests, protect habitats, provide trail systems for non-motorized recreation, and open areas for wildlife. The survey indicated that the local public has a fairly strong environmental conservation leaning. While extraction of natural resources is not completely discounted by the public, preservation and provision of wildlife and recreation services are highly desired.

The GW NF boundary counties' economic health, as measured by per capita income, grew at a rate similar to that of Virginia's and slightly slower than West Va.'s during the 1990's. When considering the real rate of growth (inflation adjusted dollars to 2004), the forest impact area grew at 1.4 percent per year over the 1990 decade; compared with the Virginia's growth of 1.5 percent and West Va.'s 1.7 percent per year. Still, per capita income in 2000 was only about $5,900 less than that of the Virginia and $2,300 more than West Va.'s.

The George Washington analysis area's unemployment rate decreased from 5.3 percent to 3.5 percent from 1995 to 1998, to 3.1 percent in 2001. The rate in 2001 was less than the rate of Virginia, 3.5 percent, and West Va., 4.9 percent. Increasing income growth for the forest area, as well as normal unemployment rates, indicates the area is relatively strong economically. People with strong incomes and jobs are more likely to have free time and need an outlet for recreation. The national forest is a prime outlet for these people.

The George Washington impact area had poverty rates which declined slightly from 1980 to 2000. The share of individuals living in poverty in 2000 was about 11 percent. This was slightly over one percent more than Virginia's and seven percent less than West Va.'s.

Transfer payments in the George Washington analysis area showed a 4.6 percent increase in average annual real rate of growth from 1970 to 2003, similar to that of Virginia, but much less than West Va., 4.9 and 3.8, respectively. The GW NF transfer payment growth gives the local economies added economic support.

Percentage of female head of households was lower than either state's percentage in the analysis area. In 2000, the GW NF was 2.4 percent below Virginia's 8.1 and 0.9 percent below West Va.'s 6.6 percent of all households---indicating a potential lesser degree of hardship at the local level.

The services and manufacturing sectors are a significant source of employment in the analysis area accounting for 24 and 19 percent, respectively, of the employment in 2000. The economy's main drivers, in the labor income area, are services and manufacturing as well. Employment in the services sector, which includes lumber and wood products, has the highest share of any other sector in the economy. Its share increased from 1990. Manufacturing, meanwhile, decreased its share slightly by about one percent from 1990. The area as a whole has become slightly more diverse over the 1990 decade. As indicated by the Shannon-Weaver Entropy indexes, over the 1990's decade the George Washington analysis area increased its diversity while that of Virginia decreased marginally and West Va.'s was essentially flat. Still the forest area had an index reading that was about 10 percent less than both of the states. These indexes indicate that overall, the local economy is significantly less diverse than the states' economies---making the area more reliant on other areas to furnish the goods and services needed in these forest counties.

Thus, the economy and demography of this area appears to be relatively healthy. Population has grown steadily in the 1990's; poverty has decreased. Housing construction is vigorous. The economy's composition has changed only marginally in the last decade. It has become more reliant on importation of goods and services. Other than manufacturing, the local economy is producing less of its own goods and services for export, resulting in a loss of the ability of a dollar to multiply in the spending stream before it leaks out of the economy. The analysis area has a fairly diverse economy with resilient characteristics that may allow it to weather downturns in the economy. For the George Washington analysis area, most of the economic and demographic variables looked at in this overview were comparable with those of Virginia, but several deviated from those of West Va.---a state that has some economic and non-growth issues.

Population diversity was considerably less than Virginia's and about on par with West Va.'s. Except for housing values and per capita income which were below Virginia's levels, most social and economic characteristics looked at in this overview seem to be on par with that of Virginia.

APPENDIX D. Climate Change Trends and Strategies for the George Washington National Forest

Overview

For the George Washington National Forest and much of the southeastern United States, climate variability and weather events such as strong winds and heavy rains from hurricanes, droughts, heat waves, episodes of warm winters, floods, ice storms, and lightning storms have long been part of the natural environment. From a climate perspective, the southeast has some of the warmest temperatures, generally receives more rainfall than any other region, and experiences many extreme climate events (U.S. Global Change Research Program 2001).

These climate variables and associated disturbances have always influenced the makeup and geographical distribution of many ecological communities and landscapes across the South. However, the increasing changes in climate and disturbances projected for the future are expected to lead to substantial alterations in our forests and the services they provide (U.S. Climate Change Science Program, 2008a). The International Panel on Climate Change (IPCC 2007) has identified future impacts of temperature warmings, changes in precipitation, extreme weather events, severe droughts, earlier snowfall, rising sea levels and other changes that could significantly affect forest ecosystems. The complex interaction of all of these factors is shown in Figure X. The Forest Service has identified climate change as 'one of the greatest challenges to sustainable management of forests and grasslands and to human well-being that we have ever faced, because rates of change will likely exceed many ecosystems' capabilities to naturally adapt' (Forest Service Strategic Framework for Responding to Climate Change, 2008).

In light of the importance of this emerging issue, new management strategies are being considered for forest ecosystems across the South. Some of the challenges facing national forests in developing strategies for addressing climate change are the uncertainties about the direction of change, especially at local levels, and how different ecosystems will respond to future natural and human-induced pressures. Forest Service scientists have been studying various aspects of climate change on forests for many years. Yet, our knowledge of how plants and ecosystems respond to the threats of a changing climate and how to react appropriately at local levels where management actions are most effective is still very limited (Solomon 2008). Uncertainties about outcomes will require flexibility, and land management strategies based on current or historical conditions will need to be adjusted or replaced with approaches that support adaptation to changing conditions (USDA Forest Service, October 2008).

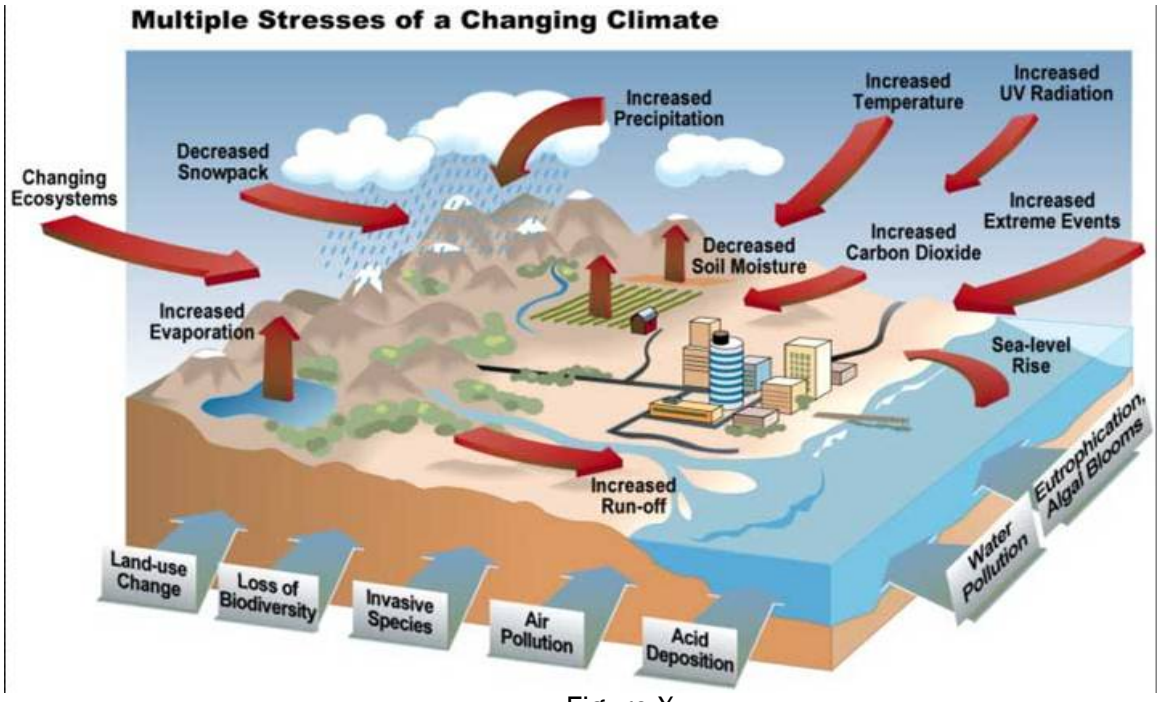


Figure X.

In developing management strategies to deal with a changing climate, it has been recognized that forests can play an important role in both mitigating and adapting to climate change. Mitigation measures focus on strategies such as carbon sequestration by natural systems, ways to increase carbon stored in wood products, ways to provide renewable energy from woody biomass to reduce fossil fuel consumption, and ways to reduce environmental footprints. Adaptation measures address ways to maintain forest health, diversity, productivity, and resilience under uncertain future conditions. Adaptation and mitigation activities must also complement each other and balance with other ecosystem services (USDA Forest Service, October 2008).

Forest Service research activities in the coming years are expected to help both public and private land managers better understand changing conditions and determine appropriate management approaches for both adaptation and mitigation. The global change research approach that will guide Forest Service Research and Development for the next decade will not only address enhanced ecosystem sustainability (adaptation) and increased carbon sequestration (mitigation) but will also provide decision support models for land managers and facilitate scientific collaboration and technology transfer (USDA Forest Service 2008).

At this time, the science of climate change modeling is at the stage of stepping down global models to regional scales (Davis 2007), so a combination of national projections, regional-level climate trends for the southeastern United States, and a recent report prepared for the state of Virginia provides the most reliable context for describing expected climate changes and impacts for the George Washington National Forest. Specifics regarding many mitigation measures, such as the appropriate calculations for carbon offsets and how to consider carbon sequestration rates, are still being developed, so most of our focus at the forest level for now will be on using management options to improve resilience and adaptability of

native ecosystems under changing conditions. Then, over the 15-year life of the Plan, as issues are better understood and appropriate measures are identified, climate change strategies can be adjusted through the adaptive management process.

National Climate Change Trends and Expectations

Warming temperatures, altered precipitation patterns, rising sea levels, and increases in the number and intensity of extreme weather events are already causing observed ecological responses across the United States (U.S. Climate Change Science Program, 2008a). Although there are variations by region, overall temperatures across the nation warmed during the 20th century, with 11 of the 12 years from 1995-2006 among the warmest since instrumental record keeping was started in 1850 (U.S. Climate Change Science Program, 2008b; IPCC, 2007). Precipitation patterns and distribution also vary regionally, but the total annual precipitation in the contiguous United States has increased 6.1 percent over the last century, with about half of the increase attributed to increased storm intensity (U.S. Climate Change Science Program, 2008b; Karl and Knight, 1998). Warming temperatures, along with land subsidence, contribute to sea level rise. Relative sea levels have risen 3-4 mm per year in the Mid-Atlantic States and 5-10 mm per year in the Gulf states (U.S. Climate Change Science Program, 2008b; U.S. Environmental Protection Agency, 2007).

Anticipated increases in extreme weather events outside the historic range of natural variability may alter the frequency, intensity, duration, and timing of disturbances such as fire, drought, invasive species, and insect and pathogen outbreaks. Changes in forest composition and growth may also have associated impacts on wildlife habitats, the supply of wood products, specialty markets, and recreational opportunities (U.S. Climate Change Science Program, 2008b; Marques 2008).

Forests provide a wealth of services and products including clean water, clean air, biological habitats, recreation opportunities, carbon storage, timber, specialty commodities, fuel, and aesthetic and cultural values. Scientists have indicated that a changing climate can affect the future biodiversity and alter the function of the forest ecosystems that support these services and products (U.S. Climate Change Science Program, 2008a). Species distributions may shift, some species are likely to decline while others expand, and whole new communities may form. Forest productivity may be reduced in some instances due to a decline in photosynthesis caused by increased ozone, and productivity may be enhanced in other settings where elevated levels of carbon dioxide (CO_2) have a fertilizing effect on overall tree growth.

The overwhelming majority of studies of regional climate effects on terrestrial species reveal consistent responses to warming trends, including poleward and elevational range shifts of flora and fauna. Responses of terrestrial species to warming across the Northern Hemisphere are already well documented by changes in the timing of growth stages (i.e., phenological changes), especially the earlier onset of spring events, migration, and lengthening of the growing season (IPCC 2007).

Mammalian responses to rising temperatures and other climate changes are diverse. Many small mammals are coming out of hibernation and breeding earlier in the year than they did several decades ago, while others are expanding their ranges to higher altitudes. Some

show trends toward larger body sizes, probably due to increasing food availability and higher temperatures. On the other hand, reproductive success in polar bears has declined due to melting Arctic sea ice (IPCC 2007).

Birds are an important part of many functioning ecosystems because of their roles in seed dispersal, pollination, and as both predator and prey. Scientists have observed that birds are breeding and laying their eggs earlier and that migratory species have altered their wintering and/or critical stopover habitats. For example, warmer springs have led to earlier nesting for 28 migrating bird species on the east coast of the U.S. (IPCC 2007).

A range shift toward the poles (northward in the Northern Hemisphere) or to higher elevations has occurred among many invertebrates that are considered pests or disease organisms (IPCC 2007).

Habitat ranges for butterflies in North America have shifted northward and in elevation as temperatures increased. In some cases, such as the Edith's Checkerspot Butterfly, local populations have become extinct in the southern portion of their range (IPCC 2007).

Fishing is highly valued in the U.S. as both a commercial enterprise and as a recreational sport. Fish populations and other aquatic resources are likely to be affected by warmer water temperatures, changes in seasonal flow regimes, total flows, lake levels, and water quality. These changes will affect the health of aquatic ecosystems, with impacts on productivity, species diversity, and species distribution (IPCC 2007).

Stream habitats are projected to decline across the U.S. by 47 percent for coldwater, 50 percent for cool-water, and 14 percent for warm-water species. In the southern Great Plains, summer water temperatures already approach the limits for survival of many native stream fish (IPCC, 2002). An 8°F increase in average annual air temperature is projected to eliminate more than 50 percent of the habitat of brook trout in the southern Appalachian Mountains. The Northern pike, which spawn in flooded meadows in early spring and whose young remain in the meadows for about 20 days after hatching, would be especially affected by low spring water levels. Higher winter temperatures have been observed to decrease the survival rate of the eggs of yellow perch (a coldwater species). On the other hand, one study found that higher winter temperatures (by 2ºC) were beneficial for rainbow trout but the same temperature increase in summer caused negative effects (IPCC 2007).

The ability of reptiles and amphibians to adapt to changes in climate depends in part on their ability to move to more suitable habitat. A European study found that most reptile and amphibian species could expand their ranges in a warmer climate if dispersal were unlimited, but if they were unable to disperse then the ranges of nearly all species (more than 97 percent) would become smaller (IPCC 2007).

SOUTHERN REGION CLIMATE CHANGE TRENDS AND EXPECTATIONS

Over the past decade, a number of models have been developed to simulate climatic effects anticipated in the future. These scenarios are based on historical data, trends, and analysis of different plausible assumptions. While climate model simulations are continuing to be developed and refined, climate projections typically do not yet accurately address expected conditions below the regional scale in the United States. In the report by the United States Global Change Research Program on Climate Change Impacts on the United States (2001), the two principal models that were found to best simulate future climate change conditions for the various regions across the country were the Hadley Centre model (developed in the United Kingdom) and the Canadian Climate Centre model. Unless otherwise noted, the following discussions of climate change expectations for the southeastern United States are based on findings from the 2001 U.S. Global Change Research Program report and more recent projections in the U.S. Climate Change Science Program Reports (SAP 4.3, May 2008a; SAP 4.4, June 2008b).

For some aspects of climate change, virtually all models agree on the types of changes to be expected for the southern region:

The climate is going to get warmer, especially warmer minimum winter temperatures. Both the Hadley and Canadian models show increased warming in the southeast but at different rates (see inset on Future Climate Scenarios for the southeast). Overall regional temperature changes are projected to be equivalent to shifting the climate of the Southern U.S. to the central U.S. and the central U.S. climate to the northern U.S.

The heat index, which is a measure of comfort based on temperature and humidity, is going to rise. The principal climate model simulations agree that the heat index will increase more in the southeast than in other regions. By 2100, the heat index under the Hadley model is projected to increase by as much as 8-10°F and by over 15°F in the Canadian model. The Northeast may feel like the southeast does today, the southeast is likely to feel more like today's south Texas coast, and the south Texas coast is likely to feel more like the hottest parts of Central America.

Threats to coastal areas will increase, including rising sea levels, beach erosion, subsidence, salt water intrusion, shoreline loss, and impacts to urban development.

Precipitation is more likely to come in heavy, extreme events.

Future Climate Scenarios for the Southeast

Warmer temperatures:

Maximum summer temperature increase:

Hadley model = 2.3° F (2030)

Canadian = 5° F (2030), 12° F (2100)

Mean annual temperature increase:

Hadley = 1.8° F (2030), 4.1° F (2100)

Canadian = 3°F (2030); 10° F (2100)

Higher summer heat index (average increase):

Hadley model = 8-15° F (2100)

Canadian model = 15° F (2100)

Moisture changes:

Intensified El Nino & La Nina phases as CO_2 increases.

Hadley = 20% increased moisture by 2090

Canadian = decreased moisture; droughts

Increased extreme weather events:

Droughts, floods, hurricanes, tornadoes, freezes, winds, ice storms, heat waves.

Higher sea levels for Atlantic & Gulf Coasts:

Hadley = 8-12 inch rise (2100)

Canadian = 20-24 inch rise (2100)

For other aspects, models tend to differ on expectations. The southeast is the only region where climate models are simulating large and opposite variations in precipitation patterns over the next 100 years. The Canadian model projects more extensive and frequent droughts in the southeast, starting with little change in precipitation until 2030 followed by much drier conditions over the next 70 years. The Hadley model, in contrast, suggests there will be a slight decrease in precipitation over the region during the next 30 years followed by increased precipitation. There is also uncertainty over the extent of effects of El Nino and La Nina cycles. El Nino events typically result in cooler, wetter winters in the southeast and fewer Atlantic tropical storms, while La Nina events tend to have the opposite effects with warmer, drier winters and more hurricanes.

Unexpected interactions among multiple disturbances happening at the same time add to the level of uncertainty. For example, tree growth is generally projected to be stimulated by increases in CO_2, but limits on availability of water and soil nutrients during droughts often weaken tree health leading to insect infestations or disease, which in turn promotes future fires by increasing fuel loads and further weakening tree health (Marques 2008).

Based on current projections, the following discussion highlights some of the potential impacts of a changing climate on forests in the southeastern United States and on the George Washington National Forest.

<u>Forest productivity</u> – In general, biological productivity of southeastern forests will likely be enhanced by increased levels of CO_2, as long as there is no decline in precipitation and as long as any increases in moisture stress due to higher air temperatures are low enough to be offset by CO_2 benefits. Hardwoods are more likely to benefit from increased CO_2 and modest temperature increases than pines, since pines have greater water demands than hardwoods on a year-round basis. Without management adaptations, simulations using the Hadley model show pine forest productivity will likely increase 11 percent by 2040 and then exhibit a declining trend to an 8 percent increase by 2100 compared to 1990 productivity estimates. Hardwood productivity will likely continue to rise, with projections of a 22 percent increase by 2040 and 25 percent by 2100. This shift in productivity could have significant effects in the South. Forest productivity increases may be offset, however, by escalating damage from forest pests and more extreme weather disturbances.

<u>Forest pests</u> – The potential for a changing climate to increase the distribution of forest pests and diseases is a concern, particularly for pests that already cause widespread damage such as Southern pine beetles. Higher winter temperatures are expected to increase over-wintering beetle survival rates, and higher annual temperatures will produce more generations each year leading to increased beetle infestations. Other factors, however, complicate projections of future infestation levels. Field research has demonstrated that moderate drought stress increases pine resin production thus reducing colonization success, while severe drought stress reduces resin production and increases pine susceptibility to beetle infestation. Insufficient evidence currently exists to predict which of these factors will control future beetle populations and impacts (McNulty et al. 1998).

<u>Fires</u> – Fire frequency, size, intensity, and seasonality are directly influenced by weather and climate conditions. Nationwide projections show seasonal fire severity is likely to increase by

10 percent over the next century, with possibly larger increases in the southeast. At least two ecosystem models run under the Canadian climate change scenario suggest a 25-50 percent increase in fires, and a shift of some southeastern pine forests to pine savannas and grasslands due to moisture stress. Under a hotter, drier climate, an aggressive fire management strategy could prove critical to maintaining regional vegetation patterns.

Shifts in major vegetation types for the Southeast – The broad variety of ecosystem types found across the southeast ranges from coastal marshes to mountaintop spruce-fir forests. Although the South is one of the fastest growing population regions in the country, forests are still common in many parts of the southeast, and forestland averages approximately 30 percent of each state. Potential changes in vegetation distribution due to climate change vary with different model scenarios. Under the Hadley model, forests remain the dominant natural vegetation in the southeast, but the mix of forest types changes. Under the Canadian model, savannas and grasslands expand and replace parts of the southeastern pine forests along the Coastal Plain due to increased moisture stress. In this scenario, the current southeastern forest moves into the north-central part of the United States. Both drought and increased fire disturbance play an important role in the potential forest breakup.

Weather-related stresses on human populations – Low-lying Gulf and Atlantic coastal areas are particularly vulnerable to flooding. With floods already the leading cause of death from natural disasters in the southeast, increased flooding from more active El Nino/La Nina cycles could have greater adverse impacts. Even if storms do not increase in frequency or intensity, sea level rise alone will increase storm surge flooding in virtually all southeastern coastal areas. Another concern is the prolonged effect of elevated summertime heat events, which coupled with drought conditions, not only causes elevated heat stress to humans but also increases smog levels.

Increased forest disturbances – Increases in extreme events and changes in disturbance patterns may have more significant impacts, at least in the near future, than long-term changes in temperature or precipitation. Natural disturbances that may be associated with climate change include hurricanes, tornadoes, storms, droughts, floods, fires, insects, diseases, and non-native invasive species. Although disturbances are a natural and vital part of southern ecosystems, it is the change in frequency, intensity, duration, and timing exceeding the natural range of variation that is a concern (Marques 2008). Multiple disturbances interact and further exacerbate damages. Hurricanes can cause severe disturbance that not only results in direct loss of biological communities and habitat, but the widespread damages can also shift successional direction leading to higher rates of species change and faster biomass and nutrient turnover. Invasive species and insect pests often have high reproductive rates, good dispersal abilities, and rapid growth rates enabling them to thrive in disturbed environments.

Water stresses – The difficulty in predicting whether precipitation will increase or decrease in the southeast over the next 30-100 years extends to uncertainties over future water quantity and quality conditions. Current water quality stresses across the southern region of the country are primarily associated with intensive agricultural practices, urban development, and coastal processes such as saltwater intrusion. Although water quality problems are generally not critical under current conditions, stresses are expected to be

more frequent under extreme conditions, particularly in low stream flow situations associated with droughts. Under the Hadley model, stream flow in the southeast has been projected to decline as much as 10 percent during the early summer months over the next 30 years. The Chattahoochee and Tombigbee River basins are projected to have decreased water availability over the next 50 years, and as stream flow and soil moisture decrease, agricultural fertilizer applications and irrigation demands tend to increase creating further stress and conflicts over competing uses. Parts of the southeast that depend more on ground water are particularly vulnerable to depletion of aquifers, which can take centuries to recharge after chronic drought conditions (Hoyle 2008).

Outdoor recreation – Outdoor recreation opportunities are likely to be impacted by climate change but would vary by location and activity. Higher summer temperatures could extend summer activities such as swimming and boating but may also reduce other outdoor activities such as hiking and trails use in hot, humid sections of the South. Warmer waters would increase fish production and fishing opportunities for some species but decrease fishing for other cold water species. Summer recreation activities are likely to expand in cooler mountainous areas as temperatures warm along the coastal plain and lowland elevations. Skiing opportunities are likely to be reduced in the South, and some marginal ski areas may close due to fewer cold days and snow events.

Local Level Climate Change Trends and Expectations

In December 2008, the Governor's Commission on Climate Change released a "Final Report: A Climate Change Action Plan" for the state of Virginia. The report included expected impacts of climate change on Virginia's natural resources, the health of its citizens, and the economy which included the industries of forestry and tourism. It also identified what Virginians can do to prepare for the likely consequences of climate change as well as an estimation of the amount of, and contributors to, the state's greenhouse gas emissions through 2025. The Governor's Executive Order 59 (2007) set a greenhouse gas emission target of 30% below the business-as-usual projection of emissions by 2025.

The Governor's Commission on Climate Change used the Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report as the primary reference point on the science of climate change, and also included testimony of a variety of experts. Estimates provided in the recent Chesapeake Bay Program Scientific and Technical Advisory Committee (STAC) report, "Climate Change and the Chesapeake Bay: State-of-the-Science Review and Recommendations" (Pyke et al. 2008) were also incorporated because of its regionally-specific nature. The findings of the expected impacts of climate change for Virginia from the Commission's report, as they relate to national forest management in Virginia include the following. These impacts could be further compounded by Virginia's growing human population. As of July 2009, the Virginia Employment Commission estimates that, between 2010 and 2030, Virginia's human population will increase by almost 23 percent (http://www.vec.virginia.gov/vecportal/lbrmkt/plugins/lmiapp.cfm/popproj#).

- Virginia should prepare for a minimum of a 3.6°F increase in air and water temperatures but these temperatures could increase as high as 10.8°F by 2100. Changes in precipitation and weather patterns are more difficult to estimate, although there has been scientific consensus that most of Virginia

will experience a slight (0-10%) increase in precipitation and an increase in coastal storm intensity (IPCC, 2008; Pyke et al., 2008).

- There will likely be a projected sea level rise for coastal Virginia of 2.3–5.2 feet by 2100. Oxygen levels in the Chesapeake Bay are expected to decrease due to increasing temperatures and increasing storm runoff. Acidification of the Bay and Atlantic Ocean also is a concern as waters absorb more carbon dioxide (CO_2). Though the George Washington National Forest lies along the western mountains of Virginia, all of the forest is in the headwaters of the Chesapeake Bay watershed.
- At varying rates, vegetation ranges will move from current locations to higher altitudes and latitudes, such that suitable habitat for some species will decline, other species will become extirpated, and other species will become extinct. Virginia's freshwater streams and high elevation areas currently offer essential habitat to many species that require cooler conditions. As temperatures increase and precipitation patterns change, these habitats will no longer support the same suite of species they do today.
- Threats already faced by Virginia's ecosystems, such as invasive species, pathogens and pollution will become exacerbated. Many new exotic or invasive species may move into Virginia and existing pest species may flourish and cause more widespread damage than they are now.
- There is a lack of research and specific information on the impacts of climate change on Virginia's forestry industries, and commercial and sport fishing industries.
- Virginia's forestlands sequester approximately 23 million metric tons of CO_2 per year but an average of 27,000 acres of forestland is lost annually to development. The George Washington National Forest encompasses about 1 million acres (or seven percent) of the forestlands in the state. The Jefferson encompasses another five percent, making both forests the largest land manager in the state. The GW also includes about 105,000 acres in West Virginia.
- Extreme weather events could lead to compromised water and food supplies for people. Unstable weather patterns could also cause periods of drought that threaten municipal water supplies.
- Climate change is expected to increase the incidence of human diseases associated with air pollutants and aeroallergens that exacerbate other respiratory and cardiovascular conditions.
- The three largest sources of greenhouse gas emissions in Virginia are electricity generation, transportation and non-utility uses of fuel in industrial, commercial and residential facilities. Demands for electricity, transportation and fuel would likely increase as population increases.
- The Virginia Department of Mines, Minerals and Energy (DMME) projects that natural gas consumption will grow 3.6 percent from 2007 through 2016 under a business-as-usual scenario. Natural gas increasingly is being used for electric generation because it is the cleanest of the fossil fuels, which may cause an even greater increase in demand for natural gas supply.
- While most of the Commission report's recommendations focused on

greenhouse gas emission reduction, the following recommendations could be incorporated into the plan components or management approach for the George Washington National Forest:

- Virginia should establish a greenhouse gas monitoring and reporting system.
- Conserve existing natural carbon sinks and increase the capacity of those carbon sinks to decrease net greenhouse gas emissions.
- Incorporate the planning documents of the Virginia Department of Conservation and Recreation (Natural Heritage Plan) and the Virginia Department of Game and Inland Fisheries (Wildlife Action Plan) that identify important habitat types, specific habitat sites, areas important for maintaining biodiversity, and conservation actions needed to conserve all of Virginia's wildlife and native habitats.
- Virginia state agencies and universities should work with federal partners to develop regional adaptive resource management plans that incorporate climate change impacts. Priorities should be given to maintaining resiliency and diversity and connectivity in natural systems.

Key Climate Change Factors and Effects for the George Washington National Forest

Based on current projections, the primary regional-level and state-level predicted effects of climate change that would impact the Forest include: (1) warmer temperatures; (2) extreme weather events; and (3) increased outbreaks of insects, disease, and nonnative invasive species.

Increased variation in temperature and moisture can cause stress and increase the susceptibility of forest ecosystems to invasions by insects, diseases, and non-native species. New environmental conditions can lead to a different mix of species and tend to be favorable to plants and animals that can adapt their biological functions or are aggressive in colonizing new territories (Whitlock 2008). However, changes in adaptability may be too slow given the predicted rate of change. Species that are already broadly adapted may become more prevalent, and species with narrow adaptability may become less prevalent.

Disturbance factors that create more vulnerability in native ecosystems or require extensive controls to maintain the status quo are likely to affect desired conditions for healthy and diverse forests.

Desired conditions for healthy forests include resilience to dramatic change caused by abiotic and biotic stressors and mortality agents (particularly the southern pine beetle, gypsy moth, hemlock woolly adelgid and emerald ash borer on the GWNF) and a balanced supply of essential resources (light, moisture, nutrients, growing space). For the GWNF, gypsy moth epidemics have caused the greatest insect damage to date. The hemlock woolly adelgid affects only one species of trees but the loss of hemlocks in the riparian corridors has had widespread impacts, especially when coupled with the continuing effects of acid deposition. The forest has experienced several localized outbreaks of southern pine beetle. Emerald ash borer has been found in the northern parts of Virginia so far.

One of the natural disturbances that are an integral part of the forest is fire. Many of the native ecosystems that make up the George Washington National Forest, such as the pine and pine-oak forests, are adapted to or dependent on some level of periodic fire. Fire frequency, size, intensity, seasonality, and severity are highly dependent on weather and climate. As noted earlier, model results predict that seasonal severity of fire hazard is likely to increase by 10 percent over much of the United States during the 21st century, with possibly larger increases in the southeast (U.S. Global Climate Change Program 2001). The warmer Canadian model scenario which anticipates increased drought stress, projects a 30 percent increase in fire severity for the southeast. If extreme events such as hurricanes further increase forest fuel levels with widespread downed trees, there is a potential for larger, more catastrophic fires that could impact many of the desired conditions for the George Washington National Forest.

Warmer temperatures may lead to increased visitation to the George Washington National Forest for cooler, mountainous temperatures or for water-based recreational opportunities. A longer warm season could lengthen the recreation season on the Forest. Hunting and fishing seasons may be longer. Maintenance needs for roads and infrastructure could be greater. Demand for more highly developed recreation facilities (electricity) may increase. These effects would also be exacerbated by increasing population levels.

Scenery is one of the most valued quality of life benefits for life in the mountains of Virginia and West Virginia. Climatic effects on air quality could alter the visibility of landscapes. Increases in extreme weather events have the potential for the occurrence of landslides and debris flows. The potential effects may be more important as the population and infrastructure continue to increase in areas adjacent to the National Forest.

The expected effects of climate change to aquatic systems can be described by predicted changes to physical processes and the potential impacts to physical and biological systems (Bakke 2008). For the area covered by the George Washington National Forest, these include:

1) Increased storm intensity, including intensity of precipitation, would increase surface erosion, increase the magnitude and variability of peak flows, and increase sediment load to rivers;
2) Changes to total annual precipitation amount and seasonal distribution, could cause an increase in winter precipitation, a decrease in summer precipitation, an increase in average runoff in winter and spring months, and decreased summer base flows;
3) Increased flood risk and resultant channel instability, would increase channel migration and associated streambank erosion, and shift 100 year floodplain boundaries;
4) Increase in average water temperature would shrink usable habitat for cold water species and shift habitat types. Warmer water temperatures would mean lower dissolved oxygen, and there would be a disproportionate importance of groundwater-fed systems to cold water species. A recent study (Flebbe et al. 2006) projects that rising temperature changes from climate change (and the loss of hemlock along streams) will shrink native trout habitat. Using the Hadley Centre model (2.5°C air temperature increase) and the Canadian Centre model (5.5°C air temperature

increase), Flebbe found that between 53 and 97 percent of wild trout habitat could be lost as streams become warmer by the year 2100.

5) Increased evapotranspiration and loss of soil moisture would reduce baseflow in rivers, reduce groundwater recharge, and result in loss of wetland area, including conversion of perennial to seasonal wetlands;
6) Changes in vegetation cover and species composition could change long-term wood dynamics, alter erosion rates, and change riparian cover and energy inputs (Bakke 2008).

Aquatic systems may not only be affected by changes in the above physical processes in response to climate change, but also by the following changes in human management of land and natural resources:

- Increased demand for structural streambank protection
- Increased groundwater withdrawals in response to declining surface water resources
- Increased demand for irrigation water
- Increased demand for surface water storage and flood control reservoirs
- Increased renewable energy development, impacting new areas on the landscape (Bakke 2008).

Even with more stringent air quality controls, acid deposition is expected to continue to impact the Forest. Research is currently evaluating the link between soil acidification and the nesting success of high elevational birds since female songbirds need large amounts of calcium (from snail shells) to produce eggs (SRS Compass, Issue 10). Much of the high elevational habitat for songbirds is found on the GWNF and is one of the more vulnerable habitats to acid deposition on the forest.

In the Aquatic Sustainability Analysis report, watersheds on the Forest were categorized for their sensitivity to acidification. About 67% of the perennial streams on the Forest were found to be within highly sensitive watersheds, based on underlying geology and deposition rates. The smallest streams at the highest elevations, with non-carbonate bedrock were the most susceptible to acidification.

In summary, our more vulnerable ecosystems include:

- Spruce forests (sensitive to acid deposition, occupy higher elevations, habitat for sensitive species)
- Trout streams (sensitive to stream temperatures)
- Pine ecological systems (declining now, susceptible to southern pine beetle, fire-dependent)
- Higher elevation habitats
- Acid sensitive streams
- Acid sensitive soils

POTENTIAL CLIMATE CHANGE MANAGEMENT STRATEGIES

We have always experienced droughts, flooding, extreme weather events, catastrophic fire, insects and disease, and to a more gradual degree, movement in the ranges of floral and fauna species. Many of our current management strategies already strive to maintain or enhance the health and resiliency of various forest resources to better withstand environmental stresses and human-induced pressures. However, the effects of an accelerated rate of change and an increase in the intensity of these impacts on forest resources and ecosystems are still unpredictable. Climate change effects are multiple, varied, and interact with many other stressors/variables. Therefore, an adaptive management approach that monitors forest resource conditions, and monitors the current state of scientific knowledge related to responses to climate change, is needed that will allow us to proactively adjust current strategies or adopt new strategies as needed.

The strategies for the George Washington National Forest focus on both adaptation (ways to maintain forest health, diversity, productivity, and resilience under uncertain future conditions) and mitigation (such as carbon sequestration by natural systems, ways to provide renewable energy to reduce fossil fuel consumption, and ways to reduce environmental footprints). These strategies focus on: 1) reducing vulnerability by maintaining and restoring resilient native ecosystems; 2) providing watershed health; 3) providing carbon sinks for sequestration; 4) reducing existing stresses; 5) responding to demands for cleaner energy including renewable or alternative energy; and 6) providing sustainable operations and partnerships across landscapes and ownerships.

Reduce Vulnerability by Maintaining and Restoring Resilient Native Ecosystems

The primary focus of the revised Forest Plan should be the emphasis on ecosystem resiliency that will support ecological systems diversity and species viability now and in the future. Maintaining and restoring healthy ecosystems that can tolerate, or appropriately adapt to, changes in environmental and social conditions are our best strategy for preparing for potential changes from unusual climate variations. Management strategies to maintain and restore resilient native ecosystems are:

- Identify desired conditions and objectives to maintain the resilience and function of nine identified ecological systems and determine the desired disturbance regimes, including fire, for those ecosystems (e.g. the spruce habitat at Laurel Fork). Priorities for management activities could be identified for our more vulnerable ecosystems.
- Incorporate the use of unplanned fire ignitions as a tool for achieving resource management desired conditions.
- Plant blight-resistant American chestnut seedlings.
- Maintain or restore ecological conditions that are rare on the forest, such as the high elevation early successional habitat, open woodlands, old fields, rare communities, and special biological areas.
- Identify species that may need to move or migrate for populations to remain viable. Determine the types of connectivity and habitat features required to facilitate the movement of those species.
- Identify land acquisition and exchange priorities that include high elevation habitats or connectivity corridors.

- Consider shortleaf pine restoration opportunities.
- Develop limits of acceptable change or capacity studies for high use recreation facilities and trails. Monitor for resource impacts.

Watershed Health

Projected climate changes to the hydrologic cycle through warmer water temperatures, more intense storms, and greater inter-annual variability in precipitation, indicate the importance of maintaining and protecting healthy watersheds. Bakke (2008) describes three key components relating climate change processes to management and conservation of aquatic resources; resilient habitat, refugia, and restoration.

Resiliency refers to the ability of a system to return to its original condition after being disturbed. In ecology, resiliency carries the additional meaning of how much disturbance a system can "absorb" without crossing a threshold and entering an entirely different state of equilibrium. This requires that certain key habitat characteristics or processes will change little; with respect to stream aquatic habitat, these key elements are temperature and disturbance regime. Rivers and streams most resilient to temperature change include those dominated by groundwater input. Aspect, riparian shading, and valley shape also play a role in thermoregulation. A resilient disturbance regime would be one where peak flows and available sediment sources do not become altered. Likewise, streams most resilient to changes in disturbance regime would include those with flow dominated by groundwater. Resiliency can only function if the landscape offers a redundancy of habitat opportunities; there must be enough habitat and connectivity so that a disturbance to one area allows populations to recover and recolonize from another area.

Refugia are places in the landscape where organism can go to escape extreme conditions, be it short term or long term. Protecting these areas, and maintaining or improving connectivity will be increasingly important.

Restoration should include activities which reestablish the structures and function of the stream ecosystem in a manner that the ecosystem will become self-maintaining. High priority actions would be protection of good habitat, improving connectivity and access to existing habitat. If active restoration, such as enhancement of instream habitat with large wood, is to be performed in potentially unstable settings, it will be important to design these projects with the appropriate level of redundancy to accommodate greater rates of channel migration and flood magnitudes. Passive restoration techniques, such as establishment of wider riparian buffers, may be a more sustainable alternative in light of increased geomorphic instability.

Specific management strategies the George Washington National Forest can adopt to address the management and conservation of aquatic resources in light of predicted effects from climate change are:

- Protect and restore beaver meadows, wetlands, and floodplains to improve natural storage, reduce flood hazards, and prolong seasonal flows. Beaver ponds and wetlands recharge groundwater, raise the water table, retain sediment and organic matter, store water during floods and release it slowly,

mitigate low flows and drought, reduce carbon turnover rate, raise pH and ANC, while reducing SO^2, Al, and NO^3 .

- Protect and restore riparian forests to moderate changes in stream temperature, maintain stream bank stability, and provide instream habitat.
- Remove migration barriers and re-establish habitat connectivity so that species can more to more suitable habitat, or move to or from refugia.
- Reduce flood and wildfire risks in vulnerable watersheds to prevent increased surface erosion and mass wasting leading to aggradation of river channels.
- Improve or decommission roads to reduce adverse impacts during large storms to prevent surface erosion and fill slope failure and landslides. Construct stream crossings and bridges to withstand major storm and runoff events.
- Include standards to assess geologic hazards for management activities, including potential landslide hazards and risks, particularly as the population and infrastructure continue to increase in areas adjacent to the National Forest.
- Revegetate bare soil as soon as possible and suspend or eliminate recreation uses that are causing elevated sediment levels to streams and large areas of long term loss of soil productivity outside the designated use area.
- Increase riparian buffers and include channeled ephemeral streams in the riparian corridor.
- Consider nutrient replacement when planning vegetative management and/or look for alternative solutions (such as watershed liming or fertilization) in acid-sensitive watersheds.
- Identify soils highly sensitive to acid deposition and nutrient loss. Do not allow whole tree harvesting in those areas and consider possible soil fertilization treatments.
- Relocate, close or decommission roads causing significant resource damage.

Carbon Sequestration

National Forest System lands have opportunities for 1) biomass sequestration and storage of CO_2, and 2) geologic sequestration and storage of CO_2.

Biomass sequestration:

Trees and forests represent major biological "carbon sinks," places where carbon is sequestered. Carbon accrues in trees, soil, and wood products and the use of wood-based substitutes for fossil fuel-based products decreases the amount of greenhouse gas emissions.

Planting trees is often suggested as a way to "offset" the increased human contributions to atmospheric CO_2 that have led to global climate change, with some schemes actually tallying how many new trees it would take to offset a year of car emissions. But it's hard to make those calculations accurately because just how much carbon trees sequester—and more importantly, how that might change in response to heightened CO_2—is not precisely known. (http://www.srs.fs.usda.gov/compass/issue10/03carbon.htm)

Scientists working in the area do know one thing: It's not going to be as simple as "more trees, more carbon sequestered." And there are other, maybe more pressing questions: How will the forests we rely on change in response to climate conditions? Can forest management play a part in adapting forest ecosystems to climate change? (http://www.srs.fs.usda.gov/compass/issue10/03carbon.htm)

Sustainable forestry practices can increase the ability of forests to sequester atmospheric carbon while enhancing other ecosystem services, such as improved soil and water quality. Planting new trees and improving forest health through thinning and prescribed burning are some of the ways to increase forest carbon in the long run. The most defensible options for managing forests for their carbon storage are keeping forests as forests, reforesting areas where forests historically occurred, using forest biomass to offset fossil-fuel use (burning forest biomass generally means that fossil fuel will not be burned), and promoting long-lived forest products such as wood-framed buildings. Forests (particularly older forests) generally store carbon better than forest products, so harvesting old-growth forests for their forest products is not an effective carbon conservation strategy (Harmon et al. 1990). However, harvest and regeneration of young to middle-aged forests for long-lived forest products can help with carbon storage (Ryan 2008). On the GWNF, the age class distribution is heavily skewed to the mid- to late-successional age classes and we are harvesting less than ½ of 1% of our acres per year. So essentially we are managing for long rotation ages already.

<u>Geologic Sequestration:</u>
The Forest contains some lands with limestone bedrock. The weathering of limestone creates a carbon sink. The functioning of this carbon sink is influenced by the geologic characteristics of the limestone and by precipitation and runoff. Because the Forest's limestone areas will not be converted to urban-type development (i.e. paved over), the limestone area will function as a carbon sink.

In addition to this passive carbon sink of carbonate bedrock, the Congress and executive branch are considering the emerging technology of geologic sequestration and storage of CO_2 and its use on federal lands. This active use of a geologic sink can use a much wider range of geologic environment than carbonate bedrock.

In May 2009, the U.S. Department of Energy released a comprehensive study of geologic carbon sequestration and storage (CSS) on federal lands in "Storage of Captured Carbon Dioxide Beneath Federal Lands", (National Energy Technology Laboratory, 2009). This report characterizes and estimates the geologic storage potential as well as regulatory issues on all federal lands. The FS and BLM are the two agencies with the lion's share of opportunity for geologic CSS.

On June 3, 2009 the U.S. Department of Interior issued a report to Congress entitled *Framework for Geological Carbon Sequestration on Public Land*. In the News Release announcing the report, the DOI stated:
"President Obama's national energy plan calls for reducing greenhouse gas emissions by 80 percent by 2050," said Secretary Salazar. "Capturing carbon dioxide emissions in secure geologic formations prevents their release into the atmosphere, reducing the carbon

intensity of our economy. These recommendations provide a structure for a national initiative to identify appropriate public land geological sequestration sites that will help us reach our clean energy goals."

At the current time, it is not possible to assess what role geologic CCS may play on federal land. However, in the context of developing a Forest Plan that must consider adaptive management over 10-15 years or longer, it is appropriate to be aware of Congressional and executive branch known interest in geologic sequestration and storage of carbon. Management strategies for increasing carbon sequestration on the GWNF are:

- Improving stocking conditions on poorly stocked stands.
- Thinning.

Existing Stresses

An early detection and response strategy associated with nonnative invasive species will be critical to limit new introductions. Aggressive treatment of established invasive species, along with the control of insects and diseases, are likely to become more critical to maintaining desired conditions for healthy forests under a changing climate. Due to the fragmented land ownership patterns, success in reducing forest pests will sometimes require going beyond national forest boundaries, and continued work with partners will be needed. In addition, management practices (such as thinning and age class diversity) that sustain healthy forests and provide adequate nutrients, soil productivity, and hydrologic function promote resilience and reduce opportunities for disturbance and damage. Management strategies for mitigating existing stresses are:

- Southern pine beetle infestations should be quickly addressed. Silvicultural options for decreasing the vulnerability of attack could include low intensity fire and lower basal areas.
- Aggressive treatment of highly invasive nonnative invasive plant and animal species.

Alternative Energy Demands

Using cleaner energy reduces greenhouse gases. Renewable energy development plays a significant role in the agency's implementation of the Energy Policy Act of 2005, Public Law 109-58 (Testimony by Sally Collins, Associate Chief Forest Service, before the Committee on Energy and Natural Resources, United States Senate, Renewable Energy on Federal Lands, July 11, 2006). The sources of renewable or alternative energy that can be provided on national forest system lands include: wind energy, solar energy, and natural gas leasing.

Natural gas

Among fossil fuels, natural gas is a cleaner source of energy, producing less greenhouse gas than oil or coal. Natural gas is part of strategies for using cleaner energy. For example, natural gas can be part of wind or solar energy systems by supplying supply energy when wind or solar power is unable to meet continuous power demands.

The Forest Plan will address opportunities to explore for and supply natural gas as part of the Congressionally-mandated consideration of federal oil and gas leasing on National Forests System lands (Federal Onshore Oil and Gas Leasing Act of 1987).

MANAGEMENT STRATEGIES FOR THE GWNF TO PROVIDE ALTERNATIVE ENERGY OPPORTUNITIES ARE:

- Revisit the oil and gas leasing availability analysis and decision.
- Consider the potential demand for alternative energy sources on the GWNF and provide management direction in the Forest Plan.

Sustainable Operations and Partnerships

The Forest will work with the state of Virginia to incorporate the greenhouse gas emissions from our management activities into a State inventory, just as we have done with the fine particulates inventory.

The Forest will continue striving to reduce its environmental footprint and decrease the greenhouse gases emitted through day-to-day operations, including the use of more fuel-efficient vehicles, reducing the number of miles driven and making facilities more energy-efficient.

The Forest will also continue working with partners, including other federal agencies, State and local governments, non-governmental organizations and other stakeholders to be more effective in efforts to adapt lands, ecosystems, and species to climate change. Examples are the Nature Conservancy in the Fire Learning Network and the Chesapeake Bay Partnership.

MONITORING AND FUTURE RESEARCH DIRECTIONS

As noted in the previous section, many current management strategies can be used or adjusted to address changing climate conditions. As researchers develop more localized projections of anticipated climate changes and ecosystem responses are better understood, more specific management practices and strategies can be incorporated in the future.

Part of better understanding the interactions among the many climate change factors that could affect the George Washington National Forest will be monitoring how natural disturbances are affecting the forest. Climate change is a challenge to address in our annual monitoring program at the local forest level because there are multiple influences that are not well understood and many of the indicators are observable only at a very broad level over extended periods of time. However, forest disturbance has been identified as an indicator that can be observed (Dale et al. 2001). Although direct cause-effect relationships of individual disturbance events may not always be evident, it should be possible to see changes over time and determine whether they may be related to climate change factors. While current monitoring looks at disturbances such as insect and disease infestations, broadening these efforts to track damage from storm events and weather extremes could help predict threats to desired conditions and cope with changes.

In addition to including disturbances in the monitoring questions that are part of the monitoring program for the Forest Plan, the Southern Research Station (SRS) is a key partner in developing approaches for monitoring climate change and associated disturbances, and monitoring direction will be well coordinated with climate change scientists. Some initial ideas for monitoring and adapting to climate change-related disturbances include:

- Monitor changes in phenology (the timing of ecological events such as budburst and the arrival of migratory species),
- Consistently reporting disturbance events and tracking whether they are increasing in frequency,
- Evaluating impacts these disturbances and management responses have on advancing or deterring progress toward desired conditions in forest plans,
- Evaluating our organizational capacity to respond to disturbances and extreme climate-related events (droughts, fire, floods),
- Evaluating changes in condition caused by disturbances and extreme climate-related events (droughts, fire, floods),
- Evaluating the need to modify desired conditions and objectives in forest plans in light of the impacts of disturbances,
- Standardizing our monitoring questions and measures regionally to allow cumulative effect evaluations of climate change across the Southern Region
- Documenting species composition during the three and five year regeneration surveys
- Documenting noted changes in phenology events across the forest.

The SRS and other national and regional researchers are actively working on numerous projects to assess anticipated effects and appropriate actions in regard to climate change. Over the next few years, the SRS will be working on regional climate scenarios that start with the Global Circulation Models and then use regional climate models to scale down to a finer resolution that is useful to local forest managers. SRS scientists will also be continuing studies on increasing the resilience and carbon sequestration of gulf coast forests, particularly longleaf pine in Mississippi. Other future research needs include recommendations on how to mitigate hurricane impacts, expanded management options for coping with extended droughts and more extreme storms, appropriate carbon mitigation measures, and a better understanding of the likely ecological effects of anticipated disturbances.

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APPENDIX E: BUDGET AND ACCOMPLISHMENT HISTORY

Accomplishments of the objectives in the Forest Plan and the pace of reaching desired conditions on the landscape are dependent upon annual budgets. It is not possible to predict future budgets, but a review of past budgets and accomplishments can identify trends and potential opportunities based on the past. The following tables summarize the annual expenditures and annual accomplishments on the GWNF during implementation of the current plan.

Table 1 Budget History for Combined George Washington and Jefferson National Forests

Summary Category	1994 Expenditures*	1995 Expenditures*	1996 Expenditures*	1997 Expenditures*	1998 Expenditures*	1999 Expenditures*
Recreation	$4,617,933	$4,719,837	$3,925,941	$3,571,653	$3,647,937	$3,597,184
Wildlife & Fish	$1,331,717	$1,128,746	$789,954	$800,398	$896,385	$894,756
Range	$125,793	$83,483	$140,081	$245,997	$215,169	$185,927
Forest Health	$212,684	$649,712	$469,595	$994,166	$1,697,848	$1,590,401
Timber	$2,458,762	$3,342,253	$3,299,491	$5,885,256	$6,090,510	$2,755,585
Soil, Water & Air	$931,446	$468,139	$324,717	$401,368	$552,712	$571,814
Minerals	$160,359	$201,419	$192,909	$132,206	$180,388	$223,407
Senior Citizens	$509,899	$793,508	$779,235	$851,232	$985,250	$967,364
Lands	$1,505,410	$1,167,556	$1,061,982	$826,275	$921,678	$1,124,732
Engineering	$2,632,047	$2,805,729	$3,033,348	$4,596,442	$4,277,408	$3,457,285
Fire (w/o Wildfire Suppression)	$1,872,639	$3,145,758	$1,447,442	$1,547,450	$1,656,390	$1,778,913
Law Enforcement	$591,222	$315,237	$281,863	$192,529	$198,405	$103,387
General Admin	$3,352,748	$3,435,301	$2,422,648	$1,933,124	$2,183,340	$2,698,412
Planning and Inventory	$542,964	$1,681,341	$1,654,984	$1,540,440	$1,410,377	$1,436,190
Timber, Range, & Soil, Water, Air (NFVW)	$0	$0	$0	$0	$0	$0
Timber, Wildlife & Fish, & Soil, Water, Air (CWKV)	$1,036,081	$756,850	$908,565	$1,215,924	$1,138,180	$1,102,739
Misc	$335,740	$217,317	$517,758	$315,929	$126,610	$434,921
* Total expenditure in actual dollars for that fiscal year	$22,217,444	$24,912,186	$22,855,175	$27,327,142	$27,503,698	$26,410,613
Total expenditures in terms of 2009 dollars adjusted using the Consumer Price Index	$32,162,368	$35,069,465	$31,250,999	$36,527,618	$36,199,762	$34,009,922

Table 1 Budget History Cont'd

Summary Category	2000 Expenditures*	2001 Expenditures*	2002 Expenditures*	2003 Expenditures*	2004 Expenditures*	2005 Expenditures*
Recreation	$4,381,822	$5,032,639	$4,822,865	$3,390,325	$4,741,191	$3,729,700
Wildlife & Fish	$1,088,544	$1,370,037	$1,332,581	$850,451	$1,267,169	$763,139
Range	$168,213	$88,262	$57,034	$38,944	$74,144	$51,962
Forest Health	$1,068,870	$555,652	$477,975	$75,607	$179,179	$170,340
Timber	$2,563,442	$2,435,394	$2,332,099	$1,673,046	$2,545,521	$1,690,603
Soil, Water & Air	$707,540	$315,967	$574	$465,290	$36,706	$53,524
Minerals	$331,403	$467,345	$581,168	$424,994	$652,926	$475,364
Senior Citizens	$968,105	$931,111	$928,701	$892,678	$865,012	$777,092
Lands	$980,152	$978,075	$849,405	$991,783	$1,062,354	$509,507
Engineering	$5,033,153	$5,706,279	$8,571,934	$7,559,269	$5,988,273	$7,442,116
Fire (w/o Wildfire Suppression)	$1,661,042	$3,097,100	$3,770,919	$2,840,544	$4,790,989	$2,594,000
Law Enforcement	$114,219	$125,975	$139,042	($16,529)	$0	$0
General Admin	$2,289,237	$217,165	$248,716	$239,369	$0	$0
Planning and Inventory	$1,522,288	$1,921,101	$2,080,393	$1,509,631	$1,546,365	$887,104
Timber, Range, & Soil, Water, Air (NFVW)	$0	$893,224	$1,155,592	$941,075	$1,212,419	$778,937
Timber, Wildlife & Fish, & Soil, Water, Air (CWKV)	$1,115,320	$1,050,363	$923,221	$648,688	$935,119	$824,367
Misc	$417,139	$495,799	$1,885,932	$723,759	$784,181	$419,182
* Total expenditure in actual dollars for that fiscal year	$28,525,958	$29,673,598	$38,517,029	$24,038,154	$27,853,140	$22,696,479
Total expenditures in terms of 2009 dollars adjusted using the CPI	$35,539,337	$35,946,274	$45,932,896	$28,027,568	$31,633,293	$24,932,078

Table 1 Budget History Cont'd

Summary Category	2006 Expenditures*	2007 Expenditures*	2008 Expenditures*	2009 Expenditures*
Recreation	$4,028,961	$4,326,780	$4,787,129	$5,475,102
Wildlife & Fish	$852,354	$787,860	$902,747	$836,182
Range	$45,388	$41,255	$41,333	$44,543
Forest Health	$189,999	$184,060	$108,275	$271,554
Timber	$1,574,790	$1,672,471	$1,424,387	$1,459,948
Soil, Water & Air	$39,739	$25,768	$9,358	$23,492
Minerals	$385,195	$379,492	$389,171	$466,463
Senior Citizens	$711,142	$47,385	$0	$0
Lands	$610,952	$571,637	$408,454	$624,902
Engineering	$4,204,221	$2,930,273	$5,715,241	$7,268,843
Fire (w/o Wildfire Suppression)	$2,649,945	$2,835,274	$3,181,816	$4,169,865
Law Enforcement	$0	$0	$0	$0
General Admin	$4,322,857	$4,864,968	$3,736,019	$3,826,161
Planning and Inventory	$1,104,804	$1,007,894	$1,189,478	$1,169,413
Timber, Range, & Soil, Water, Air (NFVW)	$515,394	$727,544	$824,345	$1,013,537
Timber, Wildlife & Fish, & Soil, Water, Air (CWKV)	$1,101,900	$987,009	$664,242	$673,784
Misc	$302,981	$307,702	$155,596	$183,862
*Total expenditure in actual dollars for that fiscal year	$27,499,199	$24,341,836	$27,311,548	$28,473,639
Total expenditures in terms of 2009 dollars adjusted using the CPI	$29,263,868	$25,186,529	$27,214,382	$28,473,639

Table 2 Accomplishment History for George Washington National Forest (Unless Noted as GW and Jefferson NF)

Year	Timber Volume Sold (MMBF)	Timber Cut (MMBF)	Total Area Harvested (Acres)	Area Salvaged (Acres)	Trail Construction/ Reconstruction (Miles)	Road Construction (Miles)	Prescribed Burning (Acres)	Oil and Gas Leasing (Acres Under Lease)
1993	34.0	35.2	3,271	982	12	4.4	1,870	2,168*
1994	29.2	37.2	2,993	980	3	3.8	795	
1995	26.0	33.4	2,707	789	10	4.5	1,741	
1996	20.5	27.4	1,964	711	11	6.2	1,339	
1997	19.2	24.8	3,215	798	21	2.7	1,465	
1998	8.4	24.0	1,449	688	22	0.7	6,564	
1999	15.0	21.7	1,284	220	9	3.2	5,523	
2000	10.1	17.9	1,254	127	20	0.1	4,172	
2001	12.4	15.8	1,162	30	17	2.8	3,135	
2002	13.5	14.7	881	35	13	0.3	2,322	
2003	12.1	13.0	789	113	25	0.0	7,188	
2004	18.4	17.4	780	44	10	1.0	7,103	
2005	11.8	15.6	1,176	81	7	0.0	9,285	
2006	11.0	11.7	824	50	17	0.5	4,914	
2007	8.2	10.8	732	0	10	0.2	3,335	
2008	11.2	11.5	611	0	18	0.0	9,247	10,244
2009	8.2	13.3	833	74	12	0.0	9,331	
Total for All Years	269.2	345.4	25,925.0	5,722.0	236.3	30.4	79,329.0	12,412.0
Maximum Number	34.0	37.2	3,271.0	982.0	25.0	6.2	9,331.0	
Minimum Number	8.2	10.8	611.0	0.0	3.0	0.0	795.0	
Average or Mean	15.8	20.3	1,525.0	403.4	13.9	1.8	4,666.4	

Table 2 Accomplishment History Cont'd

Year	Gypsy Moth Defoliation on GWJEFF (Acres)	Gypsy Moth Spraying (GW only)	Soil & Water Improvements on GW Jeff (Acres)	Boundary Lines on GW Jeff (Miles)	Wildlife Habitat Improvements on GW Jeff (Acres)	Streams Enhance. on GW Jeff (Miles)	Lake Enhance. on GW Jeff (Acres)	Weed Treatment on GW Jeff (Acres)
1993	131,303	6,855						
1994	165,022	4,735	93	178	1003			
1995	230,500	4,800	97	308	1671	23	75	2
1996	0	2,015	122	16	3,874	25	0	20
1997	0	0	137	212	2,649	42	32	216
1998	0	0	75	187	3,861	82	17	30
1999	0	0	62	255	3,359	76	19	492
2000	55,495	0	53	105	1,942	53	13	90
2001	322,065	3,695	110	101	3,346	71	23	550
2002	47,620	2,183	81	191	6,642	74	288	350
2003	53,098	0	68	223	1,165	36	46	630
2004	0	0	60	162	3,922	54	53	301
2005	3,030	0	60	182	4,531	70	41	317
2006	2,950	0	60	66	3,340	40	88	685
2007	45,445	0	40	79	4,914	27	61	824
2008	51,322	0	54	157	3,788	30	69	1,186
2009	6,267	2,892	47	162	2,807	31	71	1,544
Total for All Years	1,114,117.0	27,175.0	1,219.0	2,584.0	52,814.0	734.0	896.0	7,237.0
Maximum Number	322,065.0	6,855.0	137.0	308.0	6,642.0	82.0	288.0	1,544.0
Minimum Number	0.0	0.0	40.0	16.0	1,003.0	23.0	0.0	2.0
Average or Mean	65,536.3	1,598.5	76.2	161.5	3,300.9	48.9	59.7	482.5