# Appendix B

# Analysis Processes

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## INTRODUCTION

The preparation of a Land and Resource Management Plan, including an Environmental Impact Statement, is required by the Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 as amended by the National Forest Management Act (NFMA) of 1976. The planning regulations promulgating these acts are found within the Code of Federal Regulations, Title 36, Part 219 (36 CFR 219). The Monongahela National Forest (MNF or Monongahela) is accomplishing revision of its 1986 Land and Resource Management Plan (Forest Plan) under the 1982 version of 36 CFR 219.

The purpose of forest planning is to identify and select for implementation a Forest Plan alternative that provides "… for multiple use and sustained yield of goods and services from the National Forest System in a way that maximizes long-term net public benefits in an environmentally sound manner" (36 CFR 219). Net public benefit is defined to be "…the overall long-term value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not. Net public benefits are measured by both quantitative and qualitative criteria and there is no single measure or index. The maximization of net public benefits to be derived from management of the National Forest System is consistent with the principles of multiple use and sustained yield" (36 CFR 219).

Congress requires that each Forest Plan must provide for the following three items:

- Maintenance of long-term productivity of the land. The land must be maintained in a condition that will not impair its capability to produce future outputs of goods and services.
- Coordination and integration of planning activities for multiple use management. Each resource must be considered equally in the planning process. At a minimum, no resource is emphasized to the exclusion or violation of the minimum or threshold management requirements of other resources. Minimum management requirements guide the development, analysis, approval, implementation, monitoring, and evaluation of the forest plan.
- Cost efficient management prescriptions. Management alternatives shall be the most cost efficient combination of management prescriptions examined that meet the objectives of each alternative management plan.

The following five items are required to be analyzed and/or determined as part of the development of Forest Plan alternatives:

- The maximum physical and biological potentials of significant goods and services together with associated costs and benefits.
- The potential to resolve public issues and management concerns.
- The allowable sale quantity (ASQ) of timber.
- Use of a systematic interdisciplinary approach to ensure coordination and integration of planning activities for multiple use management.
- Establishment of quantitative and qualitative standards and guidelines.

The Environmental Impact Statement (EIS) for the revised Forest Plan evaluates five management alternatives (the current Plan as amended and four others), and displays the rationale for choosing the Preferred Alternative as the alternative that best maximizes long-term net public benefits in an environmentally sound manner.

This appendix describes thirteen steps in the Forest Plan revision process; and in the discussion of those steps, references are made to data collection, inventory, and analysis processes important to the Forest Plan revision. This information supplements the vegetation affected environment and effects analysis

found in Chapter 3 of the EIS, as well as the social and economic affected environment and effects analysis also found in Chapter 3.

The following discussion includes basic assumptions, modeling components and inputs, rules, methods, and constraints. Additional information and documents used in the analysis process are contained in the planning record. The planning record in its entirety is incorporated here by reference. The results from the modeling process facilitate comparison of alternatives and are estimates of what can be expected if alternatives are implemented.

## PLANNING PROCESS FRAMEWORK

The above-listed requirements demonstrate the complexity of resolving natural resource management issues at the planning stage. Numerous resource specialists, analytical tools, and quantitative methods were used to address the issues and to identify quantitative and qualitative trade-offs among the alternatives. The process used to develop and analyze alternative management scenarios is based on planning steps specified in NFMA regulations.

### Step 1: Identify Purpose and Need

The issues, concerns, and opportunities (identified early in the Forest Plan revision process) were used to develop the goals and objectives that give purpose to the Forest Plan. A series of public meetings and information mailings were organized to invite input on resource management on the Monongahela after the Forest Supervisor determined a revision was needed. The public was encouraged to comment on the preliminary issues and major revision topics identified in a "Notice of Intent" to prepare an environmental impact statement for revising the 1986 Forest Plan (May 2, 2002).

These topics became the focus of the Forest Plan revision effort. Appendix A contains details about major issues, concerns, and opportunities. Chapter 1 of the EIS, Purpose and Need of the Proposed Action, provides a narrative description of the resource issues and findings associated with each topic.

### Step 2: Develop Planning Criteria

Part of the planning process is development of planning criteria whose purpose is "…to guide the planning process. Criteria apply to collection and use of inventory data and information, analysis of the management situation, and the design, formulation, and evaluation of alternatives. Criteria designed to achieve the objective of maximizing net public benefits shall be included" (36 CFR 219.12 (c)). Various laws, executive orders, regulations, and agency policies provided the basis for planning criteria. Public issues and management concerns, and the plans and programs of other government agencies also contributed to their development.

### Step 3: Collect Inventory Data and Information

Data and information needed to support Forest Plan revision were identified and compiled during the Analysis of the Management Situation (AMS). Existing inventories were assessed along with the need for new information. The types of data and information needed for the revision process were based primarily on the revision topics. An interdisciplinary team reviewed the adequacy of the information to respond to issues and analyze effects for each alternative. The following items are listed as examples of data and information collected for Forest Plan revision:

- The delineation of management prescription areas and the criteria used to identify them.
- Results of monitoring the previous Land and Resource Management Plan.
- Timber inventory and yield projection information.
- Analytical tool information (e.g., Spectrum).

**Step 4: Analyze the Management Situation**

Several indicators were used to assess the need for change in Forest Plan revision. These included public comments received during the implementation of the 1986 Forest Plan, changed conditions recognized through monitoring and evaluation, availability of new information and scientific understanding, and information gathered as a result of completing resource assessments.

This information helped the Monongahela assess the potential to resolve resource management issues and concerns, establish a broad range of alternatives, determine its capability to supply goods and services in response to societal demands, and clarify the needed changes in management direction. The management problems gave an indication of the outputs, values, and benefits needed to address issues, concerns, and opportunities. The primary tasks involved in analyzing the management situation were:

- Assessing the Monongahela's potential to resolve identified need for change topics;
- Projecting consumption for recreation, timber, and wildlife outputs; and
- Developing and analyzing benchmarks to help define economic and biological resource production opportunities and define the range within which integrated alternatives were formulated.

The AMS reflects relatively recent agency direction on ecosystem management. The AMS focuses on the Monongahela's ability to promote healthy, sustainable ecosystems and provide high quality customer services to meet a wide variety of public needs. The AMS also assesses planning issue interrelationships, potentials among resource capabilities, and the question of what mix of resource outcomes, ecological conditions, and customer services should be provided.

**Step 5: Formulate Alternatives**

The 2002 Notice of Intent to prepare an environmental impact statement for revising the Forest Plan, resource assessments, Analysis of the Management Situation documents, public comments, and planning criteria all contributed toward the formulation of alternatives. An in-depth review of the 1986 Forest Plan's Goals, Objectives, Standards, and Guidelines was also conducted to identify needed changes. The alternatives were formulated to respond to the issues, to explore a broad range of opportunity costs and tradeoffs, and to facilitate evaluating the benefits and costs of achieving various outputs and values. The planning process provided a basis for identifying the alternative that most closely maximizes net public benefits while meeting minimum management requirements. Management Prescription maps for each alternative were developed with input from District employees and resource specialists, with consideration of public comment.

**Step 6: Analyze the Effects of the Alternatives**

The physical, biological, social, and economic effects of implementing each of the five alternatives were analyzed and compared in accordance with NEPA procedures.

**Step 7: Compare Alternatives**

The planning team worked with other Monongahela staff, the Forest Supervisor, and the District Rangers to evaluate and compare the alternatives, based on planning criteria. The comparison strongly focused on the degree to which each alternative responded to the individual need for change topics and other relevant issues, taking into consideration tradeoffs associated with identified public values.

**Step 8: Recommend Preferred Alternative**

The outcome of the alternative comparison described above was the selection of Alternative 2 as the alternative best maximizing net public benefits. This alternative was presented to the Regional Forester for concurrence, and then used as the basis for preparation of the proposed Forest Plan.

**Step 9: Publish Proposed Plan and Draft Environmental Impact Statement**

Following concurrence by the Regional Forester, the proposed Forest Plan and DEIS were made available to the public, as well as notice of their availability being published in the Federal Register.

**Step 10: Solicit Public Comments**

Concurrent with the publication of the proposed Forest Plan and DEIS, public comments were solicited, with the public directed to focus their comments on the proposed Forest Plan.

**Step 11: Consider Public Comments**

Content analysis was conducted by the Forest Service to compile the public comments, categorize them, and develop public concern statements to be addressed before a final management alternative was selected. Based on public and agency comments, changes to the proposed Forest Plan were made to reflect public interests, to incorporate new information, and to correct errors in the draft documents.

**Step 12: Recommend Selected Alternative**

The selected alternative will be chosen as the basis of the *2006 Land and Resource Management Plan* of the Monongahela National Forest and will be made available to the public. The preferred alternative for the Final EIS is Alternative 2 Modified.

**Step 13: Publish Record of Decision, *2006 Land and Resource Management Plan*, and FEIS**

Following concurrence by the Regional Forester, the Record of Decision (ROD), the 2006 Land and Resource Management Plan, and associated Final EIS will be entered into public record and made available to the public in hardcopy and electronic format.

## INVENTORY DATA AND INFORMATION COLLECTION

Various data were used by the Planning Team to address issues, concerns, and opportunities; determine resource potentials and limitations; quantify outputs; predict and analyze the effects of alternatives; and analyze the management situation. Collecting and organizing data for analysis involved the use of many sources of information. Two primary sources of information were the Combined Data System (CDS) database and the Forest's Geographic Information System (GIS).

**Combined Data System (CDS)**

The Combined Data System, known as CDS, was the Stand record keeping system on the Monongahela National Forest when revision began. CDS is a database consisting of over 70 separate tables. The tables contain stand-related information ranging from harvest activities to individual tree species to wildlife habitat improvements.

Since CDS was the official Stand record-keeping system, the contents of the database continually changed as activities occurred across the Forest. To provide a consistent forested vegetation data set, a static copy of CDS was exported into a Microsoft Access database.

**Geographic Information Systems (GIS)**

Geographic Information Systems (GIS) use computing technology to manage, analyze, and distribute geographic information. Most natural resource information for the Monongahela is accessed via GIS, either directly or through integration of GIS with non-spatial data sets. A reference library of GIS data was created for Plan revision purposes. The library consists of data layers derived during revision in addition to more than 50 base data layers. The data in the library were used to analyze suitable timberlands, build Spectrum analysis units, and perform a variety of analyses needed for alternative design, alternative comparison, and effects analysis.

## VEGETATION AND SCHEDULING ANALYSIS

In order to understand the Monongahela's capacity to produce goods and services and attain desired conditions, a modeling exercise was conducted as part of constructing the benchmarks and developing Forest Plan alternatives. Assumptions were made at various steps in the modeling exercise. Several overriding assumptions were used to guide design and execution of alternative models:

- The Forest Plan will be strategic and guide broad decisions to achieve goals and objectives;
- On-the-ground decisions will use standards and guidelines from the Forest Plan to meet goals and objectives;
- The models used are sufficient to support strategic planning and decision making; and
- Each alternative will use the same standards and guidelines, and only the area of land allocated to a management prescription varies.

### Model Tools

An array of analytical techniques and tools were utilized throughout the modeling exercise. The vegetation modeling component of Plan revision was done using the Forest Vegetation Simulator (FVS) computer software program, and the management scheduling component of Plan revision was conducted using the Spectrum computer software program.

**Forest Vegetation Simulator (FVS)**

Forest Vegetation Simulator (FVS) is a computer software package developed, maintained, and supported by the Growth and Yield Unit of the Forest Service's Forest Management Service Center. FVS is a suite of forest growth and yield models used to simulate vegetation responses to management activities. FVS can simulate growth and compute yields for most major forest tree species, forest types, and stand conditions. FVS can accommodate a wide range of silvicultural treatments.

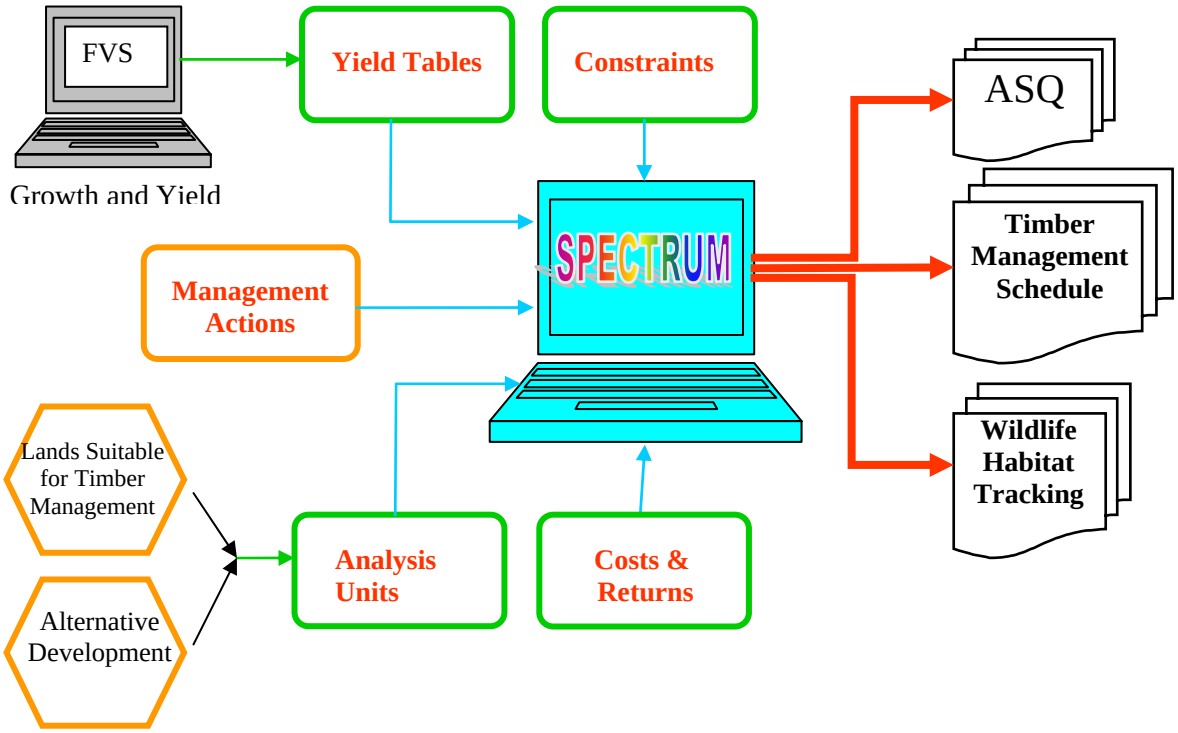
**Spectrum**

Spectrum is a computer software package developed by the Forest Service's Ecosystem Management Coordination staff, in cooperation with the Forest Service's Rocky Mountain Research Station. Spectrum is a modeling system designed to assist decision makers in exploring and evaluating resource management choices. Spectrum provides information and insight on management options and strategies; alternative pathways to desired outcomes; and the environmental and socio-economic implications of proposed management.

Spectrum is used to construct and interpret models that are solved using linear programming computer software. Models constructed with Spectrum can simultaneously be analyzed for trade-offs between the many goals, constraints, management activities, timing options, and land types that are necessary to manage a large forest. For the Monongahela's modeling exercise, Spectrum was coupled with KETRON Management Science's C-WHIZ linear simplex optimizer.

Figure B-1 provides a diagram of interactions between the vegetation and scheduling models.

**Figure B-1. Vegetation and Scheduling Analysis - Model Overview**




## Model Design

Model design identified questions that needed to be answered and assessed what information was available for model input. The planning team identified the following factors to be considered in the modeling exercise:

- Allocating the land base into management areas;
- Variety of species/product yields;
- Forest-type acreage projections by one or more sub-categories;
- Age-class distributions by forest-type/species groups; and
- Varied social and economic conditions across the Monongahela.

Prior to using FVS and Spectrum, there was considerable work done to prepare data for input into the models. This work included:

- Identification of lands tentatively suitable for timber production;
- Analysis unit development;
- Timber yield table development;
- Economic information collection;
- Definition of assumptions and constraints; and
- Determination of suitable acreage within each alternative.

The proposed Forest Plan standards and guidelines provided a framework for defining constraints, creating analysis units, and developing possible timber management actions. Costs associated with various management activities and revenue from timber sales were assembled as additional inputs to the model.

## Identification of Lands Tentatively Suitable for Timber Production

"During the forest planning process, lands which are not suited for timber production shall be identified …" (36 CFR 219). The first step in the regulations for identifying lands not suited for timber production is to identify lands not tentatively suited for timber production. Identifying lands not tentatively suited for timber production was done as part of the Analysis of the Management Situation, Timber Suitability Assessment. Table B-1 shows lands tentatively suited for timber production.

**Table B-1. Lands Tentatively Suited Timber Production**

| Acres | Description |
|---|---|
| 916,968 | Legal acreage of Monongahela National Forest, February 2004 |
| 2,847 | Difference between legal acreage and GIS |
| 4,737 | Difference between legal acreage and CDS |
| 19,964 | Land is not forest land |
| 38,023 | Land cannot produce timber, using current technology, without irreversible resource damage |
| 8,934 | Land cannot be adequately restocked with reasonable assurance |
| 84,870 | Land withdrawn from timber production by an Act of Congress, the Secretary of Agriculture, or the Chief of the Forest Service |
| 757,593 | Land tentatively suitable for timber production |

## Analysis Unit Development

Analysis units represented the Monongahela's land base in the modeling exercise, and their development was a prerequisite to using Spectrum, and to an extent FVS. Analysis units were created by combining various ecologic, economic, and social classifications of the Forest. The strategic nature of Plan revision required the selection of focused ecologic, economic, and social classifications. Precedence was given to

those classifications that related to the Need For Change topics and allowed for more detailed analysis of the alternatives.

The following land attributes were chosen to stratify the model's land base:

1. Management Prescription
2. District
3. Median Distance to Forest Service Level 3, 4, 5, or Other Public Road
4. Forest-type Group
5. Age Class
6. Site Productivity Class
7. Indiana Bat Habitat
8. Site-specific Management Restrictions

**Management Prescription -** Management prescriptions (MPs) are comprised of management practices and intensities that are selected and scheduled to attain multiple-use goals and objectives in a specific area. Management Prescriptions are created by zoning the Forest into smaller units to provide more effective and efficient management organized around a common emphasis, such as vegetation diversity, wildlife habitat, or backcountry recreation.

The assignment of MPs to each alternative was based on a combination of ecologic, economic, and social factors. These factors were varied across the alternatives in order to explore a range of options. The following MPs were represented in one or more of the alternatives:

- MP 2.0 – Uneven-aged Vegetation Management
- MP 3.0 – Vegetation Diversity
- MP 4.0 – Conifer Management Emphasis
- MP 4.1 – Spruce and Spruce-Hardwood Ecosystem Management
- MP 5.0 – Designated Wilderness
- MP 5.1 – Recommended Wilderness
- MP 6.1 – Wildlife Habitat Emphasis
- MP 6.2 – Backcountry Recreation
- MP 6.3 – Indiana Bat Habitat Emphasis
- MP 7.0 – Developed Recreation Emphasis
- MP 8.0 – Special Areas
- MP 8.1 – Spruce Knob-Seneca Rock NRA
- MP 8.2 – National Natural Landmarks
- MP 8.3 – Scenic Areas
- MP 8.4 – Ecological Areas
- MP 8.5 – Research Areas
- MP 8.6 – Grouse Management Areas
- MP Unassigned

**District -** Districts are organizational units that subdivide a National Forest into contiguous areas of manageable size. The primary role of districts is to facilitate operational activities. The Monongahela National Forest has six Ranger districts: Cheat, Gauley, Greenbrier, Marlinton, Potomac, and White Sulphur. The Cheat and Potomac Districts have been administratively combined, as have the Marlinton and White Sulphur Districts.

Delineating the land base by district allowed for outputs to be summarized in familiar terms. The spatial distribution and contiguity of districts allowed management prescription goals and objectives to be

achieved more uniformly across the Forest. The Forest was delineated by the following five districts, because the merger of districts within the CDS database has yet to be completed:

- Cheat
- Gauley
- Greenbrier
- Marlinton/White Sulphur
- Potomac

**Median Distance to Forest Service 3, 4, 5, or Other Public Road -** Operational activities on the Monongahela are affected by the Forest's and State's existing road network. The distance of harvest activities from existing roads affects both the cost of administering timber sales as well as the value of timber being sold. The relation of harvest activities to existing road networks can also influence biological and ecological resources, e.g., the introduction, spread, and control of non-native invasive species.

Median distance to Forest Service 3, 4, 5, or other public roads was calculated for each stand, and those values were aggregated into the following four classes:

- 0 to 3/8 mile
- 3/8 to 6/8 mile
- 6/8 to 9/8 mile
- 9/8 mile and greater

**Forest-type Group -** The physiography of central Appalachia has fostered much species diversity. Trees are a dominant form of vegetation on the Monongahela, and over 60 species of trees are represented on the Forest. Species of trees commonly occurring together are classified into forest types. More than 30 forest types are defined for the Monongahela

Forest types were aggregated into six forest-type groups for modeling purposes:

- Conifer/Spruce
- Northern hardwoods
- Mixed hardwoods
- Mixed oak
- Pine-oak
- Open

**Age Class -** Age classes are important in analyzing ecological, silvicultural, and biological information. Age classes were developed as follows:

- Seedling/Sapling – 0-19 years
- Pole timber – 20-39 years
- Sawtimber – 40-79 years
- Mature sawtimber – 80-119 years
- Older – 120+ years

**Site Productivity Class -** Site productivity is the potential of a site to produce. Forests can produce many ecologic, social, and economic goods and services. The measure of productivity varies depending on the context. In terms of timberland, site productivity refers to the inherent capacity of forest land to grow crops of industrial wood. A typical unit of measure is cubic feet/acre/year based on the culmination of mean annual increment of fully stocked natural stands.

Two site productivity classes were recognized in the model. They were developed using the USDA definition of prime timberland.

- High – >= 85 cuft/acre/yr
- Low – < 85 cuft/acre/yr

**Indiana Bat Habitat** - The U.S. Fish & Wildlife Service currently lists the Indiana bat (*Myotis sodalist*) as 'Endangered in the Entire Range,' which includes West Virginia. The Threatened and Endangered Species Amendment to the Monongahela National Forest Land and Resource Management Plan (LRMP) was signed in March, 2004. In that amendment, a new management prescription was defined around known Indiana bat hibernacula and primary range, which includes summer foraging, roosting, and fall swarming habitats. Primary ranges varied in size but extended no more than five miles in radius from hibernacula.

Indiana bat habitat refers to those areas created for the Indiana bat in the Threatened and Endangered Species Amendment to the Monongahela National Forest LRMP. The Threatened and Endangered Species Amendment addressed other species besides Indiana bat; however, Indiana bat habitat was specifically delineated in the model because of its large area and varied management actions between alternatives. The following two categories were utilized:

- Ibat circle = Lands comprising Indiana bat habitat
- No = Lands not comprising Indiana bat habitat

**Site-specific Management Restrictions** - Management Prescriptions are typically allocated at a broad scale because of their programmatic nature. Whereas certain issues are effectively addressed at the landscape level, other issues are more appropriately addressed in a site-specific manner. The site-specific management restrictions category was created to supplement the broad-scale use of MPs; the two attributes interact through logical intersection.

A variety of issues on the Monongahela lend themselves to site-specific management restrictions. To facilitate strategic planning, management restrictions of similar nature are grouped into classes. The following two classes of restrictions were included in the model:

- All – All silvicultural options are available
- None – No silvicultural options are available

The default site-specific management restriction value in the model was All. The following areas were assigned a value of None:

- Not tentatively suited for timber production
- Suitable West Virginia Northern Flying squirrel habitat
- Eligible Wild and Scenic Rivers with either Wild or Scenic classification
- Indiana bat key areas
- High scenic integrity and high importance
- Perennial and intermittent stream channel management corridors

## Timber Yield Table Development

A yield table is a tabulation of products or conditions generated by an entity. Yield tables are commonly a function of time and unit area when used for natural resources. With timber, yield tables typically include volume(s), basal area, and number of trees per acre at specified stand ages. Many factors affect the values shown in timber yield tables: tree species, site productivity, natural disturbance (wind, fire, and disease), and management activities.

In revising the Monongahela's Land and Resource Management Plan, generating yield tables met two objectives:

- Provide information necessary to display volume and stumpage value differences for each alternative analyzed in the environmental impact statement.
- Document the volume yields used in the analysis for comparison with actual yields obtained during implementation of the Forest Plan. Monitoring and evaluation will determine if the projected yields are being realized.

Timber yield tables were developed using the Northeast variant of the Forest Vegetation Simulator (FVS). The Northeast variant applies to a geographic area covering 13 Northeastern States: Connecticut, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, and West Virginia. Data from the Forest Inventory and Analysis (FIA) Program of the USDA Forest Service were used to calibrate FVS to the National Forest System lands of the Monongahela. Once calibrated, data from the Combined Data System (CDS) were used to project growth and yields for Spectrum.

Both stand and plot-level data from CDS were utilized in projecting yields. Forest-type group and site productivity class were derived from stand-level data, and individual tree information was obtained from plot-level data. A limit existed in outputting yield estimates from FVS because Spectrum allows no more than nine qualifiers for a single yield table. The following species product groups were used as the nine qualifiers in Spectrum yield tables:

- Black cherry sawlog
- Red maple sawlog
- Sugar maple sawlog
- Yellow poplar sawlog
- Northern Red oak sawlog
- Chestnut/White oak sawlog
- Other softwood sawlog
- Other hardwood sawlog
- All species pulpwood

Timber yield tables were used to estimate timber volume produced from the Monongahela given the goals, constraints, management activities, and timing options of each alternative. Yield estimates were developed for combinations of two land attributes and activities:

1. Forest-type Group
2. Site Productivity Class
3. Proposed Management Activities

**Forest-type Group -** Forest-type groups were covered in the *Analysis Unit Development* section. Yield estimates were generated for all forest-type groups except Open because Open land was considered to remain in that state throughout the planning horizon.

**Site Productivity Class -** Site productivity class was covered in the *Analysis Unit Development* section. Yield estimates were generated for both high and low site productivity classes within a forest-type group.

**Proposed Management Activities -** Management activities on National Forests are varied and include such diverse actions as restoring/preserving historical sites, creating recreation sites, improving wildlife habitat, and harvesting trees. For timber yield tables, management activities focus on silvicultural systems and harvest treatments. The choice and intensity of management activities affect the volume of timber produced and vegetative composition and structure on the land.

The management activities, specifically silvicultural systems and harvest treatments, applied in the modeling exercise were estimates of probable treatments used for analysis in the environmental impact statement. These activities were designed for modeling purposes only and are not necessarily carried into management direction in the proposed Forest Plan, or implementation of the revised Plan.

Proposed management activities, labeled as management actions in Spectrum, consisted of a management emphasis and management intensity. The following management emphases were included in the model to differentiate site preparation activities after harvest.

- Prescribed-burning
- Planting
- Herbicide
- No emphasis

Management intensities were broadly defined in order to incorporate more harvest treatments and logging systems into the model. The following management intensities were considered for modeling. Priority for inclusion in the model was given to management intensities that satisfied modeling assumptions and were critical to meeting desired conditions.

- Conventional clearcut with 0, 1, and 2 thinnings
- Conventional two-aged cut with 0, 1, and 2 thinnings
- Conventional shelterwood cut with 0, 1, and 2 thinnings
- Conventional group selection cut
- Conventional single-tree selection cut
- Helicopter clearcut with 0, 1, and 2 thinnings
- Helicopter two-aged cut with 0, 1, and 2 thinnings
- Helicopter shelterwood cut with 0, 1, and 2 thinnings
- Helicopter group selection cut
- Natural growth (no cut)
- Open condition (no cut because no trees)

Timber yield tables were prepared for each combination of forest-type group, site productivity class, and management intensity. For example, mixed hardwood/high site/clearcut with 1 thinning had a timber yield table and pine-oak/low site/shelterwood with 0 thinnings had a separate table. Although conventional and helicopter logging differentiate management intensities, separate timber yield tables were not created for each because helicopter logging yields were modified in Spectrum itself. Specifically, helicopter logging yields were identical to conventional logging yields except helicopter logging in Spectrum did not remove any pulpwood from the site.

**Economic Information Collection**

Economic information is a primary component of Spectrum models. The outputs from Spectrum are the result of management actions and timing choices being chosen for each analysis unit. The specific management actions and timing choices for an analysis unit depend on goals and constraints in the model. Usually, constraints in a model can be satisfied by a range of management actions and timing choices. Economic information allows the linear programming computer software to select cost-efficient combinations of management actions and timing choices for a given Spectrum model.

Economic information for managing timber included both cost and revenue estimates. A revenue estimate was obtained for each species product group discussed in *Timber Yield Table Development*. The assigned values were derived from the Appraisal Principles and Methods chapter of the Monongahela's

Timber Prep Handbook, which is part of the Forest Service Directives system. Revenue estimates for timber were adjusted lower according to the median distance to Forest Service 3, 4, 5, or other public road class of each analysis unit and whether conventional or helicopter logging was used.

Cost estimates involved with silvicultural systems and harvest treatments were compiled from a variety of sources. The specific values applied to a management action depended on the management emphasis, harvest treatment (clearcut, group selection, thinning, etc…), and logging system (conventional or helicopter) of the action. The following types of cost estimates were included in the model:

- Sale administration
- Sale contract preparation, advertisement, and offer
- Sale NEPA
- Sale preparation
- Site fencing for browse protection
- Site planting of seedlings
- Site planting of seedlings with tree shelters
- Site preparation with herbicide treatment
- Site preparation with hand tools
- Site preparation with prescribed burning
- Site crop tree release
- Site stocking survey
- Site non-commercial thin
- Site vine control

**Assumptions and Constraints**

The degree to which a modeling exercise characterizes reality depends partially on the assumptions adhered to in constructing the model(s). Assumptions are made to provide context for the exercise and to interpret reality in a workable manner for the model(s). Constraints are applied in the model(s) to represent resource thresholds, relationships between and among activities and outputs, and policy requirements. Constraints can be used to limit or meet Forest-wide and Management Prescription goals, objectives, standards, and guidelines.

Several assumptions that guided design and execution of alternative models were stated earlier in the description of the analysis process. A planning horizon of 100 years was established in the Monongahela's Planning Criteria. The alternative models were formulated for a 150 year time horizon, consisting of 10-year periods. The models had a starting date of 2004. The 50 additional years beyond the planning horizon were included in the model formulations to control ending-inventory modeling artifacts and to create reasonable expectations the model would meet and hold desired conditions.

One of the many assumptions in the modeling exercise involved choosing an objective function for solving the formulations. An objective function is a rule for assessing the efficacy of choices made by the linear programming computer software. In all of the alternative model runs, the objective function was to maximize net present value of management activities. One of the two benchmark objective functions was maximize net present value subject to minimum management requirements, and the other was maximize timber volume subject to minimum management requirements and regardless of cost.

Constraints had either an implicit or explicit form in Spectrum. Implicit constraints involve limiting choices before running the model. An example is not enumerating management actions and timing choices for a specific silvicultural system and forest-type group during model formulation. Certain

choices cannot be made by the linear programming computer software if they do not exist in the model formulation. Explicit constraints involve limiting choices during the model run. An example is enumerating all management actions and timing choices for every silvicultural system and forest-type group during model formulation only to restrict choices while running the model.

In addition to different forms of constraints, the alternative models also had different types of constraints. The following types of constraints were addressed in the models:

1. Harvest Policy Constraints
2. Forest-wide Constraints
3. Management Prescription Constraints

**Harvest Policy Constraints** - Regulations to implement the National Forest Management Act (36 CFR 219) require forest plans to contain constraints on timber flow over time and on forest structure at the end of the planning horizon. Spectrum contains special constraints to address timber flow, long-term sustained yield, and ending forest structure.

- Non-declining Yield (NDY) -- ensures the base sale schedule for any future decade is equal to, or greater than, the planned sale for the preceding decade.
- Long-term Sustained Yield Capacity (LTSYC) -- calculates and controls the timber yield from lands being managed for timber production that may be sustained under specified management intensity.
- Perpetual Timber Harvest -- ensures the inventory in the last period is equal to, or greater than, the average standing inventory throughout the planning horizon.

**Forest-wide Constraints** - Forest-wide constraints are broad in geographic scope. The constraints normally apply to either an entire land base or a large enough subset of a land base to approximate the whole. Forest-wide constraints are flexible in that most or all of the analysis units are available to address the constraints.

Forest-wide constraints for the Monongahela were operational in nature, with the exception of harvest policy constraints that were considered a special case. The following set of operational constraints, in part or entirety, was included in the alternative models:

- Upper limit on acres receiving any harvest activities
- Ratio between acres receiving helicopter logging and all logging activities
- Ratio between acres receiving intermediate harvest activities and all harvest activities

**Management Prescription Constraints** - Management Prescription constraints are more focused in geographic scope than forest-wide constraints. An individual constraint is applied to a Management Prescription either in its entirety or in spatially distributed subsets. When applied in spatially distributed subsets, a Management Prescription constraint is attained more uniformly across the Forest.

The Monongahela alternative models had Management Prescription constraints applied in whole as well as in spatially distributed subsets. The following set of Management Prescription constraints, in part or entirety, was applied in whole in the alternative models:

- Lower limit on acres of mature sawtimber
- Ratio between acres receiving shelterwood regeneration cuts and all regeneration cuts
- Ratio between acres receiving two-aged regeneration cuts and all regeneration cuts
- Ratio between acres in each age class and all acres for the northern hardwoods, mixed hardwoods, mixed oak, and pine-oak forest-type groups

Spatially distributed Management Prescription constraints for the Monongahela were age based. Spatially distributed constraints were applied at the District level. Districts were chosen because of their geographic size and distribution across the Forest. They were also chosen because of their functional role in managing the Monongahela. The following Management Prescription constraint, in part or entirety, was applied across Districts in the alternative models:

- Ratio between acres in each age class and all acres for forested land

**Determination of Suitable Acreage**

"During the forest planning process, lands which are not suited for timber production shall be identified …" (36 CFR 219). The first step in the regulations for identifying lands suitable for timber production is to identify lands tentatively suitable for timber production. Tentatively suitable lands became the scheduling base for benchmark analyses. Formulating and evaluating each alternative identifies lands appropriate for timber production. Lands appropriate for timber production in the preferred alternative become lands suitable for timber production in the Forest's Land and Resource Management Plan. Harvest activities may occur on lands not suited for timber production when necessary for other resource objectives; however, timber sales are not planned on a scheduled basis for these areas. Furthermore, volume from these areas does not contribute to the base sale schedule.

Identifying lands tentatively suitable for timber production was done as part of the Analysis of the Management Situation, Timber Suitability Assessment, and the process followed 36 CFR 219.14(a). During formulation of the alternatives, direction set forth in 36 CFR 219.14(c)(1) and 36 CFR 219.14(c)(2) was used to identify lands tentatively appropriate for timber production, and those lands subsequently became the scheduled (i.e., having management actions available for scheduling) lands in the model formulations. .

The following criteria identify analysis units that were scheduled in the alternative models.

- Management Prescription is 2.0, 3.0, 4.1, 6.1, or 6.3; all silvicultural options are available; not comprising Indiana bat habitat*; and Forest-type Group is conifer/spruce, northern hardwoods, mixed hardwoods, mixed oak, or pine-oak
- Management Prescription is 4.1; all silvicultural options are available; not comprising Indiana bat habitat*; and Forest-type Group is mixed hardwood, mixed oak, or pine-oak

  *Analysis units comprising Indiana bat habitat were identified for scheduling in Alternative 1 but were not identified for scheduling in Alternatives 2, 2M, 3, and 4. The criteria above describe Alternatives 2, 2M, 3, and 4.

As part of the evaluation of alternatives, 36 CFR 219.14(c)(3) states lands must be assessed for "cost-efficiency, over the planning horizon, in meeting forest objectives, which include timber production." For the purposes of National Forest System Land and Resource Management Planning, 36 CFR 219.3 defines cost efficiency as, "[t]he usefulness of specified inputs (costs) to produce specified outputs (benefits). In measuring cost efficiency, some outputs … are not assigned monetary values but are achieved at specified levels in the least cost manner." In enumerating management actions for analysis units, a natural growth management action was made available for all lands identified as tentatively appropriate for timber production. The natural growth management action allows the scheduling model to forgo direct management, over the planning horizon, in favor of letting natural processes occur. An objective function of maximize net present value of all management actions ensures no management action with a negative present net worth, over the planning horizon, will be chosen unless necessary to meet non-timber forest objectives. All lands identified as tentatively appropriate for timber production were scheduled (including the natural growth option), assessed, and determined to be cost-efficient in meeting forest objectives.

## Model Results

Results from the management scheduling model were used in developing and analyzing alternatives. After modeling tools were chosen and guiding assumptions made, a series of benchmarks were conducted. The benchmarks became one of many pieces of information used in developing alternatives. The alternatives themselves were subsequently modeled with the management scheduling software, and those results were used in alternative comparison and effects analysis.

### Benchmarks

Benchmark analyses are included as part of the Analysis of the Management Situation (AMS). The purpose of the AMS is to "*provide a basis for formulating a broad range of reasonable alternatives*." The benchmarks define the range within which alternatives can be constructed. Hence, there is an emphasis on minimum and maximum conditions and outputs for national forests, e.g., minimum level of management, maximum timber potential, etc… Benchmarks themselves do not constitute alternatives since alternatives are designed to consider integrated management of all resources.

Benchmarks approximated economic and biological resource production opportunities and were useful in evaluating the compatibilities and conflicts between individual resource objectives. The 1986 Land and Resource Management Plan benchmarks were considered sufficient for most resources. The following three benchmarks were re-analyzed during plan revision:

1. Minimum Level Management
2. Maximum Timber Production
3. Maximum Net Present Value

**Minimum Level Management -** The minimum level management benchmark defines actions needed to maintain and protect the unit as part of the National Forest System. This benchmark focuses on base levels of management sufficient to protect resource integrity; thus, outputs are possible but incidental in nature.

Minimum level management objectives were:

- Protect the life, health, and safety of incidental users
- Protect against land and resource damage from and to adjoining lands of other ownership
- Conserve soil and water resource
- Prevent significant or permanent impairment to the productivity of the land
- Administer unavoidable, non-Forest Service special uses and mineral leases, licenses, permits, contracts, and operating plans

For the minimum level management benchmark, no scheduled harvesting activities occurred and vegetation followed natural succession. Developed campgrounds were closed, and maintenance was only for those facilities needed to support basic ownership activities. Dispersed recreation (hiking, hunting, fishing, etc…) was not promoted but was allowed. Cultural resources were identified and protected when being impacted by other resource activities.

The primary purpose of this benchmark was to develop a baseline for subsequent analyses and to be a building block for alternatives. Consideration of the objectives stated above aided in the development of resource management standards and guidelines.

**Maximum Timber Benchmark -** The maximum timber benchmark estimates the maximum physical and biological production of timber together with costs and benefits. There is no requirement to consider cost

efficiency. The NFMA regulations, at 36 CFR 219, outline minimum specific management requirements to be met in accomplishing goals and objectives for a national forest. The requirements guide the development, analysis, and eventual implementation and monitoring of forest plans. The requirements set forth guidance on resource protection, vegetation manipulation, silvicultural practices, riparian areas, soil and water, and diversity of plant and animal communities.

A set of assumptions were used to define the analysis conducted with Spectrum:

- Objective function was maximum timber for ten periods
- All tentatively suitable lands were available for scheduling
- Harvest of existing stands occurred no earlier than Culmination of Mean Annual Increment
- Base sale schedule cannot exceed long-term sustained yield capacity
- No demand limitations placed on timber production.

Several key results of the maximum timber benchmark were:

- 753,000 tentatively suitable acres were allocated to timber production
- The long-term sustained yield capacity of 43 MMCF/year (258 MMBF/year) was never reached in the planning horizon
- Sale schedule for the first five decades.

**Table B-2. Maximum Timber Benchmark Sale Schedule**

| Indicator | Decade 1 | Decade 2 | Decade 3 | Decade 4 | Decade 5 |
|---|---|---|---|---|---|
| Volume (MMCF/year) | 41 | 41 | 41 | 41 | 41 |
| Volume (MMBF/year) | 246 | 246 | 246 | 246 | 246 |

**Maximum Net Present Value (NPV) Benchmark** - The maximum net present value benchmark estimates the maximum net present value of those resources having an established market or assigned value. Cost efficiency and revenue maximization are the focal points of this benchmark. Similar to the maximum timber benchmark, minimum management requirements are considered in formulating the model.

A maximum net present value benchmark was completed for the timber resource. A maximum NPV benchmark for the mineral resource was not completed using Spectrum. The Department of Interior, Bureau of Land Management (BLM) is responsible for issuing and administering federal mineral leases after the Forest consents to a lease issuance on National Forest System (NFS) lands. Since the Forest cannot affect the abundance of minerals or predict the nomination of areas for leasing, it is not possible to schedule the regulated production of mineral resources from the Monongahela.

A series of assumptions were used to define the analysis conducted with Spectrum:

- Objective function was maximize net present value from timber for ten periods
- All tentatively suitable lands were available for scheduling
- Harvest of existing stands occurred no earlier than Culmination of Mean Annual Increment
- Base sale schedule cannot exceed long-term sustained yield capacity
- No demand limitations placed on timber production.

Several key results of the maximum net present value benchmark were:

- 753,000 tentatively suitable acres were allocated to timber production
- The long-term sustained yield capacity of 45 MMCF/year (270 MMBF/year) was never reached in the planning horizon
- Sale schedule for the first five decades

**Table B-3. Maximum Net Present Value Benchmark Sale Schedule**

| Indicator | Decade 1 | Decade 2 | Decade 3 | Decade 4 | Decade 5 |
|---|---|---|---|---|---|
| Volume (MMCF/year) | 40 | 40 | 40 | 40 | 40 |
| Volume (MMBF/year) | 240 | 240 | 240 | 240 | 240 |

**Alternatives**

Results from the modeling exercise were one piece of information used in alternative comparison and effects analysis. Each model run had a single solution file from the linear programming computer software. The solution file lists management actions and timing choices for every analysis unit in the model formulation. Spectrum reads solution files and summarizes results through predefined and customized reports. The level of detail in reports is primarily limited by the resolution of information used in developing the models.

Due to the innumerable summaries Spectrum can generate, creating a limited number of standard reports was favored over tailoring summaries to each resource specialist. The following standard reports were generated for each alternative and covered all decades within the planning horizon:

- Acres suitable for timber production by Management Prescription.
- Acres treated by Management Prescription, silvicultural system, logging system (conventional or helicopter), and treatment type.
- Volumes produced by Management Prescription and species product group.
- Volumes produced by median distance to roads, logging system, and species product group.
- Acres treated by median distance to roads, logging system, and treatment type.
- Decadal age classes by Management Prescription and forest-type group.

When necessary, tailored reports were created for resource specialists with the specific summaries depending on the specialist's unique analysis needs. It was decided that summaries created for various resources were best addressed in the context of the resources themselves. Thus, results summarized for resource specialists are either presented or analyzed in the EIS, EIS appendices, or project record.

## WILDLIFE ANALYSIS

The Forest Service is mandated to provide and manage habitats to maintain viable populations of existing native and desired non-native wildlife, fish, and plant species. A Species Viability Evaluation (SVE) was conducted as part of the Forest Plan revision process. The evaluation analyzed potential impacts on the maintenance of viability for existing native and desired nonnative species related to expected activities from the five alternatives developed for Forest Plan revision. A detailed listing of SVE species and outcomes can be found in Appendix D to the EIS.

NFMA planning regulations also mandate the use of Management Indicator Species (MIS) in Forest Plans as a means of monitoring the effects management activities are having on species viability. More information on the MIS selection process can be found in Appendix D to the revised Forest Plan.

The scheduling model was developed to project outcomes from our proposed and probable practices over the planning horizon. The outcomes focused on forested vegetation types and age classes. The scheduling model was either constrained to meet certain species viability or habitat needs, or model results were output in a form that was used to assess whether vegetation amounts and compositions would support various habitat needs.

The scheduling model managed lands suited for timber production. The balance of the forested acreage of the Monongahela was not scheduled to receive management activities. On lands not suited for timber production, succession and natural processes determine the development of vegetation and long-term changes in tree species and age composition. In the scheduling model, stands on these unsuited lands were assumed to grow older throughout the planning horizon. However, we recognized that disturbance events like fires, floods, insect or disease outbreaks, and wind-throw may interrupt and reset conditions back to an earlier stage. Such disturbed areas typically cover a small portion of the landscape at any given time. However, assuming full plan implementation, we acknowledge that our projections could overestimate late successional habitats and underestimate early successional habitats.

The timber harvest scheduling model (Spectrum) gave resource managers a comprehensive picture of the forested vegetation composition for the entire Forest. The Monongahela was able to assess its capability to promote landscape conditions to provide for viable populations of native and desired non-native animal and plant species.

## ECONOMIC ANALYSIS

### Modeling Economic Effects

Four key economic indicators were reviewed in this analysis for the purpose of developing an estimate of relative effects of each forest plan alternative. The results of these analyses are displayed in the EIS, Chapter 3.

Economic effects to local counties were estimated using an economic input-output (I-O) model developed with the software package IMPLAN Professional 2.0 (IMPLAN). Economic relationships generated within IMPLAN were extracted and used in the Forest Economic Analysis Spreadsheet Tool (FEAST). IMPLAN/FEAST information has traditionally been the professionally accepted means of analyzing effects of forest plan alternatives. It provides for an area-wide view of relative differences for employment, income, and revenue. This model and spreadsheet analyze the effect on employment and income based on projected levels of outputs and expenditures over the first ten years of forest plan implementation as depicted for each alternative.

Information used in IMPLAN is specific to West Virginia and is data from the year 2003 as later data is not available. Employment and income data were derived from the US Department of Commerce, Bureau of Economic Analysis (BEA) Regional Economic projections from 2000 to 2018. Personal income by major source of earnings by industry, and total full-time and part-time timber employment by industry projections were included.

Definitions of terms used within the IMPLAN model followed those provided by the BEA and are standards in economic reporting. For example, the “agricultural sector” includes agriculture, forestry, and

fishing as a classification of economic data provided by the BEA and Census Bureau. Basic assumptions of IMPLAN do not include restructuring the economy over time, nor does it predict the specific future of industry related to the opening or closing of businesses. IMPLAN was used to estimate jobs and income related only to national forest resources and subsequent changes in proposed management of those resources.

The results of the IMPLAN modeling should not be viewed as absolute economic values that accurately portray the infinitely complex interactions of the regional economy, but rather as an estimate of relative potential effects. Interpretations of the IMPLAN data should be as comparisons among Forest Plan revision alternatives of the potential relative economic effect because of limited economic data, associated assumptions, and the limitations of the IMPLAN model itself.

IMPLAN was used to analyze direct, indirect, and induced effects by sector based on timber volume by product, and specific measurable recreation, wildlife, fisheries, range, and mineral-related resources values. Timber volume estimates used in the IMPLAN model were developed from Spectrum, a management scheduling model. A Spectrum analysis was conducted for each alternative.

## Impact Area

An impact area was defined in order to capture the area in and around the Forest within which effects of management on the Monongahela can be best understood. The degree of effect may vary within the boundary of the region of influence, and effects will likely occur outside this boundary. Defining an impact area considers state and local planning regions and associated economies, national forest supply based regions, Forest Service expenditures, and other factors.

The impact area for the Monongahela includes 10 counties and 22 gateway communities, all in West Virginia. The 10 counties are Barbour, Grant, Greenbrier, Nicholas, Pendleton, Preston, Pocahontas, Randolph, Tucker, and Webster. The 22 communities are Albright, Belington, Cowan, Craigsville, Davis, Durbin, Elkins, Franklin, Hillsboro, Kingwood, Lewisburg, Marlinton, Mill Creek, Parsons, Petersburg, Phillipi, Rainelle, Richwood, Summersville, Thomas, Webster Springs, and White Sulphur Springs. For the purposes of this analysis and to establish a minimum size threshold, gateway communities in the Monongahela region are defined as those communities having at least one hotel or accommodation business in town *and* one or more grocery or convenience store. Brief profiles were developed for the 10 counties and 22 communities having potential to be affected by the revised Forest Plan. These profiles are presented in the Social and Economic Environment section of Chapter 3.

The Monongahela provides direct and indirect multiple social and economic benefits to its region of influence, West Virginia, and surrounding states. Benefits contributed to the region by National Forest System lands include market and non-market opportunities such as timber, tourism, sightseeing, hunting, and fishing.

## Affected Environment

### Forest Service Program Areas

The projected impacts of the alternatives on jobs and labor income are based on Forest Service expenditures and the estimated outputs in various program areas of Forest management, including recreation, wildlife and fish, timber, minerals, and livestock grazing. The output levels used for this analysis represent the projected 10-year average for each alternative. Forest resource specialists have provided budget estimates based on the best available information and professional judgment. The

alternatives were analyzed using cost estimates built upon actual Forest expenditures, primarily during fiscal year 2002.

**Major Economic Sectors**

Economic effects of the alternatives on jobs and labor income within the impact area were analyzed for the following sectors:

- Agriculture
- Mining
- Utilities
- Construction
- Manufacturing
- Wholesale Trade
- Transportation & Warehousing
- Retail Trade
- Information
- Finance & Insurance
- Real Estate & Rental & Leasing
- Professional, Scientific, & Technical Services
- Management of Companies
- Administration and Waste Management
- Educational Services
- Health Care and Social Assistance
- Arts, Entertainment, & Recreation
- Accommodation & Food Services
- Other Services
- Government and Public Administration

**Payments to Counties from Federal Land Managers**

The relationship between counties and the Forest Service is an important one, in part because of economic benefits that the counties receive from the federal government. These direct benefits are linked to two specific funds: 25 Percent Fund/Stabilized Payments, and Payments In Lieu of Taxes (PILT).

**25 Percent Fund and Stabilized Payments** – These payments are made to the State of West Virginia for redistribution to counties in proportion to the number of acres of National Forest land within each county. These payments are limited to use for schools and roads by the Act of May 23, 1908, except that Public Law 89-207 (4/28/65), which established the Spruce Knob-Seneca Rocks National Recreation Area, authorized their use for schools, roads, and county government in counties containing NRA lands (Grant and Pendleton). West Virginia Code 20-3-17 and 20-3-17a allocate these funds 80 percent for schools and 20 percent for roads in all counties except Grant and Pendleton, where 65 percent is allocated for schools and 35 percent for general county purposes (none for roads).

The 25 Percent Fund/Stabilized Payments are also made for Hampshire, Hardy, Pendleton, and Monroe Counties for lands in the George Washington and Jefferson National Forests.

The original 25 Percent Fund was made up of 25 percent of National Forest receipts resulting from timber harvesting, grazing, recreation fees, land uses, and minerals. Timber sale receipts include the value of roads constructed by timber purchasers, and deposits for sale area betterment under provisions of the

Knutson-Vandenburg (KV) Act of 1930. Beginning in 1993, payments for receipts from federal minerals were made directly by the Minerals Management Service (National Energy Bill of 1992).

In October of 2000 the *Secure Rural Schools and Community Self-Determination (SRSCS) Act* was passed. It offered counties the option of receiving the traditional 25 percent payment based on revenue, or taking a "stabilized" annual payment based on the highest three years of payments for the years 1986 thru 1999. In West Virginia, seven of the 10 counties with Monongahela NFS lands opted to take the stabilized payment, beginning in fiscal year 2001. These counties are Greenbrier, Pendleton, Pocahontas, Preston, Randolph, Tucker and Webster. Monongahela payments to all 10 counties from 25 Percent Fund/Stabilized Payments totaled $1,876,669 in 2005.

**Payments in Lieu of Taxes (PILT)** – These payments are paid to the State of West Virginia for redistribution to the local governments of counties containing any of several specific types of federal lands, including National Forests. Counties receive payments in proportion to the amount of acreage of National Forest System land within each county. These payments are made under the provisions of the Payments-in-Lieu of Taxes Act of 1976 (PL-94-565). The rate of payment is established for "entitlement acres" (lands on tax rolls at time of acquisition). PILT payments can be used for any governmental purpose. Additional payments are also made for a period of five years for lands acquired for National Forest Wildernesses. There are a number of special provisions of the law, most of which are not pertinent to West Virginia.

The actual amount of PILT payments in any year is subject to adequate Congressional appropriation of funds. Although the payments are authorized to increase over time, funds have not been appropriated to fully fund the authorized amounts in recent years.

Many counties in West Virginia, including several within the Monongahela National Forest, receive PILT payments for lands administered by the National Park Service or the Corps of Engineers or the US Fish and Wildlife Service. Monongahela payments to all 10 counties from PILT totaled $1,195,786 in 2005.

## Assumptions and Methodologies

The following assumptions were made for resource program revenues used in the economic analysis:

- Based on professional judgment, range revenues from livestock grazing are not expected to change over the next 10 years.
- Based on professional judgment and national averages, recreation and wildlife/fish-related visits are estimated to increase by 2.5 percent annually over the next 10 years.
- Based on professional judgment and economic variables beyond the control of the Forest, there is no way to predict what mineral revenues might do over the next 10 years, so it was assumed that they would stay the same as current.
- Based on Spectrum modeling completed for the EIS analysis, timber revenues would vary substantially from current levels, and would vary by alternative.

Timber volumes for Alternatives 1-4 were calculated using Spectrum (see EIS Appendix B) and expressed as volume per decade over 10 decades. Values for Alternatives 1-4 were calculated using average prices from the Monongahela NF 2002 Cut & Sold report. They are summarized in Table B-4.

**Table B-4. Average Decadal Timber Product Volumes (MCF) and Values by Alternative**

| Product | Unit of Measure | Alt. 1 | Alt. 2 | Alt. 2M | Alt. 3 | Alt. 4 |
|---|---|---|---|---|---|---|
| Sawlog Volume | MCF/Decade | 74,970 | 77,494 | 77,037 | 57,785 | 100,223 |
| Pulp Volume | MCF/Decade | 32,724 | 27,863 | 27,734 | 25,297 | 33,108 |
| Sawlog Value | $1,000/Decade | 150,190 | 152,990 | 151,990 | 115,750 | 195,110 |
| Pulp Value | $1,000/Decade | 1,040 | 1,160 | 1,160 | 1,040 | 1,240 |

Because MCF/Decade = CCF/year, the volume totals for the annual CCF average are the same as the decadal MCF average. The values, however, were divided by 10 to arrive at average values in $1,000/year.

**Table B-5. Average Annual Timber Product Volumes (CCF) and Values by Alternative**

| Product | Unit of Measure | Alt. 1 | Alt. 2 | Alt. 2M | Alt. 3 | Alt. 4 |
|---|---|---|---|---|---|---|
| Total Sawlog | CCF/Year | 74,970 | 77,494 | 77,037 | 57,785 | 100,223 |
| Hardwood Sawlog | CCF/Year | 71,221 | 72,844 | 72,317 | 54,896 | 93,207 |
| Softwood Sawlog | CCF/Year | 3,749 | 4,650 | 4,720 | 2,889 | 7,016 |
| Total Pulp | CCF/Year | 32,724 | 27,863 | 27,734 | 25,297 | 33,108 |
| Hardwood Pulp (50%) | CCF/Year | 16,362 | 13,931 | 13,867 | 12,648 | 16,554 |
| Softwood Pulp (50%) | CCF/Year | 16,362 | 13,931 | 13,867 | 12,648 | 16,554 |
| Total Sawlog | $1000/Year | 15,019 | 15,299 | 15,199 | 11,575 | 19,511 |
| Hardwood Sawlog | $1000/Year | 14,799 | 15,085 | 14,984 | 11,402 | 19,260 |
| Softwood Sawlog | $1000/Year | 220 | 214 | 215 | 173 | 251 |
| Total Pulp | $1000/Year | 104 | 116 | 116 | 104 | 124 |
| Hardwood Pulp (50%) | $1000/Year | 52 | 58 | 58 | 52 | 62 |
| Softwood Pulp (50%) | $1000/Year | 52 | 58 | 58 | 52 | 62 |

These numbers were broken down by product volume and value over the-10 year analysis period as follows:

- Volume sources vary by alternative slightly between sawlog and pulp.
- Sawlog volume averages 93-95 percent hardwood and 5-7 percent softwood by alternative.
- Pulp volume was not broken out for hardwood vs. softwood, so it was assumed to be a 50-50 split.
- Value sources average 98-99 percent sawlog and 1-2 percent pulp.
- Sawlog value average 98-99 percent hardwood and 1-2 percent softwood.
- Pulp value was not broken out for hardwood vs. softwood, so it was assumed to be a 50-50 split.

Using these assumptions and information, volumes and values were calculated as shown in Table B-5.

For Current Conditions, volume and value were calculated as averages for the past 10 years (1995-2004), based on Table TR-4 in the Timber Supply section of Chapter 3 in the EIS. Table TR-4 information was collected from Forest and Regional records.

The total volume offered for that 10-year period was 110.5 MMBF, which is an average of 11.05 MMBF per year. This amount was divided by a factor of 6 to get 1.84166 MMCF per year, which was multiplied by 10,000 to get 18,417 CCF per year. This volume was separated into products (hardwood sawlog, etc.) over the 10-year analysis period based on the following information:

- Volume sources averaged 80 percent sawlog and 20 percent pulp.
- Sawlog volume averaged 98 percent hardwood and 2 percent softwood.
- Pulp volume averaged 92 percent hardwood and 8 percent softwood.
- Value sources averaged 99+ percent sawlog and <1 percent pulp.
- Sawlog value averaged 99+ percent hardwood and <1 percent softwood.
- Pulp value averaged 91 percent hardwood and 9 percent softwood.

18,417 x 0.8 = 14,734 CCF sawlog volume
14,734 x 0.98 = 14,439 CCF hardwood sawlog
3,683 x 0.92 = 3,388 CCF hardwood pulp

18,417 x 0.2 = 3,683 CCF pulp volume
14,734 x 0.02 = 295 CCF softwood sawlog volume
3,683 x 0.08 = 295 CCF softwood pulp volume

The average annual value for the 10-year period was $3,044,000. This value was separated into products (hardwood sawlog, etc.) based on the information stated above, and divided by 1,000 to arrive at $1,000/year numbers.

$3,044 per year x ~0.99 = $3,017 sawlog value
$3,017 x ~0.99 = $2,992 hardwood sawlog value
$27 x 0.91 = $25 per CCF hardwood pulp value

$3,044 x ~0.01 = $27 pulp value
$3,017 x ~0.01 = $25 softwood sawlog value
$27 x 0.09 = $2 softwood pulp value

The results for the current condition breakdown for volume and value are shown in Table B-6.

**Table B-6. Summary of Current Condition Timber Product Volumes and Values**

| Product | Volume | Value ($1,000) |
|---|---|---|
| Hardwood sawlog | 14,439 CCF/Year | $2,992 |
| Softwood sawlog | 295 CCF/Year | $25 |
| Hardwood pulp | 3,388 CCF/Year | $25 |
| Softwood pulp | 295 CCF/Year | $2 |