Timber Supply

INTRODUCTION

The per capita demand in the United States for wood products continues to increase in spite of increased recycling efforts and improved efficiency of wood production (USDA Forest Service 2003). Wood use efficiency in manufacturing processes increased by 41 percent from 1952 to 1998. Harvesting on National Forest System (NFS) land provided nearly 18 percent of the volume produced in 1964, but had dropped to less than 4 percent by 1998 (USDA Forest Service 2002). West Virginia is a net exporter of wood, while the United States is a net importer.

The Multiple Use-Sustained Yield Act of 1960 requires NFS land to be managed for outdoor recreation, range, timber, watershed, wildlife, and fish. The Endangered Species Act of 1973 requires that forest management provide for the protection and recovery of threatened and endangered (T&E) species and the National Forest Management Act (NFMA) of 1976 provides direction for maintaining biological diversity and habitats for native plants and animals. All of these resources should be considered when determining the long-term sustained yield of the timber resource. The NFMA also gives guidance on the maximum amount of harvesting that may occur on NFS land. Section 13 of NFMA limits the amount of harvest to a quantity that is equal to or less than that which could be removed annually in perpetuity on a sustained yield basis. The Act allows for a departure from this non-declining, even-flow concept in order to meet overall multiple-use objectives. The NFMA also requires that national forests periodically re-assess the land considered suitable for timber production and the amount of production that may occur on a regulated sustained basis. The Monongahela National Forest (MNF) is complying with the Act through the following analysis of timber suitability, allowable sale quantity (ASQ), and the harvest methods to be used in timber production.

Need For Change

Through implementation of the 1986 Forest Plan, it has become apparent that areas available for commercial timber harvest were different than originally estimated. This has resulted from the combined effects of newly acquired lands and mitigation factors such as riparian protection buffers, restrictions on recently identified listed species habitat, and limitations relating to visual quality objectives.

In addition, assumptions were made about using cable logging systems on steeper areas of the Forest. Timber operations with cable logging systems have not developed as predicted. Assumptions were also made using 200-year rotation lengths. Many hardwood tree species have an average life expectancy of less than 200 years. The Forest needs to reconsider its timber harvest options and methods in terms of how they should or should not be used to help achieve desired vegetation conditions.

Timber harvest volumes have decreased over the past 10 years, mostly due to certain species' habitat requirements that were not known in 1986, Forest reorganization, and changes in management emphasis. These changes have led to a need to revisit suitable lands determination,

revise supply estimations, and recalculate ASQ based on changes to the land base, land allocation, and management direction.

Issues and Indicators

Issue Statement

Forest Plan management strategies may affect the amount of land suitable for the sustainable harvest of timber products, the amount of timber offered by the Forest, and the methods used to harvest the timber.

Background

In 1897, the Organic Act established the National Forest System to furnish a continuous supply of timber to the nation and to protect watersheds. This direction remains today. Regulations implementing the NFMA require a Regional Forester to estimate the amount of timber that can be sold annually on a sustained-yield basis. The NFMA also requires the identification of lands that are not suited for timber production.

The 1986 Forest Plan identifies the NFS lands that are suitable for timber production. As the 1986 Forest Plan has been implemented, though, some land designations made then have changed. For example, some lands previously designated as suitable for timber production have been found to support populations of T&E species. Forest Plan Amendment #6 (March, 2004) reclassified some of these lands to protect the habitat of these species. Other lands that had been classified as unsuitable for timber due to access problems are now classified as suitable because of the use of helicopter logging where fewer roads are needed. Also, trees have been growing for 19 years since the 1986 Forest Plan was signed, and this growth has added considerably to the potential timber volume on the Forest. There is an identified need to recalculate timber production for the Forest.

Timber management on the Forest is primarily influenced by the allocation of Management Prescriptions (MPs), as some areas on the Forest are assigned prescriptions that allow or emphasize timber harvest, and others are not. Some of the MPs are considered not suitable for managing timber, and some include lands that are both suitable and unsuitable. The prescriptions with suitable lands also have desired conditions for vegetation that may affect the harvest methods used to achieve them. The range of alternatives proposed in this EIS have different allocations of MPs, and can be used to show relative differences in timber production and methods based on those allocations.

Indicators

The following indicators reflect the potential relative change under each alternative based on anticipated levels of management activities that could have effects on timber supply.

- Acres of land suited and not suited for timber management by alternative,
- Potential cubic board feet of ASQ by alternative,
- Acres treated by harvest method by alternative.

Scope of the Analysis

The affected areas for direct and indirect effects to timber suitability are lands administered by the Forest. This area represents the potential lands that would or would not contribute to a sustainable and regulated timber supply from the Forest. The affected areas for ASQ are the lands classified as suitable for timber management under each alternative. The affected areas for cumulative effects on timber supply are forested lands in the counties located within the proclamation boundary of the MNF. This area includes lands administered by both the Forest and other owners. Suitability is calculated for the present, knowing that it can change on a project-by-project basis. ASQ and harvest methods are analyzed over a 100-year planning horizon, and reported for the first, fifth, and tenth decades to show trends over the long term.

CURRENT CONDITIONS

The Forest now contains over 919,000 acres within 10 counties in West Virginia. The state is 78 percent forested, making it the third most heavily forested state in the country. The Forest has 9 percent of the total timber volume in West Virginia on 7.5 percent of the forested land in the state. Annual net growth of timber volume, accounting for mortality losses, was nearly four times the average amount harvested annually between 1989 and 2000. Annual mortality on NFS land on the Forest is slightly higher than other forested land in West Virginia, most likely due to the large percentage of Forest acres that are not actively managed. Table TR-1 shows the percent of land that is forested in the counties located within the Forest proclamation boundary, the percent of MNF land in each county, and the number of acres of MNF land in each county.

Table TR-1. Forested Land and MNF Land by County, 2000

County	Acres	% Forested	% MNF	Acres MNF Land
Barbour	221,062	64	0.1	11
Grant	305,920	79	6.5	20,001
Greenbrier	654,592	75	16.5	108,084
Nicholas	420,333	80	5.6	23,540
Pendleton	446,033	82	18.3	81,801
Pocahontas	603,270	89	51.3	309,429
Preston	418,483	69	0.9	3,897
Randolph	669,658	88	30.4	203,407
Tucker	269,869	84	37.6	101,399
Webster	357,504	93	18.4	65,800
Total	**4,366,724**	**78**	**21**	**917,369**

Source of % Forested Land by County: Forest Statistics for West Virginia 1989 and 2000, USDA Forest Service, Northeastern Research Station, Resource Bulletin NE-157

Sawtimber stands make up 78 percent of the Forest, with 34 percent of the volume in valuable Grade 1 (high-quality lumber grade) trees. Other forested lands within West Virginia have an average 21 percent of the hardwood sawlog volume in Grade 1. The difference in the quality

percentages is because timber stand improvement activities have been applied to thousands of acres on the Forest over the course of several decades. One of the primary purposes of these treatments has been to remove poor quality trees, leaving the higher quality trees to increase in growth and value.

Red maple is the most prevalent species on the Forest, containing 14 percent of the volume. All oak species together represent almost 24 percent of the volume. Red maple volume on the Forest comprises more than 13 percent of the State total, while Forest oak volume comprises about 14 percent of the State total. Almost 80 percent of the red spruce growing in West Virginia and 50 percent of the yellow birch is found on the Forest (Widmann and Griffith 2004).

Suitable Land Available for Timber Management

During Forest Plan revision, the Forest Service is required to identify lands tentatively unsuited for timber production [16 USC 1604(k); 36 CFR 219.14]. The amount of tentatively unsuited land does not vary by alternative because these are the lands that are considered not physically or economically capable of producing timber for the entire Forest.

During the analysis for the 1986 Forest Plan, there were an estimated 851,848 acres on the Forest, of which 723,670 acres were considered tentatively suitable for timber management. Acres that were withdrawn from tentatively suitable timber land included water, non-forested land, Wilderness, other withdrawn land, and sites that could not be managed as regulated NFS land without undue resource risk, as seen in Table TR-2.

Table TR-2. Lands Tentatively Suited for Commercial Timber Harvest, 1986 Forest Plan

Acres	Description
851,848	National Forest System lands in 1986
- 19,913	Non-forested land, including water
- 89,107	Forested land withdrawn from timber production (Wilderness, WSRs, etc.)
- 11,664	Lands not suited because restocking within 5 years cannot be assured
- 1,223	Lands not suited due to irreversible damage that could occur from timber operations
- 6,271	Lands not suited because current information is inadequate for decision-making
723,670	Tentatively suitable land for timber production

The 1986 Forest Plan contained additional acres that were withdrawn from suitable timber lands for various reasons, as shown in the table below.

Table TR-3. Lands Suited for Commercial Timber Harvest, 1986 Forest Plan

Acres	Description
723,670	Tentatively suitable land for timber production
- 60,581	Lands not appropriate for production because of environmental limitations
- 114,664	Lands not appropriate because Management Prescriptions do not include timber harvest
- 217,265	Lands not appropriate because they are the least cost-effective to achieve harvest goals
331,160	Tentatively suitable land not currently within or planned for non-timber purpose

Changes have occurred since 1986 that have affected the Forest's land suitability determination. Over 65,000 acres have been added to the Forest through land acquisition. Many of these acres were managed for timber in the recent past and were therefore considered suitable and added to the suited timber base. However, a similar amount of acres were removed from the suited base because they were identified as T&E listed species (primarily West Virginia northern flying squirrel habitat. Therefore, the current suited base (332,200 acres), as represented by the 1986 Forest Plan as amended (and Alternative 1), is considered to be roughly what it was in 1986, although those acres have shifted somewhat on the landscape due to changes described above.

Allowable Sale Quantity

The ASQ represents the maximum quantity of timber that may be harvested from the area of suitable land covered by the Forest Plan during the planning cycle. This quantity is based on modeled estimates of harvest needed to achieve desired vegetation conditions in the Plan, as tempered by specific Plan constraints. It is not intended to be an accurate prediction of annual volume produced or a volume target, as production may be affected by a number of variables, including budget, personnel, appeals, litigation, disturbance events, and shifting Forest priorities. The ASQ is generally expressed in million cubic feet (MMCF) or million board feet (MMBF) of timber volume. The timber volume available for harvest varies by alternative based primarily on the amount of suitable timber land.

Based on the capability of the land and availability for commercial timber production, the 1986 Forest Plan estimated the maximum yearly production potential of the Forest at approximately 250 MMBF per year. Considering all of the other resources that need to be managed, the Final Environmental Impact Statement for the 1986 Forest Plan analyzed six alternatives with maximum potential average annual timber production (ASQ) ranging from 40 to 50.2 MMBF in the first 10 years (1987-1996) and 75 to 177 MMBF in the fifth decade (2027-2036). The predicted ASQ for the selected alternative was 57.1 MMBF in the first decade, 57.9 in the second decade, and 60.1 in the third decade, which we about to enter.

Table TR-4 shows the volume of commercial timber sales offered, sold, and harvested for fiscal years 1987 through 2004. The volumes differ because not all volume that is offered is sold or harvested, or sold or harvested in the same year it is offered. These figures represent the volume of timber products sold through the competitive sealed bid process and removed under timber sale contracts.

Table TR-4. Commercial Timber Produced on the MNF, 1987-2005, in Million Board Feet

Fiscal Year	Volume Offered	Volume Sold	Volume Harvested
1987	34.3	30.0	36.0
1988	40.1	36.0	50.7
1989	40.5	39.0	36.9
1990	39.1	34.0	28.3
1991	39.0	39.0	36.4
1992	38.7	35.4	36.6
1993	30.0	30.0	33.5
1994	32.8	26.7	20.9
1995	29.7	25.6	22.1
1996	15.2	12.2	28.3
1997	17.0	12.7	25.2
1998	14.6	9.9	24.5
1999	0.9	9.6	24.2
2000	15.2	3.9	13.9
2001	13.9	13.2	7.5
2002	2.0	12.8	7.8
2003	0.9	2.1	11.7
2004	1.1	2.1	9.0
2005	12.6	8.4	8.2

The 1986 Forest Plan calculated ASQ for the first decade and expressed it as average annual harvest volume. When the 1986 Forest Plan was signed, many people considered ASQ to be the volume target for the Forest. From 1996 through 2004, the Forest with the Regional Office negotiated volume targets. The dramatic decline in timber volume offered and sold beginning in 1993 was in part due to Forest reorganizations based on expected budget cuts and changes in management emphasis. The reorganizations combined district offices and reduced the number of positions on the Forest, especially in the forestry and engineering job categories. The more recent decline in timber volume offered and sold was due to Forest Plan Amendment 6 dealing with threatened and endangered species. Since the 2004 Amendment, the volumes offered, sold, and harvested have begun to rise again.

Timber Market in West Virginia and Local Counties

Although the volume offered and sold continued to decline, timber prices increased more than six-fold from 1987 through 1993 and have remained fairly constant since then with a few exceptions. Leading the increases in value were sugar maple, yellow poplar, red oak and especially black cherry prices.

With over 350 businesses producing wood products, the wood industry in West Virginia employs more than 30,000 people and generates an estimated $3.2 billion to the state's economy (http://www.forestry.com/indassistance.cfm?menucall=industry; accessed June 9, 2005). During the past inventory period, annual growth of timber was estimated at 430.4 MMCF, while annual removal from timber sales averaged 247.9 MMCF for the State. The ratio of growth to removal

is approximately 1.7:1, which means West Virginia is growing nearly twice the amount of wood than it is cutting (USDA Forest Service 2003).

Table TR-5 below shows the volume of timber products from counties within the proclamation boundary of the Forest in 1996 by land ownership. This year was chosen to display because it represented the approximate average of volume harvested over the period from 1986 to present. Overall in 1996, 13 percent of the wood harvested in these counties came from Monongahela NFS lands. The volume of roundwood products for West Virginia in 1996 was estimated at 169.6 MMCF. Thus, the 10-county area produced about 39 percent of the volume for the State. Only about 5 percent of the State's volume came from NFS lands within the 10 counties.

Table TR-5. Volume Harvested (MMCF) of Products by County and Ownership in 1996

County	% NF	Volume Harvested (MMCF)								
		NFS Land	% Total	Other Public	% Total	Forest Industry	% Total	Other Private	% Total	All Owners
Grant	6.5	0	0%	0	0%	0	0%	1.8	100%	1.9
Greenbrier	16.5	0.9	6%	0.3	2%	6.8	49%	5.9	43%	13.8
Nicholas	5.6	0	0%	0	0%	2.9	21%	10.7	79%	13.5
Pendleton	18.3	0.9	37%	0	0%	0	0%	1.5	63%	2.4
Pocahontas	51.3	3.4	75%	0	0%	0	0%	1.1	25%	4.5
Preston	0.9	0	0%	0.2	4%	0	0%	5.4	96%	5.6
Randolph	30.4	0.5	4%	0	0%	1.6	14%	8.9	82%	10.9
Tucker	37.6	1.1	34%	0	0%	0	0%	2.2	66%	3.3
Webster	18.4	1.9	20%	0	0%	5.4	57%	2.2	23%	9.5
All Counties		8.7	13%	0.5	1%	16.6	24%	39.7	62%	65.4

Source: *http://srsfia2.fs.fed.us/php/tpo2/tpo.php*

Wood harvest for industrial uses in West Virginia totaled 202 MMCF in 2000, an increase of nearly 22 percent compared to 1994. However, this was a smaller increase than recorded from 1987 to 1994 of 38 percent. Overall the production of pulpwood roundwood increased 30 percent in 2001 compared to 1994 (Hansen et al. 2006).

Table TR-6 shows the amount of timberland in the State of West Virginia by ownership, indicating that federal lands have a relatively small proportion of timberland within the State.

Table TR-6. Area of Timberland in West Virginia by Ownership, 2000

Ownership	Acres	Percent
National Forest	980,200	8.3
Other federal	107,000	0.9
State	164,800	1.4
County/municipal	59,600	0.5
Inter-governmental	17,400	0.1
State Forest	73,400	0.6
Forest Industry	1,094,800	9.3
Farmer	607,600	5.2
Miscellaneous Corporate	2,134,800	18.1
Miscellaneous Individual	6,162,000	52.2
Miscellaneous Other	395,400	3.4
Totals	11,797,000	100.0

Source: USDA Forest Service Northeastern Research Station Resource Bulletin NE-157

Table TR-7 shows the number of wood using industries in counties with Monongahela NFS lands, as well as the types of products these industries produce.

Table TR-7. Number of Wood Using Industries by County

County	Number of Industries	Types of Products
Barbour	13	Lumber, Ties, Cants, Cabinets, Rails, Posts, Moulding, Flooring, Furniture, Pews
Grant	5	Lumber, Ties, Cants, Moulding, Firewood, Mulch, Baskets, Dimension Pieces
Greenbrier	4	Lumber, Cants, Architectural Woodworking
Nicholas	14	Lumber, Cants, Furniture, Veneer, Cabinets, Moulding, Siding, Panels, Flooring, Pallets, Boxes, Posts, Rails, Trim, Doors, Stairs
Pendleton	2	Lumber, Ties, Log Cabin Parts
Pocahontas	11	Lumber, Cants, Posts, Rails, Firewood, Pulpwood, Log Homes, Paneling, Furniture, Crafts, Framing
Preston	9	Lumber, Cants, Ties, Moulding, Paneling, Framing, Flooring, Pallets, Crates
Randolph	26	Lumber, Cants, Posts, Rails, Flooring, Furniture, Cabinets, Firewood, Doors, Toys, Pulpwood, Moulding, Paneling, Trim, Frames, Plaques, Picnic Tables, Signs, Stairs, Stakes, Clocks, Casing, Handle Blanks, Mantles, Windows, Benches, Swings
Tucker	3	Lumber, Architectural Woodwork, Posts, Rails, Ties
Webster	9	Lumber, Cants, Ties, Posts, Rails, Pallets, Paneling, Flooring, Siding

Source http://www.wvforestry.com/indassistance.cfm, accessed March 9, 2004

Since the existing 1986 Forest Plan was signed, two Oriented Strand Board (OSB) mills (in Braxton and Fayette Counties) and one major hardwood-flooring mill (Randolph County) have opened within hauling distance of MNF lands. The two OSB mills utilize nearly 1.5 million tons of soft hardwood fiber annually. Generally, these mills will bring in material from distances up to 150 miles for processing. The hardwood-flooring mill utilizes about 1.75 MMBF per week of mostly oak lumber. Two other mills utilizing yellow poplar, cucumber tree, and sycamore also began operations in the 1990s, with the capacity to use 100 MMBF annually. These five new mills directly created over 1,000 new jobs in West Virginia. In the early 1990s, the Mead

Westvaco paper mill in Covington, Virginia added another paper machine that nearly doubled their previous capacity (from 1.6 million tons of wood fiber to 3.0 million tons). Much of the pulpwood harvested from Forest timber sales goes to nearby Mead Westvaco paper mills. Pulpwood volume has represented only about 20 percent of total volume harvested on the Forest and has been typically low value material. Many of the existing sawmills have increased their wood use capacity by adding a work shift. A few other sawmill companies have constructed additional sawmills within West Virginia or have increased production by improving technology.

In 1986, about 400-500 MMBF of timber was harvested in West Virginia. In 2003, about 1,000 MMBF was harvested (personal communication on 3/17/04 with Ed Murriner, Assistant State Forester). From 1999-2003 the MNF sold 22 sales to 11 different purchasers. Six of the purchasers were located within the Forest Proclamation Boundary, three purchasers were within 15 miles of the boundary, and the other two purchasers had timber processed within the Proclamation Boundary.

Management Prescriptions/Silviculture Systems/Harvest Methods

Each Management Prescription (MP) describes the amount and type of activities that may occur in that area. The amount and/or type of activities that may occur, such as timber harvest, prescribed burning, wildlife habitat improvements, etc. will be defined in the desired condition, goals, objectives, standards, and guidelines and in each MP. As MPs vary in the mix and amount of treatments or lack of treatments, they provide a good comparison between alternatives.

The selection of which silvicultural system and harvest method to use on these lands is based primarily on the site, the existing condition of the forested stand, and the desired condition and objectives of the MP.

A variety of silvicultural tools are available for vegetation treatments to provide a variety of habitats and products. These tools include timber stand improvement cuts (both commercial and non-commercial), regeneration cuts, planting, herbicides, and prescribed fire, all of which can influence the stand complexity of the understory, midstory, and overstory layers of the forest. In addition, systems used to harvest timber can vary from rubber tire skidders to cable yarders and horses to helicopters.

The 1986 and 2006 Forest Plans allocate land to specific MPs, each with certain desired conditions and associated outputs. Each MP has a primary emphasis that guides the management of forest resources in the area. Active management (commercial and non-commercial timber harvest) of forest types and age classes occurs in MPs 2.0, 3.0, 4.0, 4.1, and 6.1 at various intensities and for differing reasons. The following are goals for MPs that allow active vegetation management:

MP 2.0 - The purposes for lands assigned MP 2.0 are to emphasize a continuous forested scene and shade-tolerant vegetation. Shade-tolerant vegetation will be managed by uneven-aged silvicultural actions (1986 Forest Plan, Chapter IV).

MP 3.0 - MP 3.0 lands will emphasize large, high quality hardwood trees for lumber and veneer, hard mast, and scenic attributes. The forest will be a mosaic of stands of predominately hardwood trees and associated understories with variety in size, shape, and height of tree species depending on the silvicultural system applied (1986 Forest Plan, Chapter IV).

MP 4.0 - Lands assigned MP 4.0 will emphasize a variety of coniferous species managed for fiber and lumber. This MP includes existing conifer stands, with some associated hardwoods (1986 Forest Plan, Chapter IV).

MP 4.1 - The MP 4.1 emphasizes the active and passive restoration of spruce and spruce-hardwood communities and the recovery of species of concern found in these communities, a mix of forest products, management of hardwood communities where spruce is not present or represents only a minor component of a stand, and research or administrative studies on spruce restoration. Passive management and research or administrative studies only would be allowed on lands determined to be suitable habitat for the WVNFS (2006 Forest Plan, Chapter III).

MP 6.1 - The primary purpose of lands assigned to MP 6.1 is to provide habitat for wildlife species that prefer remote habitat. Most roads remain closed to public vehicle traffic through most of the year. A mixture of forest products is a secondary goal to assist in the management of wildlife habitat. Since hard mast is to be emphasized in these areas, sites reverting from hardwood to conifer (pine and spruce) are to be managed to ensure long-term continuous hard mast production by providing a variety of age classes (1986 Forest Plan, Chapter IV).

The silvicultural system defines the treatment to regenerate (or prepare for a regeneration cut) a forested stand of trees using a particular harvest method. Each system is formulated and designed for a specific set of circumstances, objectives, or environmental conditions yet is dynamic to allow flexibility as situations or scientific knowledge changes. The basic conditions to consider when choosing a silvicultural system include:

- Characteristics of the tree species and forest types.
- Features of the site(s) where the trees are growing.
- Protection or enhancement of other resources such as wildlife, water, soils, etc.
- Goals and objectives for the area.

The characteristic of the tree species or forest type (such as tolerance to shade, susceptibility to wind throw, adaptability to soil and moisture conditions, and vulnerability to insects, disease, and fire) determines the range of alternative treatments that can be prescribed. For example, a plant species needing full sunlight will not grow well under the shade of closed forest canopy, or a tree species with a shallow root system should not be regenerated with the seed tree harvest method because the seed trees might blow over before a new stand can become established. Generally, there are two silvicultural systems that have been used to manage the MNF: 1) even-aged and 2) uneven-aged.

Even-Aged Silvicultural System

This system is designed to create a forested stand where all the trees are about the same age or where the difference in age from the oldest tree to the youngest tree does not exceed 20 percent

of the length of the rotation. The length of the rotation is the time when a stand of trees is mostly in the seedling stage (or immediately after a regeneration harvest) to the time when the stand is ready for a regeneration harvest. For example, in a recently regenerated stand with a 100-year rotation, most of the youngest trees would have an age between 0 and 1 while most of the oldest trees should be no older than 20. When most of these trees reach 100 years of age, the stand is again ready to be regenerated. In a regulated forest, this system is designed to create or maintain individual stands that collectively should produce a diverse pattern of age classes across the landscape over time. The purpose of this system is to regenerate tree species generally intolerant or moderately tolerant of shade for a sustainable supply of forest products. Harvest methods in the even-aged silvicultural system include:

- Clearcutting with reserve trees,
- Two-aged,
- Shelterwood,
- Seed tree, and
- Thinning.

The even-aged system tends to mimic moderate to major disturbance events found in nature such as uncontrolled wild fires during periods of drought, hurricanes, tornadoes, ice storms, or insect/disease outbreaks, but in a more controlled manner. The intent is to open the forest floor to more sunlight so trees that need full or partial sunlight (shade intolerant) can grow. These methods require fewer harvest removal entries into a stand (at least 1 but usually no more than 4 within a 100 to 120 year rotation) to increase the growth or regenerate the desired species. The size of a single even-aged regeneration-cutting unit has been limited to 25 acres in the 1986 Forest Plan, although the NFMA allows a 40-acre size limit for hardwood forest types. The 25-acre limit has been removed in the 2006 Forest Plan, and the limit would default to 40 acres to be consistent with the NFMA. Exceptions to exceed the NFMA size limit need the approval of the Regional Forester.

The **clearcutting with reserve tree method** harvests nearly all of the trees within a stand in one removal. Typically some trees are left to meet wildlife habitat or other resource needs. This method requires fewer entries, is less costly to administer, and is considered to be the most economically efficient (over the long term) of all harvest methods.

The **two-aged method** harvests most of the trees in the older age class to create a young age class. Harvest entries are usually scheduled 40 to 80 years apart to maintain two distinct age classes within the stand. The residual basal area in a two-age harvest should be from 15-25 square feet of basal area per acre. The lower residual basal area is necessary due to the length of time to the next entry to allow the intolerant and moderately tolerant species to grow into the canopy before the residual crowns close and suppress the growth of the regeneration.

The **shelterwood method** harvests the mature trees in two or more removal cuts within 3 to 20 years after the initial cut. The shelterwood method requires a re-entry harvest usually within 3 to 20 years after the first entry allowing a higher residual basal area of 30 to 50 square feet per acre. The longer the time between the initial entry and the second entry, the lower the residual basal area should be. Both the two-aged method and the shelterwood method are preferred in hardwood stands where potential advance regeneration is lacking or absent.

The **seed tree method** is usually used in conifer stands with the first cut removing all but 2 to 10 trees/acre of the best growing, seed-producing trees of the desired species to be regenerated. A second cut to remove the seed trees may be done once an adequate number of the desired seedlings have been established.

The **thinning method** is an intermediate cut that prepares a stand for a regeneration harvest. This method removes high risk (trees that most likely will not survive until the regeneration harvest is initiated), low quality, diseased, and over mature trees to increase the health, development, and growth of the residual trees in a stand. One to several intermediate cuts may be applied in a stand prior to the regeneration harvest. Thinning is applicable to all of the forest types found on the Forest.

Uneven-Aged Silvicultural System

This system is designed to maintain a high forest canopy cover of trees that have a range of diameter, size, and age classes while continuously regenerating desirable species. A stand is considered to be uneven-aged if three or more age classes are present. The purpose of this system is to regenerate desirable tree species that grow better under the shade of the forest canopy. It is often used to maintain or enhance the aesthetic values of a forested area or provide habitat for specific wildlife species.

Harvest methods in the uneven-aged silvicultural system include singletree selection and group selection. This system tends to mimic disturbance events found in nature such as individual trees or small groups of trees dying from a weather, insect, disease, or age-related event. These events favor the regeneration of those trees that grow better underneath other trees (shade tolerant). Both harvest methods in this system require frequent entries into the stand (usually once every 10 to 20 years) to encourage continuous regeneration and growth of desired tree species. The **singletree selection method** harvests individual trees, both large and small, favoring trees such as beech and sugar maple that are tolerant of the shade of the residual forest canopy. The **group selection method** removes all trees within a small area, generally at least a half acre but typically no larger than two acres, within the larger forested stand. This method allows for the growth of some of the more shade-intolerant trees species within the uneven-aged stand.

Harvest Method Application and History

Each MP emphasizes distinct goals, objectives, and desired conditions for managing a defined area of Monongahela NFS land. The harvest method describes the treatment a stand(s) will receive based on site-specific conditions in order to attain a desired condition within a MP. For example, if a stand has an understory of striped maple with an overstory dominated by oaks and the management emphasis of the MP is to restore the oak-hickory community, then a clearcut may be the chosen harvest method since striped maple grows best under the partial shade that would be the result of a shelterwood or two-age harvest. In the partial shade of a two-age or shelterwood harvest the oaks that are moderately tolerant to intolerant of shade would not grow as quickly because of reduced sunlight caused by the shading of the residual trees and would have difficulty competing with or outgrowing the striped maple. Within 15 years after the initial

regeneration harvest, most of the oaks would die because of the lack of sunlight produced by the dense shade of the striped maple trees.

The harvest method is an important silvicultural treatment that can be used to regenerate mature stands of trees that are usually in the mid- or late successional stage to the early successional stage. The early successional stage that is the result of even-aged regeneration harvest methods (clearcut, two-age, and shelterwood) provides unique habitat and food sources that are not available or available in lower quantities in the later successional stages. A specific harvest method may be chosen to increase the growth or quality of trees, enhance scenery management such as creating vistas, improve diversity of species composition, reduce the risk of fire, or minimize the risk of insect or disease outbreaks. Table TR-8 shows the timber harvest activity on the Forest from 1986 through 2003 (18 years).

Table TR-8. Acres Treated by Harvest Method on the MNF, 1986-2003

Fiscal Year	Harvest Method				
	Clearing	Even Aged	Intermediate	Uneven Aged	Annual Totals
1986	0	894	3,455	124	4,473
1987	0	1,469	3,963	273	5,706
1988	6	1,925	4,440	433	6,803
1989	0	1,593	2,459	239	4,291
1990	0	924	3,392	356	4,672
1991	35	1,457	3,133	879	5,503
1992	72	1,221	2,515	944	4,752
1993	28	1,400	1,686	27	3,141
1994	15	879	1,502	0	2,396
1995	83	971	1,631	164	2,849
1996	25	960	1,899	641	3,525
1997	58	755	1,529	405	2,747
1998	22	873	1,511	174	2,580
1999	33	1,025	1,421	351	2,830
2000	94	766	659	0	1,519
2001	4	462	534	79	1,079
2002	27	335	502	0	864
2003	41	514	741	14	1,310
Harvest Totals	**543**	**18,423**	**36,972**	**5,104**	**61,041**

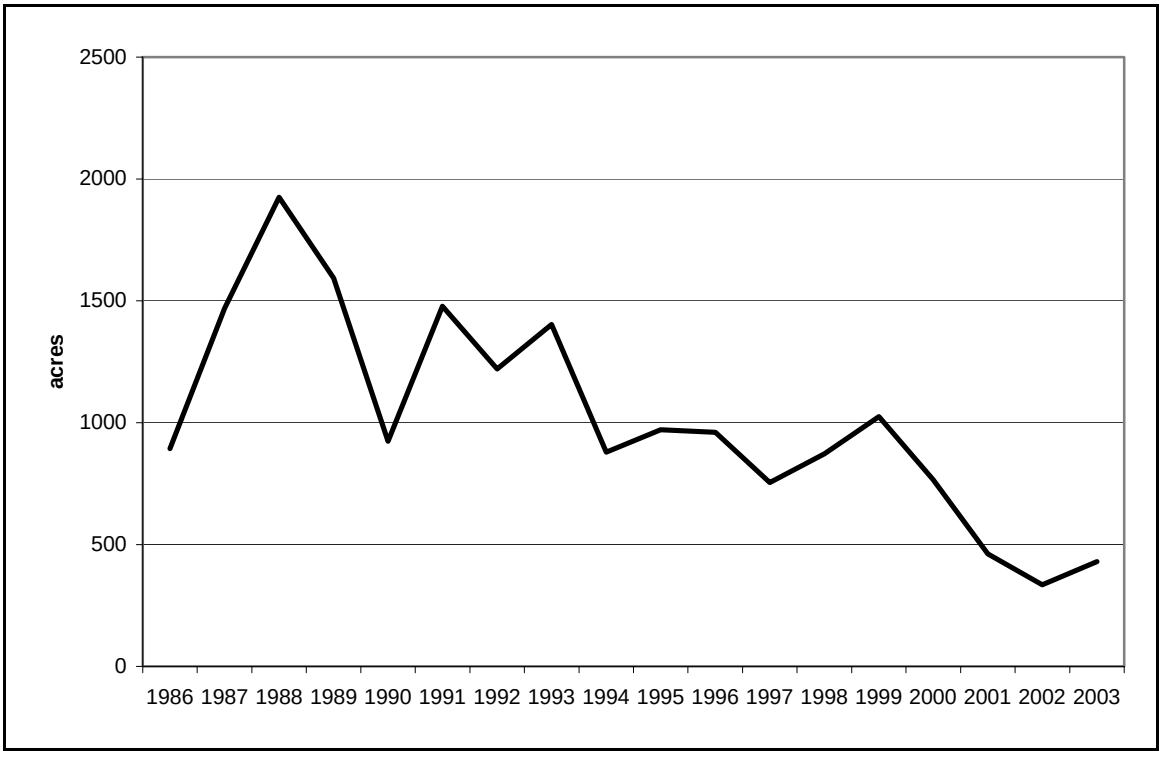
There were an estimated 18,423 acres of even-aged harvest (clearcuts with reserve trees, two-aged cuts, shelterwoods), or about 30 percent of the total harvests. There were 14,129 acres of clearcuts with reserve trees, or about 23 percent of the total harvest. The 1986 Forest Plan predicted 16,000 acres (an average of 1,600 acres per year) would be regenerated by the clearcut harvest method in the first 10 years of the 1986 Forest Plan. For the first decade of the 1986 Forest Plan, 11,720 acres were clearcut (4,280 acres less than predicted). Even with the two-aged harvested acres included, the total acres regenerated by these two methods in the first 10 years of the 1986 Forest Plan were 12,181 acres. Before 1991 the two-aged harvest method was

not used on the Forest. The 1986 Forest Plan does allow for this method of harvest, but it was then called the deferred rotation harvest method. The two-aged harvest method is similar to a clearcut with reserve trees except more trees are left standing.

The projection from the 1986 Forest Plan predicted 2,000 acres (an average of 200 acres per year) would be regenerated by the shelterwood harvest method in the first 10 years of the 1986 Forest Plan. A total of 1,432 acres were regenerated in 18 years by the shelterwood and seed tree methods (576 acres in the first 10 years). The even-aged harvest numbers for the second decade thus far have seen a much sharper decrease in reality over proposed.

One of the main implications of this discrepancy between predicted and actual regeneration harvests is that more of the Forest has remained in the same age class. Only about 3 to 4 percent of the Forest is now in a young, or early successional age class, and most of the Forest is mature timber in the mid or mid-to-late successional age classes. Without additional regeneration soon, most of the Forest stands will become over-mature or late successional over the next 50 years, with associated effects to age class and habitat diversity.

Figure TR-1 - Total Acres Regenerated by All Even-Aged Methods 1986-2003
All Management Prescriptions



ENVIRONMENTAL CONSEQUENCES

Resource Protection Needs

Resource protection has been integrated into timber management direction at various scales, from national to site-specific. The cumulative positive effect of the multi-dimensional direction described below is beneficial protection and mitigation for all resources that may potentially be adversely affected by timber management activities.

Laws, Regulations, and Policies

Numerous, laws, regulations, and policies govern the management of timber resources on NFS lands. National laws and regulations have also been interpreted for implementation in Forest Service Manuals, Handbooks, and Regional Guides. All timber management activities and the assessment of lands suitable for managing timber must comply with these laws, regulations, and policies, which are intended to provide general guidance for the implementation of timber management practices, and for protection of related resources. Some of the more important laws and regulations influencing timber management are listed in Table VE-5 in the *Vegetation Management* section.

Forest Plan Direction

Forest Plan management direction for timber resources has been developed to enhance, maintain, or restore forest vegetation to desired conditions on NFS lands. Direction occurs at both the Forest-wide and MP levels. Goals and objectives have been designed to provide sustainable levels of timber production, while maintaining, enhancing, or restoring ecosystem functions and processes. Standards and guidelines have been designed to protect other resources that could be adversely affected by timber management activities. Some 1986 Forest Plan direction has been removed, such as direction that repeated existing law or policy, conflicting direction with other resources, or direction that was no longer applicable due to changing conditions. Management direction for other resource programs was developed in an integrated manner to provide additional guidance for resource protection.

Forest Plan Implementation

Proper timber management depends on current and site-specific information about environmental conditions and the effects that these activities may have on other resources. Some of these conditions are not appropriately addressed at the programmatic level of the Forest Plan. Detailed silvicultural prescriptions, written and approved prior to implementation of individual projects, are designed to address the current and site-specific resource conditions. Through the project implementation process, adjustments are made to address resource concerns in a timely, effective, and site-specific manner. Additionally, during project planning, site-specific evaluations are conducted to verify the suitability classification of NFS timberlands within the project area. Appropriate site-specific mitigations from the project planning documentation are then incorporated into implementation guides and contract specifications that are applied and administered by Forest personnel and contractors.

Forested Land Identified as Tentatively Suitable for Timber Management

NFS lands are periodically assessed to determine whether they are suited for timber management. The analysis begins by identifying those lands that are not available and capable of being managed for timber production. This specifically results in identifying:

- National Forest System lands that do not or cannot support forested vegetation,
- Lands that have been formally withdrawn from timber production, such as designated Wilderness,
- Forested lands where restocking of tree seedlings cannot be assured within five years following final timber harvest, and
- Lands where timber production may result in irreversible resource damage to soil productivity or watershed conditions.

Lands that possess any one of the above conditions are classified as not suited for timber production. The remaining lands are classified as tentatively suited for timber production. These lands are potentially available for, and biologically and physically capable of timber production. This classification is the same for all alternatives, or in other words, the area identified as capable and available for timber production does not vary by alternative.

The assessment of tentatively suited timberlands for the revision of the Forest Plan has yielded the following information, summarized in Table TR-9.

Table TR-9 – Lands Tentatively Suited for Commercial Timber Harvest

Acres	Description
916,968	Legal acreage of Monongahela national Forest (Lands Program)
- 15,869	Land not forested, less than 10% stocking (CDS, LSC 204, 250, 255, 257, and 268)
- 2,856	Land not forested, water (from CDS, LSC 165, 170, and 180, and GIS STANDs 998)
- 763	Land not forested, administrative sites (office site, campgrounds, etc. from CDS, LSC 295)
- 476	Lands not forested, roads or rights of way greater than 120 feet wide (CDS, LSC 290)
- 38,023	Technology is not available to harvest without damage (CDS, LSC 720, 730, and 740)
- 8,934	Adequate regeneration cannot be assured within 5 years (CDS, LSC 710)
- 78,499	Land withdrawn from timber production, Wilderness (CDS, LSC 300)
- 6,371	Land withdrawn from timber production, Research Natural Areas, Scenic Areas, Botanical Areas, Zoological Areas, Fernow Experimental Forest (CDS, LSC 735, 802, 803, 805)
- 4,737	Difference between acres with no LSC and STANDs 998
- 2,847	Difference between legal acreage of Forest and acres in GIS
757,593	Land tentatively suitable for timber production

Lands classified as tentatively suited for timber production are further evaluated to determine whether they are appropriate for timber production. The tentatively suited timberlands identified as being appropriate for timber production are classified as suited timberlands. This will be discussed in greater detail below.

Direct and Indirect Effects by Alternative

Suitable Land Available for Timber Management

In Alternative 1, the forested acres considered suited for timber management are located in MPs 2.0, 3.0, 4.0, and 6.1. In Alternatives 2 through 4 these MPs shift to 3.0, 4.1, and 6.1. Most of the lands in MP 4.1 that are in suitable habitat for the endangered West Virginia northern flying squirrel (WVNFS) are not suitable for timber management and will not be actively managed except for research or administrative study purposes. Those lands in MP 4.1 that are not in WVNFS suitable habitat but have a spruce component, may be actively managed for restoration of the spruce-hardwood community, but are not considered as suitable for timber management. Only those stands that do not have a spruce component in MP 4.1 are considered to be suitable for timber management. Table TR-10 breaks out the tentatively suitable acres into categories that are considered not suited for timber management by MP. Many of the constraint categories were combined to show collective acres in order to avoid double-counting acres where two or more of the areas overlap.

Table TR-10 – Lands Suited and Available for Commercial Timber Harvest

Land Class Description	Acres				
	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
Total modeled acres	912,516	912,516	912,516	912,516	912,516
Wilderness (MP 5.0)	-78,738	-78,738	-78,738	-78,738	-78,738
Recommended Wilderness (MP 5.1)	-0	-27,657	-27,657	-99,148	-0
Backcountry Recreation (MP 6.2)	-124,125	-95,993	-105,223	-222,854	-49,716
Special Areas (MP 8.0)	-115,979	-69,920	-72,820	-57,746	-69,920
Indiana Bat Primary Range in MPs 3.0, 4.1, 6.1	-0	-148,061	-146,064	-92,971	-164,521
Tentatively unsuitable	-261,464	-161,852	-152,629	-107,693	-202,875
WV Northern Flying Squirrel Suitable Habitat*					
Eligible Wild or Scenic WSR Corridors**					
Indiana Bat Key Areas and Hibernacula***					
Very High and Distinct Scenic Integrity Areas					
Perennial & Intermittent Stream Channel Buffers					
Existing suitable base adjustment****					
Suited Timberland Available for Harvest	332,200	330,300	329,400	253,400	346,700
Percent of Forest Land Base	**36%**	**36%**	**36%**	**28%**	**38%**

*In Alternative 1, WV northern flying squirrel suitable habitat is in Opportunity Area 832, part of MP 8.0
**Includes all rivers in Alternative 1, but only Wild or Scenic classification rivers in Alternatives 2, 3 and 4
***Calculated for Alternative 1, but incorporated into Indiana bat primary range for Alternatives 2, 3, and 4
****Includes adjustments in Alternative 1 for land acquisition and exchanges, and removal of the "floating" timber base referred to in 1986 but never clearly identified on the ground

The suitable acres have also been calculated for each suitable MP by alternative in Table TR-11.

Table TR-11. Suitable Acres by Management Prescription by Alternative

MP	Alternative 1		Alternative 2		Alternative 2M		Alternative 3		Alternative 4	
	Acres	Percent of MP	Acres	Percent of MP	Acres	Percent of MP	Acres	Percent of MP	Acres	Percent of MP
2.0	6,334	46%	0	0	0	0	0	0	0	0
3.0	80,723	59%	155,735	79%	154,356	79%	146,220	80%	156,555	77%
4.0	261	65%	0	0	0	0	0	0	0	0
4.1	0	0	25,726	17%	27,295	18%	22,747	25%	29,506	15%
6.1	174,648	61%	148,834	52%	147,735	53%	84,400	47%	160,685	52%
6.3	70,236	52%	0	0	0	0	0	0	0	0

For all alternatives, the suitable lands represent the areas where commercial timber harvest and associated activities are most likely to occur. However, the acres identified above are best estimates based on current knowledge, and site-specific information is used to determine suitability on a project-by-project basis.

Under all alternatives, it is highly unlikely that all of the acres considered suitable for timber management would receive harvest treatments over the next 100 years. Some areas may end up being reclassified as not suited for reasons described above. Also, management direction provides restrictions that govern the amount of management that can occur in a specific area over a given period of time. For example, Forest-wide Timber Standard TR06 states:

> No more than 20 percent of NFS lands within each prescription area unit shall receive regeneration harvest over a 10-year period.

In addition, Standard 4118 in MP 4.1 and Standard 6122 in MP 6.1 state:

> No more than 40 percent of forested NFS lands within each 6.1 prescription area unit shall be harvested over a 10-year period. Thus, at least 60 percent of each unit shall provide security areas for wildlife during the 10-year period.

Some of the factors that influenced the differences in suitable acres in this assessment are described below by alternative.

Alternative 1 - Alternative 1 has approximately the same amount of acres suitable for timber harvest as depicted in the 1986 Forest Plan, 332,200 acres. This amount represents about 36 percent of the Forest, leaving 64 percent of the Forest in areas not actively managed for timber. In this alternative only the key areas and hibernacula of Indiana bat habitat are considered not suited for timber management; as opposed to the entire primary range. Suitable habitat for the WFNFS is removed from the suited base as Opportunity Area 832, part of MP 8.0.

Alternative 2 - Alternative 2 also has about 36 percent of the total Forest acres in lands suitable for timber harvest, although 1,900 less acres than Alternative 1. MPs 3.0 and 6.1 contain the majority of lands suitable for timber harvest. MPs 2.0 and 4.0, which existed in Alternative 1, have been incorporated into other MPs in Alternatives 2, 2M, 3, and 4. In MP 4.1, only 25,700

acres (17 percent) are considered suitable for timber harvest because they do not have a spruce component, and timber management would likely have no adverse impact on the WVNFS.

Alternative 2 Modified - Alternative 2M also has about 36 percent of the total Forest acres in lands suitable for timber harvest, although 2,800 fewer acres than Alternative 1, and 900 fewer than Alternative 2. MPs 3.0 and 6.1 contain the majority of lands suitable for timber harvest. In MP 4.1, only 27,300 acres (18 percent) are considered suitable for timber harvest because they do not have a spruce component, and timber management would likely have no adverse impact on the WVNFS.

Alternative 3 - Alternative 3 has about 28 percent of the total Forest acres in lands suitable for timber harvest, leaving at least 72 percent of the area that would not be actively managed for timber. Alternative 3 is similar to Alternatives 2 and 4 in that MPs 3.0 and 6.1 contain the majority of lands suitable for timber harvest. In MP 4.1, only about 22,700 acres (25 percent) are considered to be suitable for timber harvest. The percentage of acres is higher in this alternative because the total acres in MP 4.1 are lower. This is because a large amount of the acres that are considered to be suitable habitat for the WVNFS are in MPs such as 5.1 and 6.2 where commercial timber production is restricted.

Alternative 4 - Alternative 4 has about 38 percent of the total Forest acres in lands suitable for timber harvest and has more acres in MPs 3.0 and 6.1 than any of the other alternatives. At least 62 percent of the Forest is considered not suited for timber management in this alternative. Alternative 4 is similar to Alternatives 2 and 3 in that MPs 3.0 and 6.1 contain the majority of lands suitable for timber harvest. Only about 29,500 acres (15 percent) in MP 4.1 are considered to be suitable for timber harvest. Alternative 4 has the largest amount of acres in MP 4.1 because it does not have any acres in MP 5.1 and has the fewest acres of all alternatives in MP 6.2.

Allowable Sale Quantity

Table TR-12 displays the projected maximum annual timber harvest volume for each alternative during the first, fifth, and tenth decades in order to show both short- and long-term effects. The volume projections are based on growth and yield estimates from the Spectrum computer model. Spectrum is a linear program-based model used on NFS lands, for planning purposes, to schedule outputs over a specified period of time (see Appendix B for more information on how Spectrum was used in this analysis). These estimates have not been adjusted to consider projected budget or personnel needed to plan, analyze, and implement projects to achieve these potential outputs.

Table TR-12 – Projected Maximum Annual Volume of Timber Harvested by Decade in MMCF (Million Cubic Feet) and MMBF (Million Board Feet)

Decade	Alt. 1	Alt. 2	Alt. 2M	Alt. 3	Alt. 4
First	108 MMCF 646 MMBF	105 MMCF 632 MMBF	105 MMCF 629 MMBF	83 MMCF 498 MMBF	133 MMCF 800 MMBF
Fifth	108 MMCF 646 MMBF	105 MMCF 632 MMBF	105 MMCF 629 MMBF	83 MMCF 498 MMBF	100 MMCF 601 MMBF
Tenth	108 MMCF 646 MMBF	105 MMCF 632 MMBF	105 MMCF 629 MMBF	83 MMCF 498 MMBF	113 MMCF 679 MMBF

Alternative 1 – Alternative 1 could produce a maximum estimated volume of 107,700 MCF, or 65 MMBF, in decades 1-10. A 6,000-acre per year treatment cap was imposed during modeling to address a Biological Opinion requirement for the T&E Species Amendment to the 1986 Forest Plan, along with a constraint that ensured a non-declining even flow of timber production.

Alternative 2 - Alternative 2 could produce a maximum estimated volume of 105,400 MCF, or 63 MMBF, in decades 1-10, which is only 3 percent less than Alternative 1. Alternative 2 also has slightly less suitable acres than Alternative 1. A 6,000-acre per year treatment cap was imposed during modeling, along with a constraint that ensured a non-declining even flow of timber production.

Alternative 2 Modified - Alternative 2M could produce a maximum estimated volume of 104,800 MCF, or 63 MMBF, in decades 1-10, which is only 3 percent less than Alternative 1. Alternative 2 also has slightly less suitable acres than Alternatives 1 and 2. A 6,000-acre per year treatment cap was imposed during modeling, along with a constraint that ensured a non-declining even flow of timber production.

Alternative 3 - Alternative 3 could produce a maximum estimated volume of 83,000 MCF, or 50 MMBF, in decades 1-10, which is about 23 percent less than Alternative 1. This difference reflects a 24 percent reduction in suitable acres between the two alternatives. A 6,000-acre per year treatment cap was imposed during modeling, along with a constraint that ensured a non-declining even flow of timber production.

Alternative 4 - Alternative 4 could produce a maximum estimated volume of 133,300 MCF, or 80 MMBF, in decade 1, which is about 24 percent more than Alternative 1. However, by decade 5 the volume decreases to 100,100 MCF, which is 7 percent less than Alternative 1. By decade 10 the volume increases to 113,200 MCF, or 5 percent more than Alternative 1. The main reason the volume fluctuates so much in Alternative 4 is that the non-declining even flow constraint was removed during modeling to allow this alternative to achieve age class desired conditions in a more effective manner. This departure was used because it was "…reasonable to expect that overall multiple use objectives would otherwise be better attained" [36 CFR 219.16 (a)(3)(iv)]. However, an overall decadal volume cap was imposed to ensure that the acres treated did not exceed the long-term sustained yield capacity (see below). No cap for acres treated was imposed on this alternative.

Long-term Sustained Yield Capacity (LTSYC)

The LTSYC represents the highest uniform yield of wood that may be sustained under a specified management emphasis. The LTSYC also represents the volume of wood that may be produced while meeting all management requirements for protection of other resources. The following table identifies the LTSYC for the Forest, and for each alternative. The amounts shown are decadal volumes.

Table TR-13. Long-term Sustained Yield Capacity by Alternative
(in Millions of Cubic Feet and Millions of Board Feet per Year)

Alternative 1	Alternative 2	Alternative 2M	Alternative 3	Alternative 4
14.8 MMCF/yr 89 MMBF/yr	15.0 MMCF/yr 90 MMBF/yr	14.9 MMCF/yr 90 MMBF/yr	12.8 MMCF/yr 77 MMBF/yr	13.9 MMCF/yr 83 MMBF/yr

Indicator 3 – Acres by Harvest Method by Alternative

The analysis below discusses some of the harvest trends seen through time for each alternative, or between alternatives. The effects that these harvest methods may have on other resources are covered in other resource sections in this chapter, such as Scenic Environment and Vegetation Management. For the purpose of this exercise, uneven-aged harvest methods (individual tree and group selection) are assumed to fall into other harvest method categories for the following reasons:

- Although uneven-aged harvest can be an important silvicultural tool, it is not likely to be used extensively in the near future to achieve the desired conditions of age class and habitat diversity. Individual tree selection, in particular, would not contribute to creating young age classes. Also, natural succession would emulate the effects of individual tree selection over time, and natural succession would dominate vegetation conditions on over 60 percent of the Forest under all alternatives.

- The intensity of tree removal and effects from uneven-aged and intermediate harvests are similar in some ways. In commercial thinning, the objective is to increase the growth and yield of fairly high-value trees for future harvest; whereas individual tree selection may choose to leave trees behind for a variety of reasons, including wildlife habitat, soil stability, or visual concerns. Although the individual tree method would promote uneven-aged stand conditions over time, the effects from harvest in any given decade would be very similar to a commercial thin in terms of volume output, acres treated, and impacts on other resources.

- The intensity and effects of group selections and clearcut regeneration harvests are similar in some ways. Group selections rarely exceed 2 acres, whereas clearcuts with reserve trees typically do not exceed 40 acres. However, both systems remove the vast majority of trees from the site with the objective of regenerating the area to more shade-intolerant species than individual tree selection harvests.

Table TR-14 shows the maximum amount of acres that the Spectrum model predicted would be treated by different harvest method by alternative, over the next decade, the 5th decade, and the 10th decade.

Table TR-14 – Projected Maximum Acreage of Timber Harvest by Harvest Method by Decade

Acres in Decade 1: 2006-2015					
Harvest Method	**Alt. 1**	**Alt. 2**	**Alt. 2M**	**Alt. 3**	**Alt. 4**
Intermediate Harvests	27,411	11,324	11,335	20,382	0
Two-aged Harvests	18,092	16,396	17,239	8,602	23,800
Clearcuts with Reserve Trees	5,860	12,735	11,862	9,435	14,963
Shelterwood Harvests	3,458	4,841	4,902	2,345	12,810
Totals	54,821	45,296	45,338	40,764	51,573
Acres in Decade 5: 2046-2055					
Intermediate Harvests	639	1,032	848	560	2,614
Two-aged Harvests	15,788	16,633	16,663	12,749	15,337
Clearcuts with Reserve Trees	9,416	9,920	9,779	8,893	14,701
Shelterwood Harvests	31,778	24,507	24,232	16,777	10,929
Totals	57,621	52,092	51,522	38,977	43,581
Acres in Decade 10: 2096-2105					
Intermediate Harvests	19,615	9,460	12,480	8,706	8,758
Two-aged Harvests	14,917	16,008	15,640	12,622	18,056
Clearcuts with Reserve Trees	10,592	13,181	12,567	9,626	15,894
Shelterwood Harvests	14,876	13,375	13,348	9,288	9,053
Totals	60,000	52,025	54,035	40,184	51,761

Alternative 1 – In decade 1, intermediate thinning was included as 50 percent of the harvests, based on past harvesting patterns under the 1986 Plan. Two-aged harvests are the bulk of the remaining treatments, with clearcuts only comprising about 10 percent of the harvest. By decade 5, the model is choosing very little intermediate harvest, because most of the stands have reached an age where commercial thinning is no longer appropriate. Shelterwood and two-aged make up most of the harvests, with clearcuts comprising about 16 percent. By decade 10, a large amount of intermediate thinning is needed to improve the growth and yield of maturing trees. The amounts of shelterwood and two-aged harvests are very similar, and both are being used at a rate that is about 7 percent greater than clearcutting with reserve trees.

Alternatives 2 and 2M – In decade 1, intermediate thinning was included as 25 percent of the harvests, based on the assumption that current stands would benefit from this level of treatment over the next 10 years. Harvest levels for these two alternatives are very similar. Two-aged and clearcut harvests are used extensively to regenerate stands and begin the process of increasing age class diversity. Because of less thinning, the overall amount of harvest is somewhat less than in Alternative 1, although the volume outputs are similar. By decade 5 the total harvest acres have increased somewhat, with shelterwoods and two-aged cuts as the dominant harvest methods, and very little thinning due to the fact that most stands are too old or too young to benefit from this treatment. Again, harvest levels are very similar for both alternatives. In decade 10, the overall harvest is similar to decade 5, but there is a relatively even mix of harvest methods being used to maintain desired vegetation conditions. Alternative 2M is treating slightly more acres than Alternative 2, primarily in intermediate harvests.

Alternative 3 - In decade 1, intermediate thinning was included as 50 percent of the harvests, based on past harvesting patterns under the 1986 Forest Plan. Clearcutting would be the next most common method used, followed closely by two-aged harvests. By decade 5, the model is choosing very little intermediate harvest, because most of the stands have reached an age where commercial thinning is no longer appropriate. Shelterwood and two-aged make up most of the harvests, with clearcuts comprising about 23 percent. By decade 10, a larger amount of intermediate thinning is needed to improve the growth and yield of maturing trees. The amounts of shelterwood and clearcut harvests are very similar, and both are being used at a rate that is about 30-35 percent less than two-aged harvests. Overall harvest rates are the lowest of all alternatives for all decades primarily because the suited base is considerably smaller.

Alternative 4 – Alternative 4 was designed to achieve desired vegetation conditions, including restoration, without quite as many management constraints. Therefore, no acre cap or thinning constraint was applied, and the ASQ did not have to meet the non-declining even flow requirement because this alternative better attained the multiple-use objectives and it did not exceed the LTSYC. In the first decade the model avoids thinning in order to more efficiently regenerate stands so that they will contribute to age class diversity in the future. The relatively high amounts of regeneration harvest early on allow the model to thin more trees by decade 5, while not having to harvest as much as Alternatives 1 or 2. In decade 10, the model is still harvesting less than Alternatives 1 or 2, primarily because it is trying to more effectively meet desired age class conditions by retaining more trees in the mid and mid-late successional stages.

Cumulative Effects

Timber Supply

Overall, the range of suitable acres and volume outputs between alternatives is not very large. This is indicative of the relatively similar amounts of suited timberlands between alternatives, and the extensive management constraints that exist to a large degree under all alternatives. These constraints—including listed species habitat, stream channel buffers, backcountry recreation prescriptions, special areas, visually sensitive areas, and tentatively unsuited lands—have the cumulative effect of narrowing: 1) the amount of lands available to actively manage, 2) the expected timber supply off those lands, and 3) the decision space the Responsible Official has in using these indicators as rationale for choosing a preferred management alternative.

As displayed in Table TR-9, approximately 786,800 acres (almost 86 percent of the total Monongahela NFS lands) are tentatively suitable for timber production. Data collected in 1999 and 2000 from the USDA Forest Service Northeastern Research Station Forest Inventory Analysis indicate the MNF is growing, on an average annual basis, 3.6 times more wood than is being harvested. This data includes growth losses due to natural mortality. Table TR-10 displays the acres and categories by alternative of tentatively suitable lands taken out of consideration for timber management. None of the alternatives has more than 40 percent of Monongahela NFS lands available for timber management. It is highly unlikely that any substantial management activities will occur on those lands that are not suitable for timber management. The combination of land not available for timber management, and land that is

available but probably will not be managed for timber, means that most of the Forest will not be affected by timber management activities over the next 10 years.

The lack of management over a large portion of the Forest was not as much a concern when the analysis for the 1986 Forest Plan was taking place because at that time the Forest was much younger. Also active timber management had been occurring on a fairly regular basis for over 25 years (see Table TR-15). From 1960 through 1985 (26 years) there were 5 years when the Forest sold less than 15 MMBF of timber products. However, in the 19 years from 1986 through 2004 there were 9 years when the Forest sold less than 15 MMBF. Additionally, because the Forest is now older and still mostly even-aged forest in the older successional stages, it is likely there will be a loss of timber resources on those lands that are considered not suitable for timber management in the next 10 years. These losses will probably still occur somewhat on lands suitable for timber production but at a much slower rate. Some tree species such as scarlet oak and black cherry are reaching or have already attained what is considered to be financial maturity. Other species such as American beech and hemlock are dying from attacks by non-native insects and diseases. As these trees begin to decay or as the live wood deteriorates, their financial value declines. Eventually, as the trees die, they no longer have any financial value although they do provide habitat and food for various species and nutrients for nearby living vegetation.

Table TR-15. Volume of Timber Sold on MNF Land in MMBF, 1960-2004

1960-1969		1970-1979		1980-1989		1990-1999		2000-2004	
Year	Volume Sold	Year	Volume Sold	Year	Volume Sold	Year	Volume Sold	Year	Volume Sold
1960	21.9	1970	36.5	1980	16.8	1990	34.0	2000	3.9
1961	24.9	1971	30.5	1981	38.2	1991	39.0	2001	13.9
1962	35.7	1972	33.9	1982	27	1992	35.4	2002	12.8
1963	35.5	1973	13.2	1983	32.4	1993	30.0	2003	2.1
1964	35.6	1974	0.9	1984	26.7	1994	26.7	2004	2.1
1965	47.4	1975	1.0	1985	31.4	1995	25.6	2005	8.4
1966	45.9	1976	0.0	1986	32.4	1996	12.2		
1967	55.0	1977	10.2	1987	30.0	1997	12.7		
1968	37.0	1978	23.6	1988	36.0	1998	9.9		
1969	56.6	1979	15.5	1989	39.0	1999	9.6		
Decade Total	**395.5**		**165.3**		**309.9**		**235.1**		**43.2**

If the maximum amount of management activity is achieved in all alternatives over the next 10 years, Alternative 3 would have the most amount of timber value and supply lost because it has the most acres in lands that would be considered as not suited for timber management. Conversely, Alternative 4 would have the least amount of timber value lost because it has the most acres available for timber management.

As noted in the *Current Conditions* section, the dramatic decline in timber volume from 1993 on was in part due to Forest reorganizations based on expected budget cuts and changes in management emphasis. The more recent (2003-2004) steep declines in timber volume were due

to Amendment #6 to the 1986 Forest Plan that met habitat requirements for T&E species. The projected annual volumes seen in Table TR-12 are well above most of the volume figures in Table TR15, raising the question, how does the Forest expect to achieve such elevated timber targets?

The simple answer to that question is that the volume estimates in Table TR-12 are not targets; they represent modeled outputs of the maximum sustainable timber harvest that could occur for each alternative, given a number of factors, including available and suitable acres to manage, a long list of management constraints, and the relative ability of each alternative to achieve desired vegetation conditions in the 2006 Forest Plan. Given such unknowns as future budget levels, potential appeals and litigation, natural disturbances, and uncalculated constraints, it is difficult to say whether the projected ASQ numbers will ever be reached, but it is assumed that they will not be exceeded.

Cumulative Effects from Counties that Encompass the MNF

Monongahela NFS lands represent 21 percent of the acres of the 10 counties that have land within the proclamation boundary. These acres represent some of the largest blocks of contiguous forested acres within West Virginia.

Land ownership patterns on private lands have been changing since the analysis for the 1986 Forest Plan was completed. The trend over the past 80 years has been for agricultural land to revert to forest, but we are now seeing trends in a different direction. Larger landowners have been dividing and selling their forested properties, resulting in more individual owners with smaller tracts of land. Many of these forested tracts have become residential areas where the landowners are not willing to harvest any trees on their property for commercial forest products. Other tracts are now too small to be economically efficient for timber management. The overall result is a fragmented pattern of ownership, with many small tracts of land converted from previous or potential timber management to various other uses. Management on most private land tends to be unpredictable in the long term, as priorities can change with ownership.

The cumulative effect for NFS lands in counties within the MNF proclamation boundary on timber supply in the reasonably foreseeable future is less land available for timber harvest due to land ownership fragmentation on private land. Also less land may be available for timber harvest on the Forest due to a variety of concerns, from protection of habitat for listed and sensitive species to an increasing desire by some organizations to reduce or eliminate commercial harvesting of trees on all NFS lands. This may lead to increasing pressure on private and industry-owned lands, on fewer forested acres, to supply the increasing demand of wood products. See Table TR-16 for the amount of change in forested acres on private land for the eight largest counties within the Forest proclamation boundary and for West Virginia as a whole.

Table TR-16 – Change in Forested Land from 1989 to 2000

Area	1989 Acres	2000 Acres	Change (Acres)
Grant County	216,594	217,240	+ 646
Greenbrier County	393,383	393,394	+ 11
Nicholas County	318,414	313,955	- 4,459
Pendleton County	222,412	219,855	- 2,557
Pocahontas County	225,578	200,208	- 25,370
Randolph County	381,839	385,047	+ 3,208
Tucker County	137,300	134,748	- 2,552
Webster County	266,956	260,480	- 6,476
Counties in MNF PB	2,162,476	2,124,927	- 37,549
West Virginia	12,114,000	12,006,900	- 107,100